USING COGENERATIVE DIALOGUE TO AFFORD THE TEACHING AND LEARNING OF BIOLOGY IN AN URBAN HIGH SCHOOL

by

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Abstract

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The body of research work presented in this dissertation integrates critical ethnography with video and conversation analyses in order to provide ways to articulate and understand the complexities associated with social life enactment as it unfolds during cogenerative dialogues and in the science classroom as the teacher and her students engage in science teaching and learning. The primary goal is to improve the teaching and learning of science in an urban science classroom at a public high school in Philadelphia, Pennsylvania. In order to understand what is going on in the classroom and why, I worked with a female science teacher who identify as an African-American and her culturally diversified students in a biology class to examine teacher's and students' conscious and unconscious patterned actions, (i.e., classroom practices, that structure teaching and learning in the classroom. It is my belief that to improve science teaching and learning in the classroom, it is salient to improve science teacher's practices as a precursor to transforming students' practices. In order to ameliorate breaches in the fluency of encounters in the classroom, the teacher and her students need to establish and sustain critical, collaborative and collective conversations through cogen.

I employ theoretical lenses of cultural sociology that I triangulate with sociology of emotions and critical pedagogy. I focus on culture as schemas and associated practices layered with the triple dialectics of agency, passivity and structure as new or hybridized/interstitial cultures that are produced get enacted in the science classroom to transform teacher's and her students' encounters with each other. The salient implication is that since encounters are imbued with emotions, teacher and her students learn to generate positive emotional energy during cogen that gets reproduced and transformed in the science classroom. Positive emotional energy creates resources that help to initiate and sustain interaction ritual chains that support synchrony, solidarity, sense of affiliation and identity that are necessary for the teacher to be successful as a science teacher and her students to be successful as science learners.

Salient to the findings in this study is the need for teachers to envision teaching and learning as a collaborative and collective endeavor with their students. Teachers need the perspectives of others; and students are in the best position to provide the teacher with the authentic perspectives she needs to improve her practice. By *being with* and *working with* their teacher, students and teacher share their classroom experiences with each other, in an environment void of hegemony, in order to achieve their individual goals and collective motives in the urban science classroom. Teacher and her students get to know more about each other socially and culturally and are able to work through their differences to achieve success.

Dedication

To my children, for whose future I came to this country, the future belongs to you.

Acknowledgements

A Yoruba axiom says that when you notice a bird dancing in the middle of a trail, don't focus on the bird rather watch out for its drummers are drumming in the coppice nearby. On this occasion, I am the dancing bird in the middle of the trial and I have many drummers in the wood nearby; and I would like to cheer them on so I could continue to dance, the dance of fulfillment. I am so particularly honored to have such wonderful, talented and patient drummers, who, even when I didn't dance to their tunes, kept drumming and steering me to dance to the melody of their tune. I need to appreciate their efforts and guidance. I am therefore expressing my deepest and sincere appreciation to my drummers for bringing me to this point and beyond. You have all done a great job and contributed to the laying an everlasting foundation, solid as a rock; I owe you a lot and I promise to build on the foundation you have laid in me some lasting edifices that will endure the test of time.

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I am much more wholly thankful to God Almighty who made it possible for me to come this far and in whom I confidently place my trust to lead me on and bring me to my "promised land" whatever that is and wherever it is located. As He leads me, I follow.

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Table of Contents

List of Figures

CHAPTER 1

Catch the Fluffy Stuff

One morning in August of 1967, my father (dad) and I went out to his farms to harvest kola nuts (*Cola nitida*). The harvest that day was far less than dad had expected as we walked from farm to farm. He was visibly disappointed as his facial expression indicated. Conversely, I was a bit glad because I did not want to carry heavy basket loads of kola nuts beans walking back and forth two miles each way. I did not know the concerns dad had. Dad and I had never engaged in any form of dialogue up to that point. Dad tried to mask his disappointment, as he did not want me to know the financial challenges he faced. He did not want his son to perceive him as being weak. The situation was that the long summer vacation was coming to an end and I was getting ready to return for my second year (Form II; equivalent of 9th-grade) in secondary school within a few weeks. I needed to buy books and supplies and pay school fees.

As we headed back the trail with the meager number of kola nut pods we harvested, we were nearly half way home when dad noticed something. He went to investigate and I followed. Dad had noticed a spread of (cotton-like) silky floss (fluffy stuff) under a huge buttress-rooted kapok, silk cotton (*Ceiba pentandra*) tree. The silk tree had large pods each containing thousands of small round seeds. Some silky, feather-like flosses that act as wings carry each seed. When the pods become ripe enough, they literally ‘explode’ releasing the winged seeds into the air for wind dispersal.

Dad began to gather the fluffy stuff into piles. I put down the nearly empty basket I was carrying on my head and joined him without exchanging any word. We gathered

much silky flosses into piles and began to stuff the big basket until it was full and overflowing. The heavier kola nut pods were on the bottom of the basket. The more we pressed down on the floss, the more the fluffy stuff resisted being contained. After some efforts, it appeared we had contained the load.

As I picked up the loaded basket to place on my head, some flosses started to fly out of the basket. Dad motioned me on as he walked behind me. I had no clue what he was going to do with the material. I could not ask for fear of being considered rude and insubordinate. Even though the basket was full, it was light enough. So, I did not mind carrying the loaded basket. As we walked away from the silk tree, the wind appeared to blow a little harder and the fluffy stuff started to fly away. So, dad told me to put the basket down. As the basket hit the ground, more fluffy stuff went flying. Instinctively, I started chasing after them. I wanted to catch them because I was scared that dad would punish me should I allow something we had spent so much time and labor on to fly away.

To my surprise, dad just stood there watching and "encouraging" me. "Catch the fluffy stuff, son. Don't let them get away," he declared. So I ran in circles catching what I could. As I dumped the handful of flosses I caught back into the basket, more fluffy stuff went flying. I continued the merry-go-round for a little while with dad urged me on. I was afraid to stop. I was scared even more to make any suggestion to my dad. I had an idea what we should have done but because I might be considered rude and be punished for being insubordinate, I could not offer my idea. Traditionally, it was considered rude to second-guess an elder. Tradition could be hegemonic.

In my confusion, I did not notice that dad was laughing, at me. I had never seen that light side of him before. I was not sure if it was a "hyena laugh" or that I made a

spectacle of myself, (a hyena laugh is a kind of noise hyenas make when they are ready to devour a prey. It is also an idiomatic/proverbial expression of my tribe). Not knowing what was to come next, I stopped and decided to take the risk of my life. I was going to break tradition and offer a suggestion to my dad. Who was I to offer such a revered figure like dad a suggestion? What do I know? What knowledge do I have that placed me in a position to advise my dad on what to do? He was an educated, well-respected man. I pondered at the thought and what the outcome of my audacity might be. I could not look at him. It was considered rude in my Yoruba tradition to look face-to-face at an elder when talking to him (The Yoruba tribe is one of the largest ethnic groups located in West Africa and predominantly found in the Western part of Nigeria. We, the writer included, are speakers of the Yoruba language and dialects). I tried to choose my words carefully. So I looked down sheepishly and asked dad if it would not be better to dump the fluffy stuff on the ground, remove the heavier kola nut pods from the bottom of the basket, put back the fluffy stuff and then place the heavier pods of kola nut on top to contain the silky flosses from flying away. I closed my eyes, accepted my fate, waited and braced myself for whatever dad chose to do. I had stepped outside the boundaries of cultural norms; I had been audacious enough to second-guess an elder, an authority figure. What a taboo!

It seemed like eternity before dad spoke, he agreed with me. He did! What happened? How could he agree to a suggestion from a child like me? But he did. He told me to do just what I suggested. I could not believe my ears. I looked up towards him coyly and he was smiling. I thought he was being sarcastic, so I hesitated. I was trembling. But dad meant what he said. He noticed my hesitation and reassured me that

my suggestion was very good and that I should do as I had suggested. I did and we successfully brought the fluffy stuff home.

On our way back, dad looked at me funnily. I had a different gait in my steps like I never had before. The unthinkable had happened. I would never forget what dad told me. I translate it into the English language below. What dad said in essence was,

> Son, now I know I have a wise son. Remember, knowledge is like the seed attached to the fluffy stuff. It comes down from high above riding on the wings of wisdom. You have to catch it, contain it, and retain it before you can use it. Knowledge takes you far on the wings of wisdom.

The next day, we went back to collect more fluffy stuff. As we went back and forth, for the first time ever, my dad and I had some meaningful dialogues along the way. The short of the story was that from the fluffy stuff we collected, dad made many, hand-sewn pillows. He sold several of them, kept two for himself and gave me one, my very first pillow, ever. With the income from the pillows, I was able to buy my books and supplies before school began and continue my education. Dad believed in education as the engine for social change and the vehicle for upward mobility. He wanted me to embrace both.

Changing Social and Working Relationships

Reflecting back on this encounter that changed the social and working arrangements between dad and me, I could not but wonder what it would have been like if the relationship that later developed had developed much earlier or had been there all along. By encounter, I mean a form of cultural production in which interaction and

transaction presupposes each other in a dialectical relationship. Yes, I respected my dad, but it was much more out of fear in accordance with the ethos of my Yoruba cultural (traditional) background that skews maximum respect and voice to the elders and minimum to the child. Respect, symbolic capital (Bourdieu, 1986), was never earned in my culture; it was automatically endowed to any older person; and it was one-sided against the younger person and hegemonic. It was not mutual and often it was not reciprocated. My dad, as in the case of most teachers, did not believe that I, as in the case of students in the traditional classroom, have the capitals needed to negotiate social encounters.

Encounters are imbued with emotions; emotions are activated as a reaction to whether or not self is confirmed or verified (Turner, 2002). Primarily, I was afraid of my dad as the traditional status quo dictated. Fear is a primary emotion that generates negative emotional energy and as illustrated in the narrative above, prevented our interactions from being synchronous, initially. It prevented us from entraining to solidarity (Collins, 2004), or sharing and supporting our individual goals and collective motives (Tobin, 2005). The activity we engaged in, in that field, provided me with some structure[1] to engage my stocks of knowledge or habitus, albeit with trepidations of not knowing the possible outcomes. I use the construct of field in accordance with Bourdieu's (1990) definition of field as a location where social life gets enacted and culture is produced; a site of conflict and power struggle. In addition, I define culture, according to Sewell (1999), as a schema and its associated practices. Pitts (2007) posits

[1] I used structure in accordance with Sewell's (1992) as a dynamic, continually evolving matrix of a process of social interaction. It is dialectically related to agency and passivity; hence the triple dialectics represented as agency|passivity|structure (the Sheffer stroke, (|) represents a dialectic relationship).

that the disposition of a participant to act is afforded and constrained by structural resonance in a field. The same activity structured my dad's reversal of hegemony, his acknowledgement of my stocks of knowledge and his acceptance of the symbolic capital I had earned. This new cultural production structured our interaction|transaction differently from then on; and provided me with access to resources (my dad's habitus or dispositions) which further expanded my agency (power to enact culture). This micro success built upon other activities that followed, created fluent (i.e., timely, appropriate and anticipatory) interactions between my dad and me and generated a form of social transformation throughout the rest of the time before I returned to school.

The restrictive cultural (traditional) norms that sustained power differentials between my dad and me did not initially value my voice or the stocks of knowledge that I brought into the working relationship. Such is the case in the traditional classroom where students' voices and stocks of knowledge are not often valued, and appropriated for the mutual benefits of all participants. Prior to the change, my dad maintained a status quo that truncated my agency in similar ways as teachers often do in the traditional classroom. I theorize agency in accordance with Sewell's (1992) concept, as the exercising of the ability to coordinate one's actions with and against those of others in order to produce collective outcomes through persuasions, coercions, and the monitoring of the simultaneous effects of such coordinated actions on one's own activities and those of others. There was also a high degree of passivity and receptivity (Roth, 2008, p. 13) structured in dominance (control over) in my earlier relationship with my dad. Roth posits that passivity is like being held hostage to a situation, (i.e., when a participant in a field of encounter receives unfolding social life praxis without participating in it).

Receptivity to others is one salient aspect of passivity (Roth, 2007). Similar degrees of passivity and receptivity are immanent in the traditional classroom. Agency|passivity played roles in structuring interactions between my dad and I in that while he had power to enact social life, I could only receive the unfolding praxis without consciously contributing to it. Agency and passivity presupposed one another in a dialectical relationship. At the time, being laughed at by my dad, which I termed a hyena laugh because of historical resonance of such laughters to social violence for me, may have been my dad's attempt at using a repair ritual (Turner, 2002) to amend the breaches that had taken place in our encounter. Repair rituals are often needed to structure positive emotional energy that could later produce synchrony in our social and working relationships.

In this dissertation, I examine the need for change in the dynamics of the social and working relationships between teachers and their students in the classroom. In this chapter and subsequent chapters, I explore the use of cogenerative dialogues (hereafter referred to as cogen) as an engine for such changes in the teaching and learning of science in the urban classroom and as a vehicle for improving the classroom environment and students' participation in science. I refer to urban as any large city, with inner city of dense and diverse population of residents, where school districts (systems) are characterized by culturally diverse students body, overpopulation, shortage of human and material resources and high teacher turn-over rate (Ingersoll, 2001). I use urban and inner city interchangeably.

My research questions for this study were:

1) What is cogen?

2) How can cogen be used to transform the social and working relationships between the teacher and her students in an urban science classroom, (i.e., the learning environment)?

3) How can cogen help the teacher and her students improve their practices and the teaching and learning of science (biology) in an urban classroom?

I approach the study in this dissertation from the standpoint of one who had experienced the impact of power differentials as a son at home and as a pupil (student) in traditional classrooms under colonial rules where local teachers from the same cultural backgrounds as me acted as colonialists enforcing dominant cultural values on me and my fellow pupils (Memmi, 1965, pp. 45-76). I define a colonialist in accordance with Memmi's definition as a henchperson for the oppressor (colonizer) who carries out the mandates of colonial rules and systematically devalues the colonized (oppressed). A colonialist is himself colonized.

Added is my experience as a second-career high school science teacher in the urban science classrooms in Queens, New York City (NYC), which was only slightly different in time and place but similar in that the differential equations of power were still skewed towards the teacher and against students in the classroom. So, I have experienced the effects of power differentials in the classroom as a student and as a teacher under colonial power and under democratic principles. These experiences helped shape my approach as a high school science teacher and in this study as a participant observer as I conducted this research in an urban science classroom at a high school in the Philadelphia School District, in Pennsylvania.

Cogen

While I did not know anything about cogen when I was a high school science teacher, I did engage my students in dialogues as I tried to make sense of the contradictory patterns of their actions and science performances compared to their individual life-goals and my desires for our individual and collective successes in science teaching and learning in my classroom. Although some of those dialogues generated some positive outcomes, such as participation in science outreach programs outside the school, unlike cogen, all aspects of those dialogues (initiating and sustaining the dialogues and outcomes) were under my complete control. Those dialogues were not cogenerated. They were teacher-centered and not focused on improving my classroom practices and those of my students in relation to the teaching and learning of science in my classroom.

A Brief History of Cogen

According to Tobin (2006a), cogen started at the University of Pennsylvania, in Philadelphia, where in the late 1990s he and his associates came up with the idea of getting two high school students to assist new teachers, assigned to their school for student-teaching, to learn how to teach inner city students like them. The new teachers and the two students of different (opposite) dispositions and academic competence often met soon after each lesson was completed. These high school students acted as experts advising and coaching the new teachers (teacher-in-training) as they asked questions about their classroom practices and performances. Tobin (2006a) noted that after one year of having high school students coach the new teachers, their evaluations of the process revealed interesting insights that made the researchers decide that students and

new teachers would engage in conversations around identifying and working through contradictions that arose as new teachers and students enacted the science curriculum. The purpose was to improve the quality of teaching and learning that was taking place in the classroom. From then on, cogen became an emergent practice of reflective conversations among participants (stakeholders) who shared teaching and learning experiences in a classroom. Cogen has continued to be an evaluative, research, pedagogical and professional development tool for teachers and their students in the classroom.

What is Cogen?

Bayne (2007, p. 4) described cogen as,

> … discussions amongst stakeholders (e. g., teachers, students and administrators), [that] afford the examination of shared experiences within a field – a physical and temporal place where individuals interact with each other – in order to cocreate new culture and/or amend that culture which already exists, as a means to improve the quality and efficacy of teaching and learning.

Roth and Tobin (2001), theorized cogen as a conversation between participants such that, at its core, makes the goal of collectively generating understanding of shared experiences and future actions in the science classroom possible. Student participants have also termed cogen as their "lunch-group" meetings where they discuss and exchange ideas on how they could improve themselves and their participation in the classroom (personal communication with Bayne's students, 2008). Cogen provided structure for creating an interstitial space, a site, for the production of new and/or hybridized, interstitial, culture (Bhabha, 1994). Cogen encouraged teachers and students to interact

across sociocultural markers of differences such as age, gender, culture, race, ethnicity, academic competency, religion, and socioeconomic status according to (LaVan, 2004). She also reported from her studies on cogen that cogen supported the individual and collective agency of all participants, not only during cogen activities but also in the science classroom. Tobin, Roth and Zimmermann (2002, p. 6) posited that cogen "can be understood as a new learning environment that takes the classroom learning environments as its object of inquiry." It provided opportunity and resources for interrogating what happened in the classroom and why. I define cogen as a social field of encounter where stakeholders discuss and negotiate agreement, without fear of penalty or negative sanctions, on issues relevant and related to their shared experiences, in the classroom field, with the sole purpose of improving their experiences when they encounter each other again in the same field or another.

Participation in cogen is voluntary and encouraged for all students. While cogen rules are simple, they underscore social life practices of youth that needed transformation in order to generate positive emotional energy and entrainment to solidarity. For example, participants must respect others and their points of view. Participants must take turns to voice their opinions on the issue at hand and listen attentively to others. All voices are of equal value as no one voice is privileged over another. Any participant can call cogen whenever the need arises. At the end of discussions, a plan of action is cogenerated and agreed to. Participants hold each other responsible and accountable for implementing agreed-to plans of action in the classroom. To help focus attention and discussions on issues of mutual interest, video clips (vignettes) of a recently experienced classroom activity, shared by participants, is often viewed.

Conducting Research

Based on my experiences as a student in the traditional classrooms in Western Nigeria where my agency and those of my fellow students were individually and/or collectively truncated and our stocks of knowledge were not valued, I have always felt the need to do something to transform the social and working relationships between students and their teachers in the classroom. My experiences as a science teacher in urban high schools in NYC deepened my convictions further that the dynamics of teacher-student relationships needed to be improved in order to enhance teaching and learning in the classroom. I was also convinced that such transformation could not be accomplished by exercising control over students but through dialogues between students and their teachers. So, I was thrilled to learn about cogen and to conduct research on how cogen could be implemented to accomplish the transformations stated above. I conducted the research reported in this dissertation at an urban science classroom of a female science teacher in Philadelphia.

Ethics of the Study

The research study presented in this dissertation was approved by the Institutional Review Board (IRB) of the Graduate Center (GC) of the City University of New York (CUNY) and is in compliance with the provisions in the tenets of the Belmont Report (1979) in terms of 1) *respect for person* - individual participants in this research study were treated as autonomous decision makers capable of articulating independent goals, individuals with diminished capacity were protected from unethical and harmful

practices; 2) *beneficence* – the benefits accruing to participating outweighed the harm; and 3) *justice* –distribution of benefits and harms across all participants was fair and just.

Throughout this dissertation, I employ pseudonyms in place of proper names of students or the name of their school to provide anonymity and to protect the identity of persons and places. Identity is defined as cognition and feeling by Turner (2002, p. 99); a nature of *self*; *self* is viewed as a set of meanings about who and what one is in a situation or across situations. *Self* is always emotional (p. 101). I used the proper first name of the teacher (Michelle), whose classroom practice is the focus of this study, based on our agreement and her permission to do so. She is the teacher researcher who worked with me and allowed me to conduct research on cogen in her classroom. Michelle is the focus of Chapter 2 of this dissertation. Some of the text of this dissertation reflects the collective voice of Michelle and me. I use personal pronouns (i.e., I and me) outside of direct quotations from Michelle and others to denote my voice. All quotes attributed to Michelle and/or her students were reported as they were told me in structured and unstructured conversations and chitchats. Michelle and I spent considerable time together during this study as we planned and conducted cogen, reviewed videos with students or just by ourselves, and as we prepared for and participated in conferences together (the two of us) and with her students. Other proper names are those of fellow researchers in our research squads in NYC and/or Philadelphia whose works are relevant to this study and who did not object to having their proper names used. Also, in order to avoid cumbersome constructions where gender was involved, I use female pronouns throughout this dissertation. In essence, she stands for she or he and her stands for her or him, etc.

Judging Research Outcomes

The intended outcomes of conducting cogen research in Michelle's classroom was to transform teaching and learning of science in her class; transforming her practices and those of her students in the science classroom. Cogen was a field in which Michelle and her students could coconstruct transformative strategies to improve the teaching and learning environment, students' participation, attendance, and achievement in science. Based on earlier studies of cogen in science classes, other expected cogen outcomes include solidarity, sense of affiliation and identity, coteaching as a result of coparticipation through *working with* and *being with* others, and distributed leadership due to enhance opportunities to exercise individual and collective agency. These outcomes associated with conducting cogen in the classroom are discussed and theorized in subsequent chapters throughout this dissertation not in any particular order of significance.

To judge the quality of this study and the outcomes associated with cogen, I followed the conventions of Tobin (2006b), in "… recognizing that education research with human subjects must benefit those who are involved in the study and that researchers have a responsibility to those who agree to be involved; that benefits will not be realized only in the future, but will also lead to improvement as the research is enacted," (p. 25). I followed Tobin's example by adapting and extending the authenticity criteria delineated by Guba and Lincoln (1989) for use in fourth generation research evaluation into critical ethnography, critical pedagogy and improvement of science education through cogen.

The four authenticity criteria adapted are ontological, educative, catalytic and tactical authenticities. *Ontological authenticity* refers the extent to which participants' own emic perspectives have been improved, matured, expanded and elaborated as a result of their participation in cogen and by possessing more (new) information, have become sophisticated in its use as a result of this research study. It relates to improvement in participants' conscious and unconscious experiences of social life. *Educative authenticity* represents the extent to which individual participant's understandings and appreciations of the constructions of others outside their stakeholders group are enhanced (p. 248). *Catalytic authenticity* is the extent to which participants' actions are stimulated and enhanced to catalyze positive changes as a result of being part of this research. By enhancing individual participant's agency and access to appropriate resources, individual well-being and collective successes can be catalyzed. Lastly, *tactical authenticity* relates to the extent to which participation in cogen afford participants sufficient agency to effect positive changes in their classrooms and other fields of social life. I use these authenticity criteria to augment my knowledge of connecting theory, research and practice in the science classroom.

Research Location and Student Demographics

This study is situated in Michelle's biology class in a neighborhood public high school (*Fairness High School*) in the School District of Philadelphia, in the state of Pennsylvania. The school used to be a middle school before it was upgraded to a high school. The school has been serving the community for more than 50 years. School district records for 2008/2009 classified 83% of the student population as economically

disadvantaged based on students who qualify for free or reduced-priced lunch. The average daily attendance for the 2008/2009 school year at *Fairness High* was 79%, (School Profiles, 2008).

The community surrounding the school is predominantly Irish-Americans and Italian-Americans. Census (2000) figures indicate a distribution of 72% Whites, 11% African-Americans, 5% Latinos or Hispanics, 12% Asians, and less than 1% Native Americans. Conversely, *Fairness High's* student population comprise of 48% African-Americans, 13% Whites, 28% Asians, 10% Hispanics, and 1% Native Americans.

Fairness High is organized into four main programs (small learning communities) known as academies. Three of these academies are thematic programs aimed at developing students with specific career goals and orientations in preparation for a future vocation. These three academies are set up by and in partnership with non-profit organizations responsible for organizing and partnering with high schools in the larger school district. Students are to choose one of these three academies after they have completed the first academy, which is the 9th-grade academy. Each academy is intended to run as a cohort. Students take elective courses, by grade, tailored specifically toward the career academy they have chosen to pursue. There were some academy-specific classes and general requirement classes that often have multiple grades on the roster. One of the general classes is the 6th-period biology class; the site of this study. I theorize each of the academies and each grade level as a field (categoric units according to Turner (2002, p. 35)) where culture gets enacted because specific requirements are needed to attain and sustain membership.

The 6th-period biology class that is directly involved in this study has some unique characteristics that I believe allowed its students to respond enthusiastically to Michelle's request to conduct cogen together with them. The class is nested within various intersecting fields across academies and grade levels (i.e., the students are from different academies and grade levels). The class is culturally, socially, and academically diverse. The population distribution of the 6th-period biology class is made up of 11% White, 33% Blacks, 26% Asians from Vietnam, Cambodia, Laos, 11% Asians of Chinese origin, 4% each from Thailand and Pakistan, 4% from Puerto Rico and 7% considered themselves multiracial. In terms of gender, the class is made up of 56% females and 44% males. Because biology is one of the core science courses all students in all academies were required to complete, the 6th-period biology class is a multi-grade class, made up of 4% 9th-graders, 41% 10th-graders, 48% 11th-graders and 7% 12th-graders.

Frameworks Employed in Research

The theoretical and methodological frameworks employed in this dissertation are delineated below. These frameworks are formulated to provide ways to understand the complexities of social life enactment as it unfolds in the cogen and in the nested fields of Michelle's science classroom as she and her students engage in science teaching and learning.

Theoretical Frameworks

In this dissertation, I theorize teaching as a form of cultural production and learning as a form of cultural reproduction and transformation in accordance with Tobin (2005) construct of science teaching and learning. And as such, I examine cultural

production, reproduction and transformation of science (biology) in the urban classroom through the theoretical lens of cultural sociology (Sewell. 1989, 1992) triangulated with sociology of emotion (Turner, 2002) and critical pedagogy (Kincheloe, 2008). I bring different lenses to bear as the needs emerge as I examine and make sense of unfolding praxis in the science classroom and during cogen. My primary focus in exploring teaching and learning of science as social life enactment in the social space of the classroom and cogen is through the dialectic relationships of agency|structure (Sewell, 1992) layered with the dialectics of agency|passivity (Roth, 2008). The agency|structure dialectical relationships is a key principle in the theoretical framework I employ, which is derived largely from cultural sociology. Hence the triple dialectics of agency|passivity|structure becomes salient in understanding social life. I also employ the understandings that culture exists as schemas and their dialectically associated practices (Sewell, 1999). As indicated earlier in this chapter, agency is the power to act and the ability to coordinate one's action with those of others. Access to appropriate resources in the fields of social life is enabled by affording agency of the participants and the capitals each social actor possesses. Structure is ever evolving in a dynamic flux of social interactions. According to Sewell, culture is a system of symbols (semiotics) and associated meanings and practices, which are loosely bounded and are capable of traversing categories of nested fields. Therefore, culture produced in one field (field being locations in time and space where culture gets enacted), can be reproduced and transformed in another field of social life. One of the expected outcomes of cogen is that the new or interstitial cultures produced in the cogen field get enacted in the science classroom field. Through the reproduction and transformation of new or interstitial

cultures by the teacher and her students, the teaching and learning of science would be transformed and individual and collective successes would be assured.

For this study, I theorize encounters as sites of cultural production in which interactions and transactions presuppose each other in a dialectical relationship. As participants interact by appropriating resources, they also transact by enacting agency. I examine face-to-face encounters in the classroom and in cogen through the emotions embedded in teacher-students and student-student interactions and transactions (Turner, 2002) in the classroom and in cogen. I also explore emotions imbued in the production, reproduction and transformation of culture that initiate and sustain solidarity (Collins, 2004) amongst participants. Encounters, according to Turner, are episodes of face-to-face interactions. Encounters, being the basic unit of social life enactment, are imbued with emotions (pp. 38-39). Emotions are associated with synchrony or lack of synchrony. Successful patterns of interaction|transaction generate positive emotional energy that sustains interaction ritual chains that entrain on to synchrony, solidarity, affiliation and identity. Emotions provide needed resources to initiate and maintain social networks. Lack of solidarity or sense of affiliation is plagued with indicators of negative emotional energy such as frustrations, fear and anger (Turner, 2002). Lack of solidarity threatens successful teaching and learning of science in the classroom.

I employ critical pedagogy to understand how new or interstitial cultures generated during cogen by the teacher and her students produce critical consciousness that gets enacted to overcome dominant ideologies, injustices and inequities in the classroom (Kincheloe, 2008). By bringing unconscious verbal and non-verbal actions of participants to conscious awareness, such actions become resources that structure positive

emotional energy, which is salient for synchrony and solidarity. I focus on how such critical awareness helps teacher and her students appropriate capitals (i.e., symbolic, social and cultural) in the capital exchange cycle (Bourdieu, 1986) and how such capitals are used to transform pedagogical practices of teacher and her students in the science classroom by removing hegemony.

Methodological Frameworks

In this dissertation, I integrate critical ethnography with video and conversation analyses at the *macro, meso* and *micro* levels. I am adopting critical ethnography to seek, interrogate and reveal hegemonic tendencies that had sustained systemic injustices and inequities by "unmasking dominant social constructions and their interests" (Seiler, 2001, p. 28) and catalyzing change in Michelle's classroom. Critical ethnography provides opportunity to study society with the goals of transforming it and freeing participants from dominance and oppressive practices; that was part of my goal in this study. Critical ethnography (Barton, 2001) provides me with a way of identifying, documenting, analyzing and transforming enacted conscious and unconscious practices of the teacher and her students in the science classroom as well as in cogen. This approach allows me to understand what is happening and why through the lenses and voices of all participants (Kincheloe and McLaren, 1994) and how to transform it to make life better for participants. I approach the understanding of what is happening in cogen and the science classroom and why through the multilayer of *micro*, *meso* and *macro* level interactions. Reality of social life is enacted at the *micro* level where agency is enacted to afford or constrain access to and appropriation of resources; that is where culture gets enacted. It is at the *micro* level that face-to-face interactions of encounters take place. *Meso* level

analysis provides access to transactions that take place at the field level where resources structure the field and participants produce, reproduce and transform cultures. *Macro* level analysis provides understanding of cultural production across nested fields of social life. With this method, I am able to zoom in and out across each level. I use conversation analysis to understand how interaction participants contribute to the making and remaking of social life while informing others of things that are salient to them at that moment or about what needs to be communicated (Roth, 2005, p. 382).

Data Sources and Analysis

Ethnographic data sources for this dissertation include captured videos and transcripts of cogen and science classroom interactions between Michelle and her students. I conducted structured and unstructured conversations with Michelle and her students involved in this study, individually and collectively. I took field notes as a participant observer. In adherence to the authenticity criteria, I sought and obtained participants' perspectives in order to provide polysemic (multiple perspectives) and polyphonic (multiple voice) viewpoints of data interpretations. By providing both *emic* (insider – teacher and students) and *etic* (outsider – university researcher) perspectives, I made efforts to do justice to all participants and provide balanced accounts of events, interpretations and analyses.

The captured videos of participants during cogen and classroom activities provided "renewable" sources of data that allowed me access to the same data again and again for analyzing Michelle and her students' interactions and transactions in the classroom as well as in the cogen. These same data are available for analyzing *macro*, *meso*, and *micro* encounters by varying the speed of the video clips. At normal speed,

video clips provide *meso*-level interpretations of events unfolding in real time. *Meso*-level analysis also allowed me to develop broader understandings of classroom practices and cogen interactions of Michelle and her students. Slowing down the video speed allowed for *micro*-level analysis and frame-by-frame interpretations of non-verbal interactions and microtransactions such as gestures, body movements and orientations and head movements and positioning. *Macro*-level claims were made possible through analyzing varieties of data sources over a period of time and by paying close attentions to patterns of actions that persist over time across different fields and during various types of social encounters.

Collaborative Research – In It Together

My overarching motive for this study was to challenge the traditional teaching methods that continue to maintain the status quo and perpetrate inequities and dominant structures of social injustices in urban science education. My particular goal was to catalyze changes in the traditional practices of a science teacher and her students in order to improve the teaching and learning of science in her classroom. My intention was to employ the novel practice of collaborative dialogue as a vehicle for generating solidarity and successful interactions among culturally diverse participants across varying markers of differences in the science classroom. This task cannot be accomplished then without the collaborative participations of the science teacher (Michelle) and her students in a science class. In a study that involves critical ethnography where the goal is not just to conduct *study on* research subjects and write reports but also to conduct *study with* research subjects and catalyze change and then write reports, it becomes paramount for

the researcher and the research subjects to coparticipate and cocontribute as collaborators (coresearchers) in the research. Elmesky (2001) suggested that power relationships and divisions of labor in a collective effort like this must be established on equality and justice through genuine and mutual respect. Consequently, the study reported in this dissertation is as a result of collective, collaborative contributions of Michelle (science teacher) and her students across three biology classes with the 6th-period class as the central study location and actions. I situate participants mentioned in the chapters of this dissertation within the context of this research as their roles evolved.

Participants

In this section, I discuss briefly the participants in this study and the roles they played as we collaborated to study cogen in Michelle's classroom.

The researcher as participant observer

My roles in this study included the role of a university researcher, a participant observer and cogen mentor for Michelle. I came to know about cogen as I was finishing a science teacher education program at NYU when I was a high school teacher and decided to research the concept as a doctoral student. My lived-experience as a son and a pupil/student got me interested in finding ways to challenge and transform the ways authority figures relate to children at home and in schools when I was growing up in Western Nigeria in the days of colonial rule. Dominance, inequity and social injustice were skewed against children and students as I narrated in the earlier part of this chapter. As Nigeria marched towards independence in 1960, the manifesto called for freedom. That struggle for independence brought to my consciousness the challenge against issues of power, hegemony, equity and social justice.

As a young person, I had wanted to be a teacher. Then it dawned on me that teachers were perpetrators of hegemony in schools and they acted as colonialists. So, I changed my mind and wanted to become a scientist. Then I studied animal health and came to the USA to study at The Pennsylvania State University (Penn State) in preparation for veterinary school. I was advised that it would be hard for me to get into veterinary school because of the expense of the program. Since I was African, I would not be eligible for student loans and therefore would be unlikely to qualify for loans or financial assistance. Therefore, I changed my major to animal science. After graduating and working for many years in the research animal care and use profession I decided I wanted to be a science teacher in NYC. It was a surprise for me to find that the structure of teaching and learning in NYC at the end of the last century was only slightly different from my schooling experience in Western Nigeria in the 1960s. Many aspects of the culture of schooling were very similar to what I had experienced in Nigeria except there was no physical flogging. Students' agency was still truncated, and teachers maintained absolute authority.

It was shortage of science teachers in urban schools that motivated me to get into teaching science. I quickly developed deficit perspectives of the students and the school system as shortage of resources, overcrowding, and students' lack of interests in science became evident. As I began to dialogue with students, I began to realize that I was blaming the victims; and my desire to transform the traditional ways of teaching and learning came back. I began to change my deficit perspectives and embrace enhancing student agency and access to resources. I became a radical advocate for students' voices and multiple perspectives. Like Michelle, when I learned about cogen, I said to myself,

"this is it." I learned more about critical pedagogy, about bringing oppressions to conscious level in teaching and learning, dismantling oppressive structures and overcoming injustices and inequity in the classrooms, in the writings of Freire (1970) and the teachings of Kincheloe (2003). I believe cogen is the non-violent way to accomplish the transformation I seek. My experience in the research squad as we discussed theories and methods around cogen and teaching and learning was very rewarding and prepared me to perform my roles in this study.

Teacher as researcher

When I met Michelle, the teacher-researcher I was going to work with in this study, it was in the context of the Masters in Chemistry Education (MCE) program at the Penn Science Teacher Institute (PennSTI) in the Department of Chemistry at the University of Pennsylvania (UPenn). Michelle was taking classes to improve her chemistry content knowledge and pedagogical methods. We met during her first pedagogical course in the program. Michelle had been teaching at an urban high school where she was struggling and searching for better ways to engage her students in order to get them to learn science better and improve their achievements on test scores and benchmarks. Michelle and I had a lot in common, career-wise. How she developed her science experience and identity is discussed more in Chapter 2 of this dissertation. Michelle was willing to become a teacher-researcher and a collaborator with me in this study as we conducted cogen research in her class. She was willing to adapt and transform her practices and share her experiences with her students and me.

Students as researchers

The involvement of students as researchers in this study was very crucial. Without their willingness to participate and to trust us (Michelle and I), this study would not have been possible. Freire (1970) posited that without the oppressed being part of the plight, freedom for them could not be made possible. As we work together to undermine oppressive social structures, in accordance with (Giroux, 1992) the oppressed need to be part of the transformative and emancipative processes.

When we started cogen, Michelle had informed students that she needed them to help her become a better teacher of science and that the first few cogen would focus on how they could help her transform her practice. Unlike the usual format of choosing students with opposite dispositions and/or academic competencies, we simply invited everyone that was interested in helping their teacher, Michelle, become a better teacher. What we got was a good mix of students with different dispositions and academic competency who genuinely wanted to help Michelle improve her practice, and by *being with* and *working with* others, wanted to improve their own practices as well. For instance, we had Sporty, an African-American male and Scarface a male of a multiracial, Italian/Puerto Rican, cultural backgrounds (the only 9^{th}-grader in the 6^{th}-period class). They showed little interests in class work, at first. They literally just put their heads down on the table and pretended to fall asleep because they did not want to be bothered. Sporty told me that he really didn't like science.

Scarface became excited about cogen and from the first cogen, had a change in identity by assuming leadership roles in cogen and in the class as reflected in this written reflections by Michelle excerpted below:

> They all agreed that the majority of their classmates are staying on task and all of them are more engaged. Smiley said that before we started the cogen, she would not have ever asked Scarface or Shaggy for help because she thought they were clowns that didn't know science contents. She found out differently when Scarface and Shaggy were coteaching a lesson on diffusion and osmosis. The entire class started viewing these two class clowns as two class intellectuals.

Scarface became a motivator, a coteacher and a peer tutor. It was such a dramatic change in role identity and sub-identity. Sporty got involved in cogen very slowly. At first, he was not interested. He said he never liked science. But with encouragement from Smiley, other students, Michelle and me, and over a period of time, he began to warm up to cogen and began to attend. Sporty became much more cheerful, outspoken and worked harder at being successful in the class.

Smiley, an African-American female, a Moslem like Taylor; was a quiet, well-respected leader who galvanized everybody and worked hard to change the culture and climate of the classroom. She cotaught, peer-tutored and was responsible for constantly rearranging seating to benefit the science learning of those perceived as academically weak, as noted in this reflection by Michelle, excerpted below:

> All of the students involved in the cogen after school were very surprised to see these three young men, Murasa, Shaggy and Chad, so actively participating in the lab. They also noticed a great change in these same young men in the classroom, within the past week. We had whole-class cogen on Tuesday. Smiley agreed to move to the same table with Murasa, Shaggy and Chad. On Wednesday this plan was implemented. Now you see these guys working well in their new group and

you don't hear me saying, "guys settle down, and focus," any more. On Thursday we agreed with Smiley's decision to move Murasa to a table away from Chad and Shaggy. Everyone was in agreement that this was a wonderful move.

Taylor was an outspoken, African-American female, a Moslem, active cogen participant who advocated for better classroom interactions. Dreana was a smallish, African-American female, a tenacious basketball player, who loved to learn on her own. She was always positive minded and sharing her thoughts. Po was a male, Cambodia-American student who was so quiet that it was hard to hear him when he spoke. He was almost an invisible man in the class. He was so enthusiastic about cogen and became very active and more vocal and outspoken. Rawr and Sunshine were White females students. While Rawr was doing well academically in the class, Sunshine sometimes struggled. Sunshine initially thought cogen was a waste of time but eventually started to participate. She had previously confronted Michelle demanding that Michelle return to chalk-and-talk pedagogy. To her surprise, Michelle did not respond in kind. In addition, Sunshine found herself almost alone in that quest as the whole class had entrained to the new culture, the positive and productive changes that were taking place in the learning environment. Rawr came to Michelle after the confrontation mounted by Sunshine and said, "Boy, you really have changed; I remember the last time I did something like that and compared you to another teacher, you chewed me up."

Chica was a Puerto Rican female student and so was Maria. Maria was from the 3rd-period class. She particularly enjoyed the peer tutoring that cogen afforded. Bong and Chang were quiet, unassuming, Chinese male students who could not attend cogen regularly because they worked after school but still managed to attend some cogen

meetings. Because of the structural changes that afforded better classroom participations, they enjoyed discussing concepts in their vernacular (creolized science) before translating into English language and then sharing with the class what they discussed in their own language. They often huddled with Michelle at their table, which they shared with Taylor, Dreana and Ada (Ada was a Pakistani-American male student who did not participate in cogen because he worked to support his parents who didn't speak English). Like Po, Ada, Bong and Chang were very quiet and unassuming students in the 6th-period class.

Keisha, an African-American female from the 1st-period class, was Smiley's friend. They were almost inseparable in school; so, by default, she became a cogen participant and a cogen ambassador to her class. She tried to get her class to enact a 1st-period cogen but couldn't get other students to support her. However, she suggested the 'bring-a-friend' plan of action that targeted those who cut classes. The plan succeeded in bringing some 'cutters' back to class, not just in her 1st-period class but also in other classes as other students joined the 'crusade,' which the school administration, upon hearing about it, also encouraged.

Nix was a female 1st-generation Thailand-American who was doing very well academically. She was very outspoken and the unofficial spokeswoman for the class. She was not able to attend cogen as much as she wanted to but often would call in-class cogen and huddle with Scarface, Smiley and Rawr regularly to positively influence curricular activities, such as suggesting the use of animations, websites and who could learn better when paired with someone else.

And lastly, we had Anita, a female Spanish student, from 3rd-period class. Michelle had allowed her to write a science report in Spanish because as an ELL student,

she was afraid she would fail if she wrote the report in English. She had limited written English proficiency then. Michelle had a Spanish teacher work with her to read and grade the paper, which Anita passed. This experience made her commit to learning the English language because, "I do not want to be the only student writing my reports in Spanish," Anita said during a brief discussion. Michelle stated that, had it not been for cogen, she would not have afforded Anita the structure and resources that allowed her to succeed in writing that science report in Spanish language. "I would have said, go learn English," Michelle told me during a discussion.

A few other students and some teachers float in and out of cogen as legitimate peripheral participants (Lave and Wenger, 1991). The administrators, principal and two assistant principals enjoyed coming to watch us during cogen and would sometimes interject comments here and there; what they really enjoyed was coming to Michelle's classroom to participate in the transformed classroom environment where students were not afraid to engage them in activities as team member-of-the-moment.

Chapters in Dissertation

This dissertation is composed of five main chapters: Chapters 2, 3, 4, 5 and 6. None of the chapters is a stand-alone chapter. Each chapter is linked to other chapters and is meant to cohere together to elucidate the work done at *Fairness High School* in Philadelphia with a unifying theme of improving science (biology) teaching and learning through cogen by interrogating the classroom practices of the teacher (Michelle) and those of her students. I urge the reader of this dissertation to read it as one unified piece of work with teacher's transformed practice as a precursor to transforming students'

practices in the science classroom. The thread that binds this study together is the fact that Michelle and her students used their diversities as resources to enhance their science identity and their learning and fluency of science. As a result of my efforts to make sense of what was happening in the classroom and why, as I participated in the roles of a participant observer and researcher reporting on this body of work, there is the tendency for readers to come across some redundancies in my explication and analyses of the data obtained and the outcomes of this study.

Chapter 2

In this chapter, I traced how Michelle developed her science identity from childhood in Winston-Salem, North Carolina (NC) through to the formation of her identity as a public high school science teacher in Philadelphia, Pennsylvania (PA). I narrated her biography as she told me in structured and unstructured conversations, discussions (chats) and written and unwritten reflections. My goal was to delineate the development of Michelle's core, sub and role identities in her efforts to transform her practices as a science teacher in a Philadelphia public high school in order to insure her successes and the success of her students in the classroom.

This chapter opened with the narration of Michelle's upbringing in homes and school environments of nurture and care where her agency was expanded and stocks of knowledge valued and appreciated; and where she was able to produce science culture and fluency. I focused on Michelle's experiences as a science teacher especially at *Fairness High School* where she struggled trying to teach the way she thought she was supposed to teach using the traditional teaching methods. She was not pleased with her students' limited science fluency and achievement. She started to seek for better ways to

improve her teaching and her students' learning of science. By enrolling in the MCE program for in-service science teachers, she wanted to improve her science contents and pedagogical knowledge.

This chapter gave account of how Michelle and I met and how she came to know about cogen. She embraced cogen and decided to try it out as a pedagogical and professional growth tool in her biology class where she videoed a pre-cogen classroom interactions that served as our baseline data.

Chapter 3

In this chapter, I discussed the scope and focus of the study in this dissertation. In addition, I discussed the purposes and the processes of enacting cogen in Michelle's classroom. I elaborated on the significance of the study from personal, programmatic and educational perspectives. On the personal level, I had the opportunity I needed to conduct an authentic research for my dissertation. On the programmatic level, it was an opportunity to prove to the students in the MCE program that cogen still works. I needed to demonstrate that this novel pedagogical practice was still relevant and applicable in teaching students of all ages, and grade levels across various subjects as posited by Martin and Scantlebury (2008). On the educational level, I wanted to demonstrate to Michelle, her students, and others that by improving teachers' practices, students' achievement in science could be improved. I wanted to determine that by talking with each other about how they engage and experience each other in the classroom, Michelle and her students could *work together* (collaborate) to create positive and productive teaching and learning environments that foster individual and collective success of participants of diverse cultural backgrounds, grade levels and academic competency.

In this chapter, I advocated for teaching and learning to be a collaborative and collective endeavor not just between teachers and administrators but also primarily between teachers and their students. For education to be a practice of freedom, collaboration and collective actions are required. In explaining why we conducted cogen in her class, I used some excerpted recollections that I obtained during conversations with Michelle to support the fact that teachers need their students' perspectives on teaching and learning in the classroom. And it is only through dialogues (cogen) that such perspectives can be authentically constructive as they shape encounters and emotional energy in the classroom. When teachers have dialogues with their students, students become authentic pedagogical and professional development tools that can help teachers shape better cultural production in the classroom because they share classroom experiences together.

In the rest of this chapter, I delineated the process of conducting cogen. I went over the applicable cogen rules. I advocated for teachers to embrace conducting collective reflections about their classroom experiences with their students as a form of cultural production. Talking with students provided opportunities for polysemic and polyphonic perspectives. *Reflecting together* is agentic for teacher and her students. It empowers and emancipates participants and *humanizes* the teacher.

Chapter 4

In this chapter, I explored Michelle's interactions with her students in the 6th-period biology class before we enacted cogen. She was teaching the way she thought she was supposed to teach using the traditional teaching methods. I wanted to analyze what happened during the pre-cogen lesson using participants' lenses as they experience the

unfolding lesson. I also applied my lens as a participant observer. This lesson was captured on video to allow us (students, Michelle and me) to go back in time and have opportunities to view classroom activities again and again, at varying speeds, in order to develop *micro, meso* and *macro*-level understandings of what happened, how and why. The students' analyses and Michelle's view of her practice are what I narrated here. My intention was to use this lesson as a sample of Michelle's traditional methods of teaching prior to experiencing cogen with her students. I focused my analysis on her traditional teaching practices as I explicated emergent themes. These themes served to guide my understanding of teacher and students' practices as they unfolded.

Chapter 5

To explicate classroom encounters, I examined the proxemics of space utilization because the social space between the sender and the receiver of actions influences the way such actions are interpreted. Actions are imbued with emotions and patterned actions constitute a practice. Perceptions and use of social spaces vary and are often influenced by social markers of difference, such as, cultural background, gender, social and economic statuses and roles identities of participants. The ways Michelle and her students utilized social spaces (nested fields with their resonating structures) in the classroom is briefly analyzed. Before cogen, in her traditional methods of teaching and to maintain control over students, Michelle and her students exercised territoriality over the nested fields of social interactions and cultural production in the classroom. Sense of affiliation, solidarity and identity built through cogen, helped participants enact social life across multiple fields of encounters where territoriality was dismantled across nested fields and the classroom became the "community space" for the use of all. I focused the

rest of the chapter on discussing and interrogating some aspects of traditional teaching practices.

Chapter 6

This chapter explored the transformation of Michelle' teaching with the central motive that improving teacher's practice eventually improves the social and working relationships with students, their learning of science and science achievements in benchmarks and high stake tests. The vehicle for this transformation of teacher and students' practices was cogen. I narrated how we (Michelle and me) came to choose the 6th-period biology class as the site for conducting cogen. Cogen allowed Michelle and her students to walk in each other's shoes. I discussed some of the outcomes associated with conducting cogen in Michelle's classroom. Cogen participants developed a sense of affiliation, belonging and commitment to individual and collective responsibilities and successes. Cogen provided structure and resources for ontological changes in teacher's and her student's perspectives towards each other.

As we began to enact cogen, Michelle and her students began to cross-examine and interrogate each other's practices in the biology classroom. They focused on practices that cohere with and those that contradict teaching and learning of science. The goals were to reproduce and transform practices that cohered with successful interactions and to find ways to ameliorate practices that contradicted successful interactions in the science classroom. So, by *being with* and *working with* Michelle, her students were able to share their experiences and *work together,* collaboratively and collectively to generate positive emotional energy and solidarity across diverse markers of difference and became successful individually and collectively. Through cogen, the biology classroom became

transformed in such a way that students of different cultural backgrounds, gender, grades and academic competency thought of their classroom as a "small family" where they were not afraid to make mistakes because they knew that somebody "got their back."

I close this chapter by giving some examples of Michelle's practices that were transformed, (i.e., new or interstitial/hybridized cultures that were produced in cogen and reproduced and transformed in the science classroom). I also gave some examples of new or interstitial cultures that were produced|reproduced|transformed by the students. I provided brief descriptions of each and explained some of the theoretical perspectives underlying such new or hybridized cultures.

Chapter 2

Teacher's Identity and the Teaching of Science

In many ways, a teacher's identity shapes the efficacy of that teacher's practice in the classroom. Turner (2002) describes three types of identity: 1) core identity; 2) sub identity; and 3) role identity. One's core identity, according to Turner, is one's fundamental identity representing who an individual really is; whereas one's sub-identity is the persona an individual embodies professionally. Role identity is the identity that an individual assumes as she plays one or several roles as she enacts social life.

In this chapter, I trace the journey of Michelle a female science teacher in an inner-city high school, who identified as an African-American, through a biographical account of how she developed her science identity and science language fluency (timely, appropriate and anticipatory). I examine how her social and cultural backgrounds shaped her learning at home and in schools and her role as a science teacher searching for better ways to afford her success and the success of her students. I discuss how the structures she encountered at home, as a child, and in schools as a student and then as a teacher helped her to understand the need for her and her students to be successful in her urban science classroom.

In addition, I employ the lens of critical pedagogy on Michelle's practice to illustrate how she tried to find better ways to engage her students in creating positive and productive learning environments in order to enhance their successes individually and collectively as science learners. I explicate how changes in Michelle's ontological perspectives became resources for her to gain critical consciousness (*conscientization*) as

advocated by Freire (1970) that got her searching for ways to enact curriculum with her students. The text of this chapter reflects the collective voice of Michelle and me.

A Science Teacher's Journey

In the following section, I trace Michelle's journey from her childhood steeped in the African-American cultural traditions of the post-civil rights Southern United States (South) to her current position as an urban (inner city) high school science teacher. My goal is to examine the formation of her core, sub and role identities and the development of her science culture.

Formative Years of an African-American Female Scientist

Michelle was born into a close-knit, working-class, African-American family in Winston-Salem, North Carolina (NC), in the South where she developed her social and cultural identities. Her mother, mother's parents and maternal grandparents are African-American, but her father is of a Spanish-Italian-American cultural heritage. Michelle's paternal grandmother was a Spanish-American and her paternal grandfather was an Italian-American. Michelle's father grew up in Denver, Colorado before settling in Winston-Salem after a tour of duty in the Air Force. Michelle was raised by her mother's family, hence the prominence of her strong African-American social and cultural identity.

By phenotype alone, Michelle's racial identity as an African-American woman is not readily apparent to someone encountering her for the first time. Michelle recalled stories in which her racial identity caused some confusion. In one instance, she told me of an occasion when African-American students chided, "that Mexican needs to go back to Texas," thinking she was Mexican. She said that the students were surprised when she

proudly told them that, "I am from North Carolina, born and raised an African-American." She also recalled an encounter with her father's sister, in Denver, who reminded her not to forget that she was Spanish-Italian-American. Michelle said that her aunt thought, "I was not proud of my Spanish-Italian-American heritage," because "I was acting Black, I had the inflections of Blacks when I speak, and do not speak Spanish or Italian language." Michelle said that had her parents been married, she would likely have spent more time with her father instead of her mother's family and would have, perhaps, identify more with his cultural background, at least be able to speak Spanish and/or Italian, which could have been useful in her role as a teacher. She thought that being raised primarily by her mother, in company of her maternal parents and grand parents, made her identify primarily as an African-American.

When I first met Michelle, in the context of a teacher-student[2] at PennSTI where she was in a graduate degree program intended to improve science content knowledge and pedagogical methods of in-service high school science teachers. Michelle was searching for ways to improve her science pedagogical knowledge. She wanted to improve her teaching practice in order to afford the success of her students in learning science. As I spoke with Michelle, her identities, core (cultural) identity as an African-American, categorical unit of a female with her sub-identity of a scientist and her role identity as that of a science teacher in an urban high school, started to become apparent to me.

The structure that initiated and sustained Michele's educational pursuit was created by the fact that her mother graduated from college with a degree in nursing, even

[2]An in-service science teacher going to school in her spare time at PennSTI MCE program

though her father did not continue his education when he settled in Winston-Salem, NC following his honorable discharge from the US Air Force. As a little girl Michelle wanted to be a scientist. At the age of five, she was very curious about science and she was soundly supported and encouraged by her parents, maternal grandparents, and maternal great grandparents. So, Michelle began to develop her science identity and fluency

Since Michelle's maternal parents and grandparents lived within ten miles of each other, it was not uncommon for her to spend a considerable amount of time with her maternal grandmother who often took Michelle to her own parents' home while Michelle's mother was at work. In a written reflection, Michelle remembered how she began developing her science and fluency:

> As a child, I became interested in science, plants, and animals, because my family allowed me to ask 'Why?' and to explore. I remember, as a child, I told my family that I wanted to become a veterinarian and I had literally proclaimed myself to being just that at the age of five. I was not afraid to explore and to ask questions because no one ever tried to silence me. Most of the time my maternal grandmother and I would spend time down at my great-grandparents' house, out in the garden. I would ask my great-granddaddy lots of questions about the vegetables. What makes the tomatoes grow? Why did the corn not grow this year and about the [growth of] fruit trees? I also became interested in animals. My granddaddy owned some hunting dogs. I became interested in the hunting dogs. Most of our conversations about dogs stemmed from observing the dogs' behaviors, which dogs could run a rabbit and why did he have to put some dog

down[3]. I wanted to know the 'what,' 'how' and 'why' of everything and my granddaddy would take time to try to answer all of my questions.

The development of Michelle's science knowledge was being informed by these questions. The fact that her grand father did not shut her up gave her the structure and the agency she needed to learn some science. Michelle's mother's family were not just very supportive of her ambitions, goals, and curiosity, they created structures that would allow her to succeed in science. In addition, they did not truncate her agency because they recognized that as long as she had questions to ask and needed answers to those questions, she would continue to desire to learn. Asking these questions and getting answers encouraged communication and the production of positive emotional energy and create structure for social interaction and bonding.

For her parents, education was not an option. It was a necessity. Michelle's parents believed that opportunities for upward mobility came from being well educated, but Michelle stresses that she never felt underprivileged as a child. Michelle said in a conversation, "I could remember how excited my maternal grandfather was when I got admitted into college. Even though he was in his nineties, he gingerly climbed the three flights of stairs to see me to my dormitory room, on campus, on my first day in college."

Developing Identity as a Science Learner

As a young girl, when Michelle decided to adopt a three-legged kitten that the mother cat had abandoned, her mother did not object in spite of not being fond of animals. Soon, Michelle began rescuing a variety of strays and sickly animals, which she cared for. She was very protective of her growing brood. Michelle's sense of caring and social justice was being developed. Before long, she had a veritable menagerie in her

[3] "Put some dog down" is another way of describing euthanasia.

home. Michelle's desire of becoming a veterinarian was being realized. In addition, Michelle's father bought her microscopes and science books. The structure of science learning and access to science resources were being made available to Michelle to continue to develop her science fluency.

In grades 1-5, Michelle's structure of science learning was made stable by having the same science teacher, Ms. Smith. Michelle recalled in a written reflection how Ms. Smith made science learning interesting and fun. This expanded Michelle's agency and confidence in science learning as she enjoyed science and participated actively. Being the only science teacher in the school and teaching all grades, Ms. Smith, had the capitals to challenge students to excel in science by getting them to *work with* her; and by *being with* her, accessing and appropriating resources, Michelle was able to learn better. During an interview with Michelle, she remembered the following:

> Once I began school, I was so excited that I could go into a science lab. Ms. Smith was the science teacher and she wasn't afraid to have us explore. I remember Ms. Smith letting us take some of the animals in the lab home over the weekend and holidays. Before I could bring any of the animals home, my mother would make me read all about the proper care for that animal. I did not mind. I was so excited to be able to bring the animals home.

Ms. Smith made science learning relevant, practical, and interesting for Michelle. Making Michelle read about the animals improved her science knowledge and fluency. Michelle remembered participating in annual science fairs. One time her father built her a "wormery" box with plexi-glass where she raised worms for her science fair. She was able to see and describe the activities of the earthworms as they burrowed into the soil.

Michelle enjoyed the hands-on approach of the teacher and how Ms. Smith would encourage students to extend their science knowledge. Ms. Smith created a schema of science learning that resonated with the science culture that Michelle was generating at home as a young girl. Also by creating a caring and positive learning environment for students, Ms. Smith was affording and expanding students' agency getting them to appreciate science. Michelle remembered these experiences gleefully.

According to Michelle's account of events, her transition to middle school was very difficult. She was faced with sociocultural adjustment issues that distracted her from focusing on science learning. She recalled her experiences in middle school as "not really interesting." She couldn't remember any of her science teachers encouraging students like Ms. Smith did. "Science was taught just like all the other subjects," Michelle said during an interview. What Michelle was alluding to was that the structure of science teaching and learning in her middle school was different and traumatic to her. The camaraderie and structure of science learning she enjoyed with Ms. Smith was contradicted. She felt her science learning was not afforded and that teachers did not share student's individual goals nor foster the collective motives of students' learning in the science class. The culture of science she had produced and enjoyed in elementary school could not be reproduced and transformed in the middle school science.

Michelle was excited about starting afresh in a new environment as she found resonating science structure in high school. In the 9th-grade, she encountered a physical science teacher who challenged her differently and rekindled her passion for science. At the end of the 9th-grade, her physical science teacher recommended that Michelle take

Honors Biology in the 10th-grade. Unfortunately, her experience in Honors Biology was not a positive one, as Michelle recalled in a written reflection:

> On the first day of Biology class in the 10th-grade, I was so excited reading over the syllabus and anticipating the year. That excitement soon disappeared when I began to feel that the teacher, a White female, did not really care about her students' feelings. The teacher would speak with such a harsh, crude tone of voice. She would ridicule some of us, and answer us so sarcastically. I did not want to participate in class for fear of being ridiculed. I even began to doubt myself and question my goals. Is science for me? I also felt that she showed favoritism towards students that shared similar upbringing and background with her because, even though there were only two of us of African-American heritage in her class, she seemed to find ways to disparage us. On the other hand, she did not seem to talk harshly to students of skin color similar to her own even when they couldn't get the answers correctly.

Obviously, there was a cultural incongruence or misalignment between Michelle and this teacher. Tobin (2005, p. 27) posited, "that since the social and cultural backgrounds of the majority of the teachers were so different from those of their students, they might not know how to connect their teaching to the cultural capital of the students." The teacher may also have been trying to fit Michelle into the "mold of model students" (Elmesky, 2001). The impact of teacher-student interactions can have positive or negative effects on student achievement.

Michelle had more positive interactions with other teachers in her high school years that overshadowed the negative experiences she had in 10th-grade Honors Biology.

Michelle connected socially, culturally and academically. She felt good in those other teachers' classes, participated actively, learning what she needed to learn. Her goal was not just to pass the class, but also to broaden her science knowledge and fluency. She felt appreciated. She felt that the stocks of knowledge she brought into the classroom were valued and validated. Interactions are mediated by social, cultural and historical dynamics participants bring into an encounter. Michelle recalled in an interview,

> Two teachers who were dedicated to teaching science to any child followed the negative experience with the female White science teacher of 10th-grade Honors Biology. Both of these teachers were truly hands-on, inquiry-oriented people. It was okay to make mistakes in their class, and it was refreshing to know that I could ask how and why if I did not understand.

Obviously, Michelle and these teachers connected well. When student and teacher were able to engage in a positive social and working relationships, synchrony emerged and individual goals and collective motives were attainable. These later experiences rekindled Michelle's interests in pursuing her plan of becoming a veterinary science practitioner.

Growing in Science Knowledge

In pursuit of her life-long goal of becoming a veterinarian, Michelle volunteered her services at a veterinary clinic as an undergraduate student. But her career goals changed when she witnessed the euthanasia of a badly injured dog whose owner did not want to pay for expensive corrective surgeries. That decision contradicted all Michelle had ever wanted to do, (i.e., take care of animals). Even though her grand father had told

her of such action when she was younger, she might not have fully comprehended it until she witnessed it. Michelle decided against going to veterinary school.

As an undergraduate science major, Michelle could not forget two professors whose teaching methods made indelible impressions on her. Both of them contributed to her pursuing higher studies in plant pathology and perhaps her becoming a science teacher and wanting to teach like them. One of these professors was Dr. Dontfail. He took his science class on field trips to the arboretum, to the mountains, the community, and to his farm. He challenged his students to make the connection between science and society. He challenged them to design and conduct experiments. The professor wanted his students to use what they had experienced as resources to formulate their own hypotheses and draw conclusions based on evidence. His approach was inquiry-based pedagogy and he encouraged students to coteach the course with him. Though Michelle and other students found coteaching with the professor unusual, she enjoyed being challenged and she actively participated. It helped her learn because "you have to know the subject matter in order to teach it to others," she said in an interview. It seemed to fit her style of learning. By *working with* this professor, Michelle cogenerated new roles and identity as a coteacher in which her agency was expanded. This opportunity became a schema that structured her interactions with Dr. Dontfail and her peers positively. In the process, she gained social, symbolic and cultural capitals that further enhanced her success.

The second professor who had tremendous influence on Michelle was her undergraduate senior year research paper advisor, Dr. Mba, who recruited her to work on an environmental grant from the Environmental Protection Agency. She learned to *work*

with Dr. Mba in the lab and to educate the community about the effects of lead poisoning. In addition, she gained access into neighborhood elementary schools to conduct outreach education on the effects of lead poisoning. She enjoyed those times.

When Michelle enrolled in post-graduate school, she intended to specialize in plant pathology. However, her post-graduate experience was less pleasant than she had anticipated. She had moved from institutions where she was nurtured in mentoring and working relationships that resonated with her early years of science learning (in collaborative, congenial, collegial, and positive environments in which she grew professionally) to one that did not foster productive learning environments she had experienced previously. Michelle reflected in a note to me, "To my surprise, when I started my doctorate, the nurturing and support that I had been given at the two previous institutions were not there. I began to feel out-of-place and unwanted." Michelle dropped out of the doctoral program determined to go back someday. Meanwhile, she got married and started a family. Michelle did not consider becoming a science teacher as a possible career choice.

Transitioning into Science Teaching

Michelle's transition into teaching was sudden. Her plan was to get a job that would put her back in the lab as soon as possible. That plan changed when a guest of her in-laws, after a Sunday church service, discussed her need for a science teacher at the middle school where she was the principal. Before Michelle could get into the conversation, her mother-in-law had volunteered her services to the middle school principal. Michelle was hired to fill the position and became a middle school science teacher before she had a chance to scrutinize and evaluate her circumstances. Her earlier

experiences working with elementary school students to educate them about lead poisoning in their environment became the basis of her teacher training initially. .

Michelle taught general science in the middle school for one year and then her new family decided to move to the Philadelphia area. When she arrived, Michelle didn't want to teach again. She said she had heard information concerning the difficulties of teaching in urban (inner-city) schools. Michelle started searching for employment in science labs trying desperately to return to her routine of bench work. However, employment options were not forthcoming. Again, her in-laws, being veteran teachers themselves, suggested teaching and, once more, she obliged. This time, she needed state-certification and to obtain that, she needed to take education courses while teaching. .

How I Thought I Should Teach

"How should a teacher teach"? is a common question that plagues most teachers, especially those who are new to the profession. The question of "How do I teach these students"? is also usually in the back of a teacher's mind. Many assume that teaching is as simple as standing in front of the class. The teacher has the content knowledge and some assume that just speaking to the students will impart that knowledge and if students do not "get it," then it is their problem and not the fault of the teacher. Clearly, teaching is not a simplistic process involving content experts simply disseminating information to a classroom of passive students. Many have asked, "What is teaching? Is teaching an art or a science"? Davis (1997, p. 6) answered the first question by defining teaching as the interaction of a student and a teacher over a subject in a setting. He then went further to answer the second question by saying,

> Some say that teaching is a science. These people stress the scientific aspects of teaching and focus on ways to systematize the communication between teacher and student. They believe that it is possible, through careful selection and pacing of materials, to regulate interactions among the student, the teacher, and materials to be learned, thus reducing the possibility that learning occurs by chance. They believe that enough is now known about how people learn to develop a technology of teaching. Others say that teaching is an art. These people believe that "scientific" teaching ends up in formalized, cookbook approaches that force students to perform and bureaucratize learning. Besides, they argue, actual teaching involves great amounts of intuition, improvisation, and expressiveness, and effective teaching depends on high levels of creativity, sound judgment, and insight.

In an editorial in the *Journal of Career and Technical Education,* the editor, Janet Burns, (2005) asked this same question, “Is teaching an art or a science”? She described how at the beginning of her industrial teachers’ training, she posed this question to her class and student-teachers would take positions at either end of the science or art spectrum. But as they experienced teaching, she would ask the same question again, and very few student-teachers would be at the opposite poles. Burns (2005, p. 5) summed it up as follows:

> They have discovered that many of their decisions about teaching strategies, their responses to student misbehavior, or their selection of materials and assessment techniques, while benefiting from scientific research, often must take into consideration more subjective judgments.

From my own training and experience, I hold on to a standpoint that teaching is neither an art nor a science. Teaching is both an art and a science. Teaching is a craft and a good teacher is a good craftsworker who could bring many materials, tools, and methods to bear in order to produce effective teaching. My standpoint of teaching as a craft is reiterated by Moore (1995, pp. 1-7)[4] who described a sound teacher as a,

> skilled craftsworker, a master machinist say, who knows exactly what she must do, brings the tools she needs, does the work with straightforward competence, and takes pleasure in a job well done. She does her work right every day, and every day's work fits the larger plan of her project. The craftsworker's skill is quite separate from her enthusiasm on that particular day, which, as C. S. Lewis said in another context, depends more on the state of our digestion than on any more cosmic influence.

Moore went on to describe craft as "a collection of learned skills accompanied by experienced judgment," (p. 1). He claimed that anyone could learn it. He said, "good teaching is based on the teacher's learning." Moore also asserted that enthusiasm to teach was "no substitute for craftsmanship." He pointed to the fact that craftsmanship can be evaluated easily by gauging how prepared the craftsperson is for the task at-hand and by her respect for and rapport with her materials. In essence, the teacher (craftsperson) should know what tools to use, when and how to use them with her students. Moore concluded by suggesting that the culture of teaching requires change; and one of the changes he suggested was that instruction be a shared responsibility; and I say between a teacher and her students. In essence, education should be, according to Moore, a process of collective management between students and their teacher(s).

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[4] Retrieved 08/05/2009 from www.stat.purdue.edu/~dsmoore/articles/Craft.pdf

I argue that Moore's assertions that teaching is a craft and the teacher as craftsman is in agreement with the theories of Kincheloe (2004, p. 1) who postulated that the teacher or teacher-researcher acts as a *bricoleur;* "a handyman [craftsman] or handywoman [craftswoman] who makes use of the tools available to complete a task." Kincheloe described teaching as bricolaging. This is similar to how Sharma (2008), in applying this same principle, described Mr. Raghuvanshi as a *bricoleur* (a craftsman) and what he did (improvisation in his teaching and the learning of his students) as bricolaging. I call bricolaging craftsmanship, (i.e., being and becoming a craftsman). As Michelle found out, teaching and learning were not easy tasks.

Teaching and Learning – A Triple Dialectical Relationship

Davis (1997) defined teaching as the interaction between a student and a teacher over a subject in a setting. The interaction he referred to was the type of social life encounters that afford cultural production, reproduction, and transformation in the classroom. He argued that while learning could take place without a teacher, teaching could not take place without a learner. I reject Davis' construct that learning can take place without a teacher. I argue that learning cannot take place without a teacher because a learner who learns by herself is a learner who teaches herself (self-taught). A self-learner is a self-teacher who interacts with the subject matter in a self-structured field purposed for such learning and teaching, with self-determined outcomes. Consequent to teaching (by self or others), learning is the reproduction and transformation of what has been taught.

Tobin and Roth (2006) had theorized teaching as cultural production and learning as the reproduction and transformation of the culture produced through teaching.

Teaching and learning presuppose the existence of each other meaning that neither can be considered as coming first nor taking place without the other; hence the triple dialectical relationships of production|reproduction|transformation.

Learning to Teach the Traditional Way

Like many career changers, Michelle came into teaching science without the advantage of having taken any education courses. Unlike her certified counterparts, she did not have the benefits of foundational education courses that focused on teaching methods. Such courses would have better prepared her for the challenge of teaching science in urban high schools. In addition, she did not have the luxury of a teaching practicum, which would have paired her up with at least one cooperating teacher to experience the dynamics of the urban science classroom as an apprentice of sorts.

In preparation for her state certification, Michelle took some educational foundation and methods courses at a private university in the city while she continued teaching science at a neighborhood public high school. Michelle told me during one of our many discussions that the education methods courses she took did not fully prepare her to handle the intricacies and complexities of the interactions and emotional (social) relationships emerging in her classroom. She said that the majority of her courses reiterated the traditional methods of teaching in which the teacher is to exercise control-over students. Upon reflection, Michelle believes that these deficit ideologies about urban youth problems and lack of interest in learning, failing minority students and increasing school violence, which she brought to her early educational foundation and methods courses, were often reinforced by the pedagogical knowledge being espoused by the faculties depicting negative images of urban youths, growing rates of truancy and

violence. Accordingly, Michelle learned that to be effective, she would have to establish and maintain control over students and apply tough disciplinary measures that would send strong messages to students that she was in control of all aspects of the interactions in her classroom. Michelle said she was taught in some of the education methods courses she took that students should be kept quiet, be in their seats, raise their hands, and be called upon before they could answer teacher's questions. She was not supposed to smile for the first three months of the academic year in order to discourage students from seeing her as a 'softie.' She was to look stern and to exert her authority. Michelle believed that was how to exercise classroom management until she took courses recently on critical pedagogy that challenged these traditional hegemonic ways of teaching.

My experience in traditional teacher preparation and education methods courses was similar to what Michelle described above even though we attended different institutions in different locations many years apart. As in Michelle's experience, while the faculty members who taught many of those education methods courses emphasized student-centered approaches to teaching, they employed chalk-and-talk, traditional, teacher-centered, and lecture-based methods in their classrooms. A majority of professors that Michelle and I encountered did not model the pedagogical methods they espoused in their education methods courses. They were purveyors of a "do-as-I-say-and-not-as-I-do" method. Perhaps, these professors forgot that new teachers often followed the "what-teachers-see-teachers-do" approach, especially if the "how-to-do-it" message came from professors who occupied superior and authoritative positions. Teacher-preparation faculty members need to become cognizant of this dichotomy because, historically, student-teachers initially, teach the way they were taught

(Britzman, 1991). This problem pervades the education system even though the traditional methods of teaching continue to be challenged by reform efforts such as cogen.

I did not hear about critical pedagogy until I took a chemistry education methods course in my last semester of a Masters of Secondary Science Education degree program at New York University (NYU). It was in that course that I first learned about critical pedagogy, coteaching, and cogen. (I still did not know what critical pedagogy entailed until I took courses with the recently deceased Joe Kincheloe, as a post-grad). It was that chemistry education course that sparked my interest in researching cogen and brought me into contact with Ken as I continued my post-graduate studies. My interest in cogen was kindled because I had frequent discussions with my high school science students about their experiences in my class. I asked what I could do better, what they wanted to do with their lives, and how I could help. It was these discussions with my students that led me to start a science club and students' participation in science competitions, Saturday science (hands-on, problem-based science inquiry), and various other science-career outreach programs at various higher institutions in NYC and beyond. These opportunities and experiences became salient and relevant to my students and me as they afforded and expanded students' agency and structured their interests in learning science. Students gained more cultural, social, and symbolic capitals as they participated in these programs. I also gained more capitals (cultural, social, and symbolic) and social networks in the process. These opportunities provided resources that structured my teaching of science to my students. I shared this information with Michelle and she said, that's how I learned and was successful. That's what I want for my students.

Patterns of Traditional Teaching Methods

Michelle has been teaching biology and chemistry and mentoring/teaching a hotel management class for the past five years at *Fairness High School*. As a teacher employing the traditional methods of teaching and learning, Michelle established sets of "do not" rules in her classrooms as she was taught to do in her earlier teaching methods courses. But those rules could not be enforced justly, if at all. Enforcing the rules would constrain rather than foster the fragile working and social relationships Michelle was trying to maintain with her students. Michelle found that, on many occasions, students broke the rules and did not seem to care. In addition, some of her students seemed preoccupied with issues other than education. Issues from students' lifeworlds often crept into the school field, causing distractions and disruptions in class, which made teaching and learning difficult for Michelle and her students.

Michelle's teaching and delivery of content knowledge were becoming encumbered by the ways social life was being conducted as she interacted with her students. Michelle started to employ the control methods she learned from the traditional teaching methods course she took previously. For instance, even though Michelle had an interactive *Promethean* electronic whiteboard with Internet access that she was using to teach, she found herself restricting students from interacting with it. She would only allow one or two "trusted" students to interact with the digital resource. She was also protective of her social space (the "general space" and the "teacher's space" [see Appendix A]) and her computers; and she did not always stay long in the "students' space" (see Chapter 5 for more discussion on social space utilization). In addition, Michelle found herself using mainly chalk-and-talk methods of teaching and textbook-

provided assignments and worksheets contrary to her desires to implement hands-on, inquiry-based lessons. While she occasionally assigned cooperative learning exercises, she restricted students from interacting across their groups. All the deficit things she had heard about and dreaded were unfolding before her eyes. "This was not how I envisaged my students would learn," she reflected during an interview as we reviewed our preparations to conduct cogen.

Effects of power differential

In trying to address the issues she was facing, Michelle was reaching further into her traditional teaching methods toolkits and began implementing more of the strategies she was learning in the education methods courses. For example, Michelle would not sit down for a moment while class was in session to show that she was in control of the transactions taking place and to communicate to students that she was watching every move they made and was ready to act swiftly to forestall any act by any student that was considered, by her, as inappropriate. This was her way of establishing and maintaining classroom management. Michelle did not want to be perceived as not having good classroom management reminiscent of the traditional methods of teaching where the teacher exercises control-over students. Michelle paced around the classroom with a stern expression on her face to communicate to students that she was a "tough cookie and not a Southern Belle" because, "I am not prepared to be run-over," she said as we continued discussion on enacting cogen.

The structure of the classroom management created by Michelle followed the standard traditional methods of classroom control, which did not encourage or support collaborative and collective actions. Michelle methods of teaching did not foster inter- or

trans-group interactions during cooperative learning sessions because each group would have to present its work independently. As a result, student-student interactions were limited and most students did not get to know each other across groups because students were competing (struggle for resources or for agency to access resource) against one another turning the traditional classroom into a field of struggle (Bourdieu, 1990). The structure that created competition instead of collaboration reinforces deficit and stereotypical perspectives of students. Competitions stimulate negative emotional energy that could undermine synchrony and solidarity (Collins, 2004).

Challenging the status quo

After many years of using the traditional teaching methods, Michelle began to reminiscence and to reflect on her teaching and pedagogical challenges and her students' academic struggles. She wondered about what she could do differently. Why couldn't she engage her students like Dr. Dontfail did? Would that way of teaching be tenable in high school? The experiences of caring and justice that Michelle enjoyed as a child and a student, in addition to the science identity generated in childhood and in schools, that individually and collectively shaped and structured who Michelle is became salient resources as she began to reflect on her teaching and how to be a better teacher. Rather than blame her students, Michelle started looking at her own practice, saying to herself, "There has to be a better way to teach these kids to learn science."

There Has To Be A Better Way

"I was tired of putting on boxing gloves everyday, ready to fight my way through the day; and I was looking for better ways for me to teach and for my students to learn

science," replied Michelle in response to a question put forth at a conference where Michelle and I presented on how her practices and those of her students have been transformed by her implementation of cogen with students in one of her biology classes. Michelle was explaining, metaphorically, how much of a struggle it was for her, as a science teacher, to work through the day's lessons with all that usually occurred in her culturally diversified, multi-grade biology classrooms where the traditional methods of teaching did not seem to yield the successful outcomes she and her students desired.

Instead of blaming her students for lack of effort and motivation, or blaming the school district for lack of adequate support, Michelle thought that her students and the system would be better-served if she could learn more science content and improve her pedagogical knowledge. During a discussion, as we were preparing to conduct cogen, Michelle said:

> When they are successful, that's when I am successful; and whatever I have to do to make my students successful is what am searching for. The old ways of teaching don't work well for these kids. I am searching for better ways. Not a one-size fits all.

Learning About Cogen

In pursuit of learning how to teach better, Michelle also thought it might be better to improve her own science content and pedagogy knowledge. She enrolled in an intensive, ten-course, MCE program designed for in-service science teachers seeking opportunities to increase their science content knowledge and improve their pedagogical practice. Eight of the program's ten courses concentrated on improving science content knowledge while two courses focused on improving teachers' pedagogical practices.

Classes met all-day every other Saturday during the fall and spring semesters and for four days (all-day) per week for eight weeks during the summer semesters. The program spanned three summer semesters over twenty-six months of dedicated learning. It was a program where teachers' role identities changed from being that of a teacher to that of being the student; hence I refer to the participants as teacher-students. Teacher-students in the MCE program, of which Michelle is a cohort member, play the roles of teachers in one field during the weekdays and switch roles to that of students in another field on Saturdays. It was in the context of the MCE program that Michelle learned about cogen and embraced the concept and was willing to use it in her classroom.

Challenge to Coconstruct Pedagogical Knowledge

During Michelle's first pedagogy course, the professor introduced the MCE teacher-students to cogen by engaging them in constructivist dialogues. He discussed openly with teacher-students their expectations and goals for the course and brought them to agree together on plans of action that would structure the accomplishment of their individual goals and collective success. The professor also challenged the teacher-students to prepare to coteach the class with him so they could share their experiences with and become resources for each other. Some of the teacher-students, because they were used to the traditional methods of teaching where professors (and they as teachers) stood in front of the class and lectured, were initially surprised at the idea of being coconstructors of knowledge. Some even complained aloud. Consistent with a banking system (Freire, 1970), the complainers wanted to sit passively and be lectured to. The professor reiterated to the teacher-students the benefits of the teaching method he was employing. He urged them to give it a try and they agreed. To negotiate classroom

practice seemed strange to many of these "experienced" teachers. Some of them wondered audibly: "Why negotiate when you are supposed to be in charge? Is the classroom now a negotiable space? Is teaching and learning a negotiable practice? Do I have to coconstruct knowledge with my students? What is this cogen all about"?

The pedagogy course faculty informed the teacher-students that, in addition to engaging them as participants in cogen, he would model cogen for them. He then challenged the teacher-students to make concerted efforts to implement cogen in their own classrooms. While most of the teacher-students accepted his challenge, others were skeptical. Some thought they were going to lose control of their classroom.

For many of these teacher-students, it was, perhaps, the first time they were encountering and experiencing critical pedagogy in practice. Critical pedagogy is a way of identifying and addressing issues of systemic inequity with the goal of transforming dominant ideology in the classroom. Addressing systemic inequity and dominance are salient to cogen. Some might have read about critical pedagogy (Kincheloe, 2008) and might have doubted the efficacy of enacting such a teaching and learning method in their own classrooms. To alleviate their trepidation, the professor assigned the teacher-students some reading materials on cogen, coteaching, critical pedagogy, and cultural sociology in order to prepare them for this approach to science teaching and learning. Sonya Martin, a proponent and an experienced enactor of cogen and coteaching, was invited to speak to them. It became obvious that many of the teacher-students had not seriously considered the roles that cultural and sociological factors play in mediating their own teaching practices, much less the learning of science by their students.

Michelle was one of those teacher-students who quickly became intrigued by this non-traditional approach to science teaching. The idea of cogenerating pedagogical methods with students resonated well with Michelle and brought back memories of her experience in Dr. Dontfail's class. Michelle recalled during an interview as we were preparing to conduct cogen in her classroom,

> When I heard about cogen I thought this sounds like the answer to my prayers. It brought back memories. I had a few questions because I wasn't quite sure how this cogen would run or even what it looked like. I knew that I like the feeling of being a member of a classroom community. This was how I learned best and was successful. I wanted my students to have similar experiences to those I had as an undergraduate student. I liked the fact that I was not some peon being dictated to. I actually felt like we were a community in that class. This method brought me back to the days of undergrad being in Dr. Dontfail's class and why I had enjoyed that class so much. Dr. Dontfail had what I thought was a very unusual style of teaching – he engaged students to coteach with him.

Michelle decided that she was going to try cogen in her high school biology classes and sought my assistance.

Lending A Helping Hand

Recently, I had joined PennSTI as a research associate responsible for the programs' internal evaluation. There were two of us responsible for collecting data internally for the external program evaluators' use. The second person happened to be the professor teaching the pedagogy course in which Michelle was a first-year teacher-student. I had learned more about cogen and studied it as a member of Ken's research

squad at the GC where I had been working to complete my doctorate. In addition, I had used cogen successfully in teaching an undergraduate, pre-service teacher preparation methods course as an adjunct, and in researching and improving my own practice at Queens College (QC) in NYC. At PennSTI, I was looking for an opportunity to conduct research on cogen for my dissertation, having completed my doctoral course work at the GC. So, it was an opportune time for Michelle and me to cross paths at a time when she was seeking better ways to afford her success and the successes of her students. With my assistance, Michelle was able to implement cogen successfully in one of her biology classrooms, the 6th-period class.

Instituting Cogen In Michelle's Classroom

The desire to implement cogen became expedient for Michelle as she continued to enjoy the interactions in her pedagogy course at PennSTI. In addition, the structure of the course resonated with Michelle's previous experience as an undergraduate in Dr. Dontfail's class. She began to earnestly discuss the possibilities of enacting cogen in her high school classes with me. She was also giving hints to her high school science classes that she wanted to try out a new method of teaching and learning that would involve their evaluation of her pedagogical practices. She wanted their honest opinions so she could be a better teacher and so that they could be successful learners of science.

Pre-Cogen Preparations

As we worked toward starting cogen in her class, Michelle recalled during a discussion:

> So, after reminiscing on the rewarding experiences I had as an undergraduate with those professors who nurtured me, I felt I owed it to my students to provide them with similar opportunities and structures I enjoyed as a student. I became convinced that cogen would be the method of choice that would facilitate that opportunity. Reality then set in. It was not only the student practices that needed to be transformed but mine as well. I knew then that I needed to get input from my students on how they like to be taught and what practices I had that were contradictory to their learning.

In preparation for implementing cogen, Michelle informed her three biology classes that she was back in school and was being introduced to a method of teaching and learning called cogen that she wanted to try out in class. Michelle informed students that while participation would be on a voluntary basis, whatever decisions for changes that were agreed to at the cogen would be implemented in the class and would positively or otherwise affect everyone. Michelle said,

> I gave them all of my reasons and 6th-period was the class that was most enthusiastic about cogen. So, I invited all students to come and participate. I told them that our focus for the first cogen would be on my classroom practices that are contradictory to their learning and my teaching.

To insure compliance with research protocols, I obtained copies of PennSTI's IRB-approved student assent and consent forms for Michelle, her students and their parent(s) or guardian(s) to sign and return for our records. Michelle obtained students' signatures and requested that students take home the parental consent form for their parent(s) or guardian(s) to fill out and authorize. She also called parent(s) or guardian(s)

to follow up on the signing of the consent form and to let them know about the plan to conduct cogen and sought their supports. Within days, students began to return the consent forms duly signed by their parent(s) or guardian(s). At our first cogen meeting, one of the parents demonstrated her support by sending us a tray filled with home-baked cookies. The school administration - the principal, the two assistant principals - were also informed and they gave their consents and enthusiastic supports. Although Michelle was putting her career up for scrutiny, she was willing to do anything reasonable to support her students' learning and to improve her teaching and professional growth. In addition, she wanted to be on the frontline to put research and theory into practice stationing herself at the intersection of research and practice so as to benefit her students. Michelle thought it was a risk worth taking and challenged other teachers to do the same.

Implementing Small-Group Discussion (Cogen)

As we continued preparing to conduct cogen in Michelle's class, I provided her with a digital video camera to capture video images of one of her 6th-period lessons during classroom activities. The purpose was to establish a baseline that would be used to analyze pedagogical practices and interactions that were enacted by Michelle and her students subsequent to implementing cogen. From the captured video, we would create video clips (vignettes) that were relevant to Michelle, to her students and to me that would be used as our point of mutual focus for discussion and analysis during cogen.

In enacting cogen, all students were invited to participate; we (Michelle and I) did not choose any particular type of students. All cogen participants were encouraged to speak their minds on issues at hand and to help identify where improvement needed to be made. They were encouraged to suggest how improvements could be implemented. No

one voice was privileged over another and no power hierarchy was to be displayed in cogen. Teacher and students had equal authorities. Plans of action were collaboratively and collectively generated and implemented. Participants held each other accountable and responsible for individual and collective actions and outcomes.

As a result of cogenerating ideas to improve the quality of teaching and learning of science in their classroom, the structure or the schema of interactions and transactions between Michelle and her students became resources that transformed the culture they coproduced. This was particularly evident in how transformed roles afforded and expanded students' agency and structured interactions between Michelle and her students and between students themselves. As a result, students accepted leadership roles and became coteachers, change agents and brokers of youth culture in the science classroom.

Chapter 3

Conducting Cogen in an Urban Science Classroom

In a recent article, Martin and Scantlebury (2008) gave an updated historical account of the numerous studies in the last decade, which provided evidence of positive and productive changes with respect to the efficacy of cogen in K-12 science classrooms (urban, suburban public and private) and in science teacher preparation programs. They cited studies that supported the idea that cogen can transform learning environments by changing the social and working relationships between teachers, students, and administrators. They cited numerous changes that teachers and their students have made to afford each other's successes in the classroom. What has been added since their publication was that the use of cogen as "a promising tool to improve teaching and learning across subject areas and grade levels" (Martin and Scantlebury, 2008, p. 119) has now been extended to adult learning programs, mathematics education, and special education programs in New York City public schools as a research and pedagogical tool.

The utility of cogen as a pragmatic pedagogical, theoretical, and "methodological framework for engaging classroom participants to generate understanding (local theory [knowledge, solutions and successes]) about teaching and learning—from *being-in* a particular situation *with* other teachers and students" (Martin and Scantlebury, 2008, p. 119) has brought profound practical outcomes and transformation to stakeholders. When cogen is properly enacted, both students and their teachers gain authentic knowledge of and about each other and their lifeworlds; and they become sensitized to each other's sociocultural, emotional, and educational needs (Ladson-Billings, 1994). This awareness can foster positive outcomes in classroom practices and can generate positive emotional

energy, entrainment, and solidarity (Collins, 2004), (i.e., a sense of affiliation, of belonging and of community, toward individuals' goals and shared collective motives (Tobin, 2005)).

In this chapter, I discuss the scope and focus of my study. In addition, I explore the purposes and processes of Michelle's determination to enact cogen in her classroom at *Fairness High School*. I examine the products (outcomes) of our working together to conduct cogen in a later chapter in this dissertation (see Chapter 6).

Scope of the Study

When I set out to conduct research on cogen in Michelle's biology classroom at *Fairness High*, it was with the goal of getting her to successfully engage her students in meaningful and productive dialogues about their shared experiences in her classroom. Cogen creates space for sharing teaching and learning experiences in the classroom. By holding conversations around what happened in the classrooms and why, Michelle and her students would gain better understandings on how they could interact more productively with each other using their differences and similarities such as, academic competency, gender, race, ethnicity, culture, religion, social, and economic status as schemas to structure their interactions in the classroom. There is a copresence between similarities and difference; (i.e., where differences exist, associated similarities also exist). For instance, while Michelle's students are from different grades and academies, they all have biology class as a location of similarities and have to work together to produce science culture, identity and fluency. To produce culture, all participants need to interact across boundaries of differences and similarities. Differences and similarities are

powerful schemas that can expand or truncate agency and provide or prevent access to resources in social life.

Initially, we set out to conduct cogen with all three of Michelle's biology classes (i.e., 1st-, 3rd- and 6th-period classes). There were 24, 25, and 30 students on the respective class attendance rosters. We wanted to hold cogen with each class separately. However, when we attempted to enact cogen with the 1st- and 3rd-period classes, we experienced unexpected problems. One of the problems we had with the 1st-period class was poor daily attendance, which prevented us from generating meaningful discussions about cogen. We spent many days discussing what we wanted to do and how it would benefit all participants. However, on the day cogen was to be conducted, no students came. We concluded that many 1st-period students were not particularly interested in staying after school to participate in an after-school program. We chose after-school because of the many program conflicts as a result of students being from multiple grades and multiple academies (fields) intersecting and nested in Michelle's biology class. The day following our failed cogen attempt, students gave us varieties of excuses to explain their absences. We determined that the underlying factor was their fear of being vulnerable. Fear is one of those emotional forces (Turner, 2002) that produce negative emotional energy contributing to lack of solidarity (Collins, 2004) and sense of affiliation. The students in the 1st-period class did not trust (symbolic capital) Michelle and me enough to commit to participate in cogen activities. We had not earned the right to work with them. We had the cultural and social capitals but did not have enough symbolic capital to engage them in cogen. Historically connected capitals (i.e., symbolic, social and cultural) structure fields of social encounters. We experienced similar scenario with the 3rd-period class

also. There were no shared schemas among participants. So, we gravitated toward the 6th-period biology class because the class was more receptive to the idea of cogen and, in the end, we were not disappointed.

Significance of the Study

In this section, I elaborate on the significance of this study from three perspectives: 1) personal, 2) programmatic, and 3) educational. Each of these perspectives, individually and collectively, is salient to the purposes and intentions of this research.

Personal Purpose and Involvement

On a personal level, this study was of particular interest to me because it provided me with an opportunity to conduct authentic research for my doctoral dissertation. The process of conducting this research and the outcomes generated were the bulk of my dissertation. It was also an opportunity for me to work together with a high school teacher in my role as a cogen mentor. In addition, this was a kind of "home-coming" for cogen as I returned to the city and institution where Ken and his associates started cogen as a pedagogical and research tool. It was a return to a program that had been integral in cogen evolution in one form or another for almost a decade. It was also the first time in 5 years that cogen was again being studied by a researcher teaming up with a high school science teacher from the MCE program. Unbeknownst to Michelle and I at the time, I was also returning to a school that had a connection to cogen in the past where Catherine Milne (Cath) had worked with some teachers and had published her findings (see Milne,

Scantlebury, and Otieno, 2006) before. A member of the first cohort of the MCE program still teaches chemistry in the school.

Programmatic Purposes and Intended Goals

On the programmatic level, this was a study that goes beyond the common assumptions of the MCE program's faculty, administrators, and evaluators. These assumptions were that teacher-students participating in the program will, by default, incorporate cogen and coteaching into their instructional and assessment schemas and associative practices by virtue of being exposed to these pedagogical methods, (i.e., cogen and coteaching). I chose to call these students "teacher-students" because they were in-service teachers taking classes, as students, on the weekend. In general, the program administration had adopted cogen and its counterpart, coteaching, as professional development tools (Blasie and Palladino, 2005), as pedagogical tools (Martin, Milne, and Scantlebury, 2006), and as an assessment or evaluative tool (Martin and Scantlebury, 2008). The administration had also doggedly continued to encourage faculties and the teachers assisting them to enact both cogen and coteaching in their courses. Assisting teachers were, in most cases, graduates of the program who cotaught with science content faculty members and acted as pedagogical buffers between faculty and teacher-students. The goals were to employ cogen and coteaching as practical ways of teaching while modeling these concepts for the teacher-students so that they could incorporate these methods into their teaching practices.

As an internal program evaluator, I looked for signs that cogen and coteaching were being implemented when I conducted classroom observations of faculty members and when I evaluated faculty teaching using the *Reformed Teaching Observation*

Protocol (RTOP), an observation analysis instrument, developed by Piburn et al. (2000) and explained by Sawada et al. (2002). I shared my findings with the administrator who then shared them with faculty members on an on-going basis as a form of formative assessment of the courses thereby enabling timely adjustments to be made in course delivery and social interactions within the courses. This was done in order to afford continuing success of the participants. Such findings became resources for enacting cogen between faculty and teacher-students and to start a process of intervention, if needed.

Similar protocols were followed when I visited teacher-students in their local schools to observe and capture videos of their classroom practices. I also employed RTOP to evaluate teacher-students' classroom practices to determine how their teaching practices were informed by their participation in the MCE program, especially their use of cogen and coteaching strategies. I also searched for other evidences of improved practice such as increased use of science content knowledge. Observations were usually scheduled only once or twice per year. In addition, teacher-students captured videos of their own practices and submitted them for my evaluation.

Other than learning *about* cogen when mentioned by evaluators or some science content faculty in their classes, cogen had become nearly a cliché associated with ameliorating emergent problems only because teacher-students did not always experience cogen in most of their science content knowledge courses. Only a few faculty members embraced and used cogen (and coteaching) in their science content knowledge courses. Some science content faculty frowned at the idea of sitting down on an equal basis to negotiate some aspects of their classroom practice with teacher-students. Those faculties

felt that discussing and negotiating with teacher-students were attempts at lowering science-learning standards unbefitting the academy. This was a form of hegemony associated with traditional teaching methods.

On the other hand, the pedagogy faculty members, who were students and practitioners of cogen, (Cris, Sonya, and Wes) authentically modeled cogen in their courses and challenged teacher-students to try cogen (and coteaching) in their own classrooms. Even though the pedagogy faculties assigned readings about cogen and discussed the merits of cogen, teacher-students were often skeptical about trying cogen in their own classrooms. There was usually no one to work them through on how to implement cogen in their classrooms. Therefore, when some teacher-students tried to enact cogen, the moment they ran into any form of difficulties or resistance, they abandoned the idea and complained that it was difficult to conduct cogen in their school with their students.

One-on-one cogen mentoring

It was for the above reasons, in particular, that this study was much more significant. This study went beyond the PennSTI program evaluation protocols of scoring one or two observations per year and/or the self-recorded videos of teacher-students' practices in their classrooms. The scoring of the observations was to determine the extent to which the culture that teacher-students experienced and/or cogenerated, as cogen was enacted in their PennSTI courses, were being reproduced and transformed as they enacted practice with their students.

In conducting this research, Michelle and I worked together as equal partners with different role identities. She was the teacher-researcher and I was a participant observer

and researcher. We worked together in her classroom for about three months and continued to work together as we analyzed video data. We presented some of our findings together at conferences and, on some occasions, in company of some of the 6th-period students. When Michelle conducted classroom activities, I video recorded and occasionally, as opportunities permitted, I interjected some explanations or elaborated on some concepts having been a former biology teacher myself. Sometimes, I suggested various hands-on activities, such as the marshmallow babies that became very popular. Later, we were joined by Ms. W, a White, a female, student teacher from Sonya's science teacher preparation program at Drexel University, who came for her clinical teaching practice. She met us during this study, experienced cogen, and was inducted/mentored in cogen.

As Michelle's cogen mentor, I guided her on how to enact cogen. Without my supporting her, she might have abandoned enacting cogen. I found that I needed to mentor Michelle and her students as we conducted and experienced cogen together. Without this one-on-one mentoring and coaching, cogen would have likely devolved into a gripe or a therapy session.

Educational Perspectives

At the educational level, it was imperative that I demonstrated to Michelle and to the teacher-students in the MCE program that cogen was a viable pedagogical tool. These teacher-students read about cogen (and coteaching) in journals and books; heard about cogen in their courses and engaged in it as a way of solving emergent problems they faced as learners, yet many expressed doubt as to the efficacy of cogen as a pedagogical practice. To many, cogen sounded good in theory, but they held on to their traditional

notion that a teacher was supposed to just teach. They believed that meddling in the sociocultural 'troubles' of students by engaging them in dialogues about their classroom experiences was not part of their roles as teachers., "I am not a psychologist, nor a social worker," some of them said.

Being a believer in what could be achieved through the use of cogen in the classroom, I needed to demonstrate that this novel pedagogical practice was still relevant and applicable in teaching students of all ages, and grade levels across various subjects. The need to improve teachers' practice so students could improve their own practice and achievement in science is a continuing endeavor of education reformers. Darling-Harmond and Bransford (2005) challenged educators to examine the salient concepts and pedagogical practices that should be at the heart of any teacher education program in order to prepare teachers to facilitate the learning experiences children will need. Tobin (2006c) explored instances of cultural misalignment between teachers and students when they (teachers and students) come from different race, ethnic, and class backgrounds. Barton (2003) critiqued the deficit model that came under the banner of science for all; and she offered an alternative way to think about science and youth. Tobin and Roth (2006) posited that deficit perspectives, especially of students of color, act as powerful schemas that structure teachers' interactions, which end up truncating students' agency. Barton suggested locating science as a process of human subjectivities influenced by the intersecting dimensions of identity, relationships, and structures. In "*Rethinking Scientific Literacy*," Roth and Barton (2004) suggested that students and teachers needed to think more radically about how they learn science, view the "scientific method," and interact with "scientific facts." This, they suggested, requires a type of paradigm shift that

welcomes and requires discussions, interactions, and struggle by peripheral and central participants.

Therefore, it was important for me to demonstrate to Michelle, her students, and others that having dialogues between the teacher and her students help improve teachers' practices and students' achievement in science. I needed to demonstrate that teachers and students could *work together* (collaborate) to create positive and productive teaching and learning environments by talking to each other about how they engage and experience each other in the classroom.

Why I Call for Collaborative and Collective Actions in the Classroom

In this section, using my experience as a former urban high school science teacher, I call for teaching and learning to involve teachers and their students *collaborating with* each other and engaging in radically collective approaches to pedagogy. The collaborative and collective actions I advocate are not just between teachers and administrators (they readily corroborate each others' practices). What I am advocating are collaborative and collective actions primarily between the key stakeholders (participants) in the classroom discourse, i.e., teachers and their students. When I taught high school science in Queens, NYC, I learned that engendering *collaboration with* my students for our collective successes required having a mindset that broke away from the traditional mold of the teacher as an all-knowing pedagogue acting as controller of youth and their learning. I learned that just having control over students in the classroom did not foster the trust and positive emotions required in my social and working relationships with my students.

At that time, as a neophyte teacher (in 2000), I had similar thoughts like Michelle was having. These thoughts were always coming to me:

> There has to be a better way to teach science to these youths. How can I create productive learning environments where I can teach and my students can learn science effectively? Why can we not (my students and me) work collaboratively and collectively to enact the curriculum and manage the classroom together? What factors are constraining our collaborative efforts? How can we overcome these factors?

I asked my mentor, Ms. Sydney, an experienced female African American science teacher with decades of teaching experience, these questions as I pondered them. She told me that, with time and experience, I would find answers to these questions. She was considered an effective teacher because she knew how to establish control over her students; her presence was imposing and her tone of voice was likewise. She demanded respect almost like a drill sergeant in her classroom. She was gentle, but had a firm, vise-like, grip on the classroom. One could hear a pin drop when she was not talking. Often, she would say, "Do what I tell you and you won't have problem with me." I did not want to teach like that.

As a career changer, I came from an environment of animal care and use in biomedical research where we worked together collaboratively and collectively to set and accomplish goals; where we met regularly to evaluate progress, redefine individual goals and collective motives and retool our processes. It was an environment where structure and agency reinforced each other dialectically with shared cultural production as a motive. However, this approach contradicted the traditional modes of teaching and

learning that I was learning as a neophyte high school science teacher. I struggled with this dichotomy for some years. What I learned then and now, which resonated as I interacted with Michelle was that many teachers shared similar concerns. So, like Michelle, I began to explore alternatives to the classroom practices that had privileged control over students above collaboration and collective engagement. Traditional teaching methods premised controlling students as if control over students provided structures for receptivity to learn. I did not find that construct to be true. All I met was resistance from the students. Similar to Tobin's (2000) encounter at City High in Philadelphia, urban youths in my classes in Queens, NYC did not want me to establish control over them nor did the youths at *Fairness High* in Philadelphia want Michelle to maintain control over them.

In each of these encounters (Tobin's, Michelle's and my classes), by closely *working with* students and by providing structures that afforded and expanded mutual respect, trust, opportunities and agency to engage in dialogues, over a period of time, students and teacher got to know each other better, built networks of social and working relationships, and were able to share their goals with each other. Over time, positive emotional energy began to build up and classroom solidarity among students, and between students and Michelle, were generated. Cultural production required positive emotional energy and solidarity in action. Productive social and working relationships began to emerge as the teacher (exemplified by Michelle) and her students generated new culture for and from *working together*.

After a while, this new culture of collaboration became resources for making sense of social and cultural patterns of coherence and contradictions in the enactment of

social life and the science curriculum. *Collaboration with* students in the classroom produced the social networks required for social bonding, which engendered group affiliation; identity and solidarity needed for accomplishing individual goals and collective motives in the classroom. In this study, by *collaborating with* each other, Michelle and her students were able to challenge and cross-examine each other's experiences. They were able to use the variability generated by their individual differences and similarities as collective resources to build solidarity and community that supported the teaching and learning of science (biology) in their classroom.

Moore (1995, p. 6) had reiterated the need to "accept that instruction (*pedagogy*) is a shared responsibility that needs collective management." However, according to Davis (1997, pp. 9-10), because many teachers think of their classroom as their castles, "working as independent practicing professionals, (*independent of their students rather than interdependent with their students*) without supervision (even as a novice teacher) and without built-in mechanisms (*of collaboration*) for generating new ideas and techniques," most teachers fail to create structures that foster collaboration and collective actions with students (words in italics are mine). Therefore, they struggle along in isolation. As recommended by Davis, to generate new ideas and techniques (i.e., produce, reproduce and transform new culture) requires that teachers seek other people's perspectives. Many teachers turn to their colleagues and administrators rather than to their students with whom they share the same environments and experiences most often, in the classroom. Turning to colleagues and administrators is good, but it is only one resource. Turning to and sharing perspectives with students is more productive and transforming.

As Michelle and I discovered, when a teacher creates the structure that provides students the opportunities to participate as equal partners in the enactment of social life in the classroom, students are able to expand their agency. In addition, students are more willing to *collaborate with* the teacher to insure the successful outcomes of individual goals and collective motives of the entire class. This notion was exemplified by this excerpted written reflection by Scarface, a student and cogen participant in the 6th-period class:

> We work and interact with each other now. I enjoy 6th-period Biology more than my other classes because in my other classes, it's all one-way teaching. Teacher teaches, students listen, Students put no input into what is going on. Personally, I enjoy my work more if I get a say in what I am doing.

Collaboration with her students reduced the burden of classroom management and curricular enactment on Michelle. It produced structures for distributed leadership as students responded to changes in their role identity and expanded their sub-identities as brokers of youth culture and change agents in the classroom. Freire (1970) advocated mutual approaches to education rooted in dialogues. He called this approach "authentic" and humanizing because for education to be a practice of freedom, collaboration and collective actions are required at the micro level and across the meso levels of encounters between the teacher and her students within the classroom field.

Why We Conducted Cogen In Michelle's Class

Many folks have often asked, "Why do you guys conduct cogen"? "What is it about cogen that gets you guys so revved up and buzzing"? In this section, I answer these

questions and elaborate on why we conducted cogen in Michelle's class. Salient to this purpose was the need to transform teaching and learning of science by transforming the environment in which cultural production, reproduction and transformation take place. To do so also required that participants' practices in the classroom needed to be transformed. I strongly believe that transforming a teacher's practices is the most salient precursor to transforming students' practices and realigning successes in the classroom. I believe none of these could be accomplished without seeking the perspectives (through structured dialogues as in cogen) of students in how their teacher's practices affect their learning and then cogenerating schemas and practices that will engender individual and collective success.

Seeking Others' Perspectives

From personal experience and from watching other teachers, life in the urban classroom could be hectic. Teachers do not always see or know everything that was going on even when we pretend we do. The classroom is a very busy place and a lot of actions take place and quick judgments had to be made by the teacher. Davis (1997, p. 9) reiterated this understanding when he said, "… because classrooms are busy places and teachers are preoccupied with the decisions they are making, teachers are not always aware of what is actually happening." Davis posited that some teachers experience shock when told by an observer (who had just experienced the teacher's teaching), how the interactions in the class went. He added that teachers are often horrified when they have an opportunity to watch a video of their teaching performance and discover their "halting speeches, out-of-control gestures, constant pacing, poor eye contacts, or other disturbing mannerisms," (p. 9). Davis claimed that it was rather unfortunate that teachers do not get

much feedback on their lesson behaviors because their teaching is done in isolation. He alluded to the fact that teachers often talk to other teachers about their subject, but rarely about how they teach their subjects. He confirmed that it is difficult for teachers to ask students (see Rawr's reflection Chapter 6, pp. 162-163), "What do you think about my teaching"? He concluded that teachers need perspective. I agree with Davis (1997, p. 9) that teachers need the perspectives of others, most especially the perspectives of their own students who were their captive audience in the classroom. Teachers need to be able to freely ask their students, "How was my teaching"?

Until we started cogen in her class, Michelle, like many other well-intentioned teachers, did not consider the opportunity of utilizing the most authentic pedagogical and professional development tool within her classroom, i.e., the perspectives of (feedback from) her students. Unlike at the college level where students are provided with end-of-term forms to score faculty members' teaching on Likert-scale type response forms, when it is too late to effect timely changes that would have benefited those students whose suggestions were being sought, K-12 schools do not provide any way for students to evaluate the teaching practices of their teachers.

Most teachers dread getting feedback from their students. Most teachers often think, "What do they know about teaching"? Sometimes when teachers get feedback, it was often unsolicited. Hence, teachers tend to discount or even repress such perspectives from their students. Feedback from students may not be what a teacher wanted to hear. However, feedback from students may be genuine concerns that could benefit the teacher and her students (i.e., her teaching and their learning). Students are in a more unique position to give authentic feedbacks to a teacher because their perspectives on the

teacher's teaching and their own learning in the teacher's classroom comes from experiencing the teacher's practice over a length of time. Shared experiences shape encounters and cultural production in the classroom. As stakeholders and primary participants in teacher's unfolding practices, polling students through a small-group discussion sessions, such as cogen, would help a teacher to authentically evaluate and collaboratively improve her practice.

If feedback (i.e., students' perspectives) is authentic and generally educative; both teacher and student could learn from sharing it. Student feedbacks should structure dialogues; and dialogues can be used as tactical tools for catalyzing transformative pedagogical practices in the classroom. As such, teachers' ontologies about students and their learning and students' ontologies about the teacher and her teaching (Guba and Lincoln, 1989) can be transformed. Students' feedbacks also provided teachers with access into students' standpoints about the teacher, education, and even students' lifeworlds.

Michelle recalled during a conversation:

> I never thought I needed to talk to my students about these things. I thought they would not respond in a productive way. I was supposed to be in charge, to dictate the pace and tell everybody what to do. I used to think that I am the teacher; it is my classroom. But, guess what? It is their classroom as well. We are in this together. It is a shared space, like you [referring to me] said. It is a negotiated space and I could negotiate with them too. I do that with my child. I want my students to succeed. If they succeed, that's when I succeed as a teacher.

It was for these purposes that Michelle came to the conclusion that cogen was the answer to her prayers. As stated in of the Chapter 2 (p. 57), Michelle had come to a point in her teaching career where she realized that using traditional teaching methods had not yielded the outcomes she desired for her students. Therefore, Michelle began searching for solutions to the lack of success of her students. She came to know about cogen and was prepared to use it in her biology classrooms.

Talking With Students About Shared Classroom Experience

In the last section, I discussed the purposes of conducting cogen in Michelle's classroom. In this section, I explore the processes of enacting cogen with Michelle and her students in the 6th-period biology classroom.

For Michelle to enact cogen in her classroom, she would have to sit down with her students, at their tables, be on the same vertical and horizontal planes, in close proximity, where they (teacher and students) could "see eye-to-eye." From that vertical and horizontal vantage points, they would share their experiences and ideas about what is going on in the classroom and why, together. To have an effective dialogue with her students, Michelle have to accord them equal status as coparticipants by removing the hegemonic power of control. In essence, she has to 'level the playing field' by not dominating the discussions or putting more weight on what she would say or devalue what her students will contribute. She does not have to defend her standpoints but utilize them as resources to gain her students' perspectives in order to further her understandings of her individual role in the collective responsibilities of the classroom. She has to be willing to listen, value and consider what her students would say, i.e., value their stocks

of knowledge of classroom interactions|transactions. Michelle also would not act superior or become offended when her students say some things she may not quite like to hear. She has to be willing to share her feelings, goals and aspirations for their individual and collective successes with them. She has to be sincere with them. The same rules would apply to all other participants in the dialogue.

It would not mean that Michelle is still not their teacher, with all the rights and privileges thereof. It simply means that for that moment, she is willing to create a social space within her classroom space, structured differently and requiring a different form of disposition to act, for the sole purpose of meaningful and productive dialogues. Such space has to be void of dispositions, or other power differentials, associated with control over others, because every participant must be able to speak their minds without fear of reprisal or negative sanctions (Turner, 2002). Fear is a negative emotional force that undermines solidarity; and solidarity requires respecting other's perspectives. Participants would respect others and be able to accept respect from others. They must be allowed to voice their opinions in a personal way focusing on the issues at hand. At the end of cogen discussions, a plan of action would be generated that is collaboratively and collectively implemented the next time participants meet in class. No one would be compensated in any manner whatsoever. Vignette (video clips) from videos of a recently completed classroom activity would be used as a good way to garner mutual focus and discussions about how students and Michele experience each other in the classroom. Cogen interactions are also videoed and participants and the researcher would then analyze clips from the video.

As a teacher and her students sit down at talk and share their classroom and sociocultural experiences, a form of discourse (i.e., hybridized or interstitial culture), that accommodates educational and sociocultural differences, begins to emerge. Teacher and students learn to negotiate meanings, perspectives and how they represent the knower and the known. They learn to coconstruct knowledge. It is rather unfortunate that some teachers dread the opportunity to talk, to cogenerate dialogues, with their students. Talking about shared experiences can generate positive emotional energy and help structure positive social and working relationships in the classroom. However, some teachers think they might lose the control they have over the class rather than gain symbolic capital of trust and respect. For example, there was an older, more experienced, White female chemistry teacher at Michelle's school. She had attended many cogen meetings with us in Michelle's class. She would ask, each time she visited and participated with us in cogen, how she could implement cogen in her class. Our cogen student participants even volunteered to help her set up and enact cogen in her chemistry class. However, she continually refused because she was afraid. She thought she might lose control, power and respect. She wondered aloud, at times, how it was that Michelle was still able to command students' respect.

Cogen: Opportunity for Collective Reflections

It is unfortunate that most teachers, except those who have become critical pedagogues (i.e., grounded in justice, care and equity) and have become critically conscious (Kincheloe, 2008), dread the idea of asking students to voice their opinions on how teachers' teaching of the subject, especially of science, in the urban ecology, could be improved. Traditional teaching and teachers' professional development methods frown

at this model of professional development. Teachers are not encouraged to seek and use students' perspectives as a type of formative and summative assessments of teaching and learning at the high school level.

Talking with students, having a dialogue, (cogen) ought to be as common a practice as enacting a lesson plan after all the goals of a teacher should be to generate positive emotional energy, synchrony and solidarity in the classroom. Cogen ought to be included in a teacher's toolkits of reflective practice. Talking with students is a form of cultural production. Rather than reflect alone, a teacher should form the habit of reflecting together *with* her students who shared the same lesson and experienced the teacher's teaching. Having collective reflections is beneficial to the teacher and her students as it provides structure for polysemic and polyphonic perspectives that are salient to individual and collective success. Moore (1995), in closing his remarks on accepting an award from the American Mathematics Association, concluded by making two suggestions. One of these suggestions was that the culture of teaching and learning has to change. Among the three changes he outlined was that teachers should accept that instruction (teaching) is a shared responsibility that needs collective management. Collective reflections with students through small group discussions, as in cogen, ought to be the center of such collective management.

Davis (1997) vehemently demanded that there are certain things a teacher needs to be able to see even in the midst of the act of teaching in her classroom. But to be able to see those things, according to Davis, a teacher would need to know what to look for. In order to know what to look for, Davis posited that, "Teachers need perspective." It is obvious from Davis's assertion that he was referring to perspectives from the students

because they are the ones experiencing the classroom with the teacher; and they are able to see what the teacher could not see and might know a lot of things the teacher does not about the students and even about her own teaching. In essence he (Davis) was throwing a challenge at teachers to structure teaching and learning as a collaborative and collective practice so their students could help them see what they could not see and know what they may not have known. It is imperative for teachers to do so. This I argue is the nucleus of critical consciousness and critical pedagogy.

Collective reflections empower and emancipate participants and *humanize* the teacher (Freire, 1970). Individuated reflections by a teacher about her classroom experiences are epistemic monologues, a type of discussion between self and the "othered-self," that may not be as productive as collective reflections between self and others. By reflecting *with* her students, Michelle would enjoy productive feedbacks that generate dialogic conversations *with* her students on what works and what does not work, i.e., coherent and contradictory practices. Michelle would be courting diverse perspectives from her students that should provide her with polysemic and polyphonic viewpoints on their shared classroom experiences. In addition, Michelle would be able to challenge the role identity of her students as they provide suggestions on how to ameliorate what does not work well in order to make teaching and learning much more effective, productive and successful. By challenging and encouraging her students' participations in collective reflections through cogen, Michelle provides access and agency to appropriate the resources that students would otherwise not have had. It is through the students' perspectives that Michelle would be able to see what she would not have seen and know what she would not have known.

Participating in Cogen

In this section, I discuss how cogen participants came together and interacted with each other and how cogen affected participants. I examine Michelle's interactions with her students during cogen activities; how traditional practices were informed by cogen. I discuss what new or interstitial cultures that were produced during cogen in later chapter (see Chapter 6). Cogen provided structure and agency for Michelle and her students to proverbially walk in each other's shoes and to talk to each other about their shared and life-world experiences. Cogen also provided opportunities for the teacher and students to cross-examine each other's experiences within positive and productive environments that catalyze their transformations and successes.

Coming Together of Cogen Participants

We had initially wanted to conduct cogen in all of Michelle's three biology classes, separately. While it might have been too much data to manage at the time, we thought doing so might reveal some interesting similarities and differences specific to each class. As stated earlier in this chapter (p. 68), we ran into problems of students' interests, class and work schedules with the 1st- and 3rd-period biology classes. The 6th-period biology class students were enthusiastic from the moment they heard about cogen and were able to organize themselves to enact cogen and to participate actively. Participants agreed that students from each of the other biology (1st- and 3rd-period) classes who were interested in cogen were welcomed to participate in the 6th-period cogen meetings.

This was salient for some students from the 1st- and 3rd-period biology classes because they had friends in the 6th-period class who were active cogen participants. These students became active proponents of cogen in their respective classes. While we did not succeed in getting cogen enacted in the 1st- and 3rd- classes, their student representatives acted as cogen ambassadors and made it easier for Michelle to enact agreed-to plans and to reproduce and transform new or interstitial cultures in those classes. This provided opportunities that made cogen beneficial to all the classes that Michelle taught, even the hotel management class she supervised and mentored. Some of the hotel management students were cogen participants.

In addition, by having some students from the 1st- and 3rd-period classes, we were able to accomplish some of our initial objectives of wanting to conduct cogen in each of the three biology classes. The participations of representatives from the 1st- and 3rd-period classes gave the 6th-period cogen a cosmopolitan (Emdin, 2007) flavor. We were able to know and address the needs of the 1st- and 3rd-period classes and to obtain inputs from members of these classes through their student representatives; and that provided polysemic and polyphonic perspectives to our cogen deliberations. For example, based on their requests, we conducted a lunch-break cogen in which all of Michelle's students from all the biology classes were invited. We had a good representation from other classes and some other science teachers also came to participate with us and to learn more about cogen.

Chapter 4

Teacher's Practice Prior to Enacting Cogen

As an avid advocate of social and educational justice, John Dewey once wrote in the book *Democracy and Education*, and I quote:

> Since education is a social process, and there are many kinds of societies, a criterion for educational criticism and construction implies a particular social ideal. The two points selected by which to measure the worth of a form of social life are the extent in which the interests of a group are shared by its members, and the fullness and freedom with which it interacts with other groups. … A society which makes provision for participation in its good of all its members on equal terms and which secures flexible readjustment of its institutions through the interaction of the different forms of associated life is in so far democratic. Such a society must have a type of education, which gives individuals a personal interest in social relationships and control, and the habits of the mind, which secure social changes without introducing disorder (Dewey 1916, p. 99).

Are the ideals of democratic practices, advocated above, viable in our schools, today? Have they ever been doable? I like to answer these questions by positing that conventional/traditional methods of science teaching and learning are historically hegemonic, colonial, undemocratic and alienating to minority students, particularly, students of color. My experiences as a student in colonial schools in Nigeria and as a high school science teacher in NYC confirm my assertions. The inherent power differentials that exist between a teacher and her students are a hallmark of traditional

teaching methods and such hegemonic exercise of power limit positive interactions between students and their teacher. The rigid ways that rules, roles and responsibilities are structured; and the ways students' agencies are often truncated by teachers constrain social and working relationships in the classroom. Truncating students' agency is a form of negative sanction imbued with negative emotional energy that eventually entrains to asynchrony. In a worse scenario, the students can become entrained around the negative emotion energy in solidarity against the teacher. So the teacher is asynchronous with the collective students.

In this chapter, I explore Michelle's interactions with her students in the 6th-period biology class before we enacted cogen. My goal is to analyze what happened during the pre-cogen lesson using participants' lenses as they experienced the unfolding lesson. This lesson was captured on video to allow us (i.e., students, Michelle and me) to go back in time and have opportunities to view the lesson (video) again and again, at varying speeds, as many times as we want. This allows us to analyze what happened in the classroom as the lesson unfolded, in addition to how and why what happened happen. The students' analyses and Michelle's view of her practice are what I narrate here. My intention is to use this lesson as a sample of Michelle's traditional methods of teaching prior to experiencing cogen with her students.

Preparation for Group Work and Cooperative Learning Exercise

In this section, I give a short narration of what transpired in the classroom prior to conducting cogen in Michelle's 6th-period biology classroom through an analysis of a videoed pre-cogen classroom activity. My intention is to highlight some to the activities

that denoted untransformed traditional classroom teaching practices of the teacher, Michelle, and to some extent those of the students, with the goals of using that as baseline for comparing transformed practices following enactment of cogen. In essence, videos of transactions that took place prior to cogen would provided vignettes (video clips) that were used as points of mutual focus for generating, not just discussions during cogen, but resources for structuring and producing new cultures that became reproduced and transformed as Michelle and her students enacted curricular in the classroom and other fields of social encounters.

Educing Prior Knowledge from Students

The captured pre-cogen lesson opened with Michelle trying to educe prior knowledge from students in her 6th-period biology class about what they had learned the previous day; a lesson on types of cells and the structures and functions of their organelles. The class had worked on prokaryotic and eukaryotic cells and had further categorized eukaryotic cells into plant and animal cells. In addition, during the previous lessons the class had also discussed the various organelles of the cell and what their functions were. Students have taken notes and referred to diagrams of cells and various organelles in their textbooks and from the Internet links Michelle provided. Some students have been allowed to use the interactive, touch screen, *Promethean,* electronic whiteboard to draw and point out cells and their organelles and have read from various media. Barring student absences, Michelle could not be more satisfied with herself and the progress she thought the class was making. She was also happy about her lesson designs and how they were being implemented. At the school level Michelle's efforts to

improve teaching and learning were also noticed. The school administrators involved in this study perceived her as conscientious and hardworking.

In addition to reviewing what was learned the previous day, Michelle also intended to prepare students to work together in groups (i.e., cooperative learning teams) to discuss the functions of various plant and animal cell organelles. She wanted students to come up with ways they could use the stocks of knowledge they had acquired to recognize and identify the organelles. Her goal also was to extend her students' knowledge by getting them to find and use something in their lifeworlds that performs analogous functions as the organelle(s) the group chose. Students would then describe those functions. As the lesson unfolded, she later gave her students the example of the city's subway (underground) mass transit system as an analogy of endoplasmic reticulum transporting ribosomes from one part of the cell to another.

Michelle had initially set out to ask a few questions to jolt students' recollections of the things they had learned. In creating their own self-generated analogies, Michelle was hoping that by linking such functions of the organelles to real-life examples and experiences, her students would be able to "come-out-of-the-box" of abstract thinking and learning into experiential and concrete learning and application of knowledge. She was planning to take students to the next level, to the day's lesson. It was her intention to go beyond cells and to teach students about the different types of tissues and organs, their structures and functions. She had planned to end the lessons on the concepts of cells, tissues, and organs with a lesson on homeostasis of the whole organism. Albeit, Michelle's pedagogical approach was rooted in the traditional, teacher-centered, teaching methods.

Teacher's Expectations

When Michelle began to ask the questions that were intended to elicit her students' prior knowledge of what was learned the previous day, she expected that students would recall answers readily. She anticipated some amount of enthusiastic responses from her students because the topic was covered just the previous day. Since, Michelle did not direct her questions to any specific students, it was a free-for-all, anybody-can-answer format of questioning. This pattern of traditional teaching method assumed that all students (social actors) have the individual or collective agency to access resources in an encounter and would willingly enter the field of interaction, (i.e., volunteer to engage the questions). This was not always true because the structure of interaction between students and their teacher in a traditional, non-constructivist classroom is often shaped by the capital exchange helix and the social and working relationships between them. As shown in Episode 1 below, only Nix, a female, Asian student, had enough courage (i.e., symbolic capital) to respond initially and she was not as coherent as she wanted to be. Nix's attempt to reformulate her answer in her own words did not match Michelle's expectation. There was a breach in the interaction that required a repair ritual (Turner, 2002) for Nix to successfully interact with Michelle. Nix did not receive the assistance she was expecting from Michelle or any other students that would have helped her reformulate her answer and restructure the encounter. From the video clip of this encounter, Nix's facial gestures indicated the building up of negative emotions and asynchrony was initiated when Nix stopped participating for the moment.

As Michelle continued to rephrase her back-to-back questions (calls), students were observed scrambling through their notes and textbooks to access resources and to

find the correct answers for her questions. The continued repetitions with variations of the same series of questions by Michelle kept changing the structure of the interaction so rapidly that students were not given the time and space needed to find answers to her questions. Many students stopped trying and kept silent. This negative sanction from students through their lack of participation caused Michelle's negative emotional energy (frustration) to rise, increasing her rate of speech and changes in her prosody (i.e., the tone of her voice), which students interpreted as yelling at them. Turner (2002) asserted that when expectations are not met, individuals experience more negative emotion such as anger, fear and sadness (p. 87). Negative emotional energy builds up and eventually entrains to asynchrony, causing contradictions and creating lack of solidarity (Collins, 2004).

When Chica, a female Hispanic student, after scrambling through her notes for answers, entered the interaction and started responding with the correct answer, the resonating negative structure of the interaction had increased in valence to a point where Michelle did not hear nor acknowledge Chica's contributions. The same thing happened when Chad, an African-American, male student, began to contribute meaningfully to the interaction (see Appendix B, p. 187). Michelle did not hear Chad and did not acknowledge his efforts to participate. As a result of agency|structure dialectics, the structure of productive interaction had been constrained and students' individual and collective agency were truncated; thus increasing negative emotional energy of Michelle and the students and eventual lack of solidarity toward collective success.

Episode 1[5]

((Looking at and pointing to the image on the interactive Promethean electronic whiteboard, the teacher, Michelle, called out in high tone of voice))

01 Michelle: … explain animal cell. (372 Hz, 77 dB) (0.6) Somebody explain the differences between plant and animal cells for me. (374 Hz, 76 dB) (1.1) What are the major differences? (360 Hz, 77 dB)

((After a pause, a demand statement and a question, in rapid succession, followed the initial undirected callout as Michelle walks toward the aisle between the 2nd and 3rd row of tables with both hands in her pockets))

(1.4s)

02 Nix: Animals, you could walk but plants grow like grass, sort of … (222 Hz, 66 dB)

((Without looking up, Nix attempted to answer with generalized answer almost without thinking))

(2.5s)

03 Michelle: What are the major differences between the cells? (336 Hz, 77 dB)

((looking in Nix's direction, Michelle repeated herself with added clarification and emphasis))

04 Nix: =Oh, the cell? (228 Hz, 66 dB)

((realizing her error, this is an attempt by Nix to repair while looking up from her note and in Michelle's direction))

05 Michelle: =What are the major differences between plant[and ani]mal cell? (346 Hz, 77 dB)

06 Nix: =[animal can]

07 Nix: =animal can reproduce and the plant, well, it can repro…, well, it's easier to begin with … (236 Hz, 65 dB)

08 Michelle: =Think about the organelles. What are the major differences between (348 Hz, 77 dB) (0.3) plant and *(animal)* cells and their organelles and their structure. (326 Hz, 77 dB)

((Nix didn't get a chance at repairing the breached dialogue as she and Michelle exchanged words without pauses and Nix appears bemused. During this exchange, other students could be observed flipping through the textbook or their notes searching for answers to Michelle's questions))

[5] Note: In this episode as in all others, the camera was stationary, located on the sink bench in the back of the room. Prior to cogen, Michelle's movements were limited to the upper half of the classroom.

(1.0s)

09 Chica: Plant has a vacuole (230 Hz, 67 dB)
((Looking in Michelle's direction, she volunteered one of the correct answers having looked through her notes earlier, yet Michelle didn't hear nor acknowledge her. Meanwhile, Nix remains bemused))

Episode 1 above showed Michelle attempting to start the day's lesson by reviewing the previous day's lesson on prokaryotic and eukaryotic cells with her students. The lesson of the day intended to get students to team together per table to come up with real-life phenomenon that performs analogous functions similar a cell organelle the team had chosen. So, Michelle started asking questions to elicit students' prior knowledge about the differences between plant and animal cells. Michelle threw open her questions to the entire class hoping someone would respond. Students started scrambling through their notes and textbooks for answers. Nix took up the challenge but soon realized that she was not meeting Michelle's expectations because Michelle had changed the format of the questioning. Michelle wanted responders to list the differences while Nix was trying to describe (explain) the differences in accordance with Michelle's initial requests, "… explain animal cell. Somebody explain the differences between plant and animal cells foe me."

While Michelle seemed initially to give adequate wait time (in utterance 01; between 01 and 02; and between 02 and 03) for students to "enter" the dialogue (wait time of 0.6 seconds for participants to change turns at talk during conversation was considered adequate according to Tobin (2006c)), this science lesson discourse was not structured as a conversation but as a call-and-response (discussed further below in the next page) discourse. In addition, most students were not cognitively ready to participate

as they were searching for resources that would allow them to meaningfully produce knowledge. Nix also soon realize that she was not fully cognitively prepared to adequately participate in the discourse as Michelle had structure it. Hence, Nix initiated a repair ritual in utterance 04, when she said, "Oh, the cell." Michelle and Nix then engaged in a back-to-back turn taking without wait time (indicated by the equal sign in utterances 04 to 07) between turns as negative emotional energy started to build up between them. The prosody of Michelle's and her students' voices, in addition to emergent interpretations of this vignette, are explicated further in the next section of this chapter.

Emergent Themes from Pre-Cogen Classroom Interactions

As we (students, Michelle and I) watched the unfolding classroom practices of the pre-cogen lesson captured on video, we began to identify several recurring themes that started to emerge. We created video clips (vignettes) of some of these themes and used them as points of mutual focus for further discussions and analyses during cogen meetings. Some of the salient themes that emerged included: 1) call-and-response, 2) teacher's voice, 3) verbatim regurgitation, 4) preachified/speechified discourse, and 5) limited direct interaction with students.

Call-and-Response Discourse

Michelle took her position in the "general space" area of the classroom. Looking back and pointing at the interactive *Promethean* electronic whiteboard, with learning materials beamed onto its screen, Michelle engaged in lecture-style pedagogy employing the call-and-response strategy. Call-and-response is an interactive discourse strategy that

has been considered as an indigenous African-American discourse and has proven successful in literacy classes in elementary schools (Piestrup, 1973) and in a study on teacher's discourse at a community college (e.g., Foster, 1989). In a digest of works done on call-and-response, Foster (2002, p. 1) drew on and extended Smitherman's (1977) definition by concluding that,

> call-and-response is a type of interaction between speaker and listener(s) in which the statements [calls] are emphasized by expressions [responses] from the listener(s), in which responses can be solicited or spontaneous, and in which either the calls or responses can be expressed linguistically, musically, verbally, non-verbally, or through dance.

Cazden (1988) considered call-and-response a discourse style and cultural practices that is an integral part of the communicative behaviors and functions among African Americans that had provided resources for expressing identity and means to convey cognitive information.

In this section, I argue that when used appropriately, call-and-response might help students to better recall prior knowledge, especially of subject matter such as science with minority students and/or ESOL and ELL students who may lack science vocabulary, literacy and fluency. Using call-and-response could allow teacher and her students to interact successfully. It could provide opportunities for students to imitate (repeat-after) the teacher, thereby allowing the teacher to scaffold learning by being able to immediately correct students' responses (answers) orally, audibly, timely and appropriately. Teachers, in using call-and-response to elicit prior knowledge, with follow-up questions, phrases and statements (calls), can help students rephrase,

reformulate and repair their answer(s) (responses). Using call-and-response can help students build up their science vocabulary, understandings and fluency quickly when used appropriately.

From personal experience as a science teacher, I noticed that when inner-city youths come to science words they could not pronounce, they struggle and are easily discouraged from reading the text further. They end up not knowing what the word meant and its role in understanding the whole concept being advanced. Using call-and-response as part of curricular enactment could go a long way to help improve science content knowledge, literacy and fluency.

As shown in Episode 1 above (see p. 96), in her teacher-centered approach to pedagogy and using her normal "teacher's voice" (explained in the next section, see p. 103), Michelle called out to no one in particular as the pre-cogen lesson started, "… explain animal cell. Somebody explain the differences between plant and animal cells for me. What are the major differences"? Michelle expected someone, anyone, to volunteer and respond with an answer (response). Structuring the field of interactions this way left the field open for someone with resonating structure, capitals and agency to access and appropriate resources needed to produce culture, within the field, (i.e., to enter into dialogue). Nix thought she had the capital and the agency to volunteer a response; and that began the call-and-response exchanges meant to stimulate the production of science knowledge needed to access students' stocks of knowledge generated from prior enactment of biology lessons.

While this approach was supposed to cohere with African-American students as an interactive, communicative discourse, there were some contradictions that constrained

enacting these practices in the urban science classroom, as pointed out by cogen participants. I deduced from various discussions with cogen participants and determined that because Michelle's biology classroom was culturally diversified; only 33% of the student population in the class was African-Americans; the remaining 67% were of White, Asian and Hispanic cultural backgrounds, this practice may not be as effective in such a culturally mixed group of students. While it had been proven to raise the reading scores in an early study of how African-American English-speaking first graders were taught how to read (Piestrup, 1973), I agree with Foster's (2002) conclusion, based on the analyses of the study of call-and-response that there was no "definitive answer to the question of the specific role that call-and-response can play in helping African American students achieve the higher levels of literacy demanded in today's classrooms," (p. 2). The use of call-and-response as a teaching and learning tool has not been studied in urban science classroom. It also does not appear that Michelle and her students have had discussions on the use of this approach and what the expectations and responsibilities of participants were whenever Michelle was to use it; it may need to be scripted or have an agreed-to plan about it following a cogen on its use. In addition, the repetition with variations of the questions and the demand statements, used by Michelle, confused students, as they did not know which variation of her questions to answer. It was evident that the use of call-and-response was more of a teacher-centered rather than student-centered pedagogy, as Michelle was the initiator and the one dictating the discourse. Had Michelle directed the questions selectively to particular student(s), this type of discourse could have been more effective; and if a responder struggles to formulate or repair her responses (Roth, 2005, p. 413), a structure of entrainment where other students would

help the students so she could learn could have been created or enabled. For example, when Nix tried to volunteer responses to Michelle's initial calls (utterance 01) by offering (utterance 02) that "Animals, you could walk but plants grow like grass, sort of," she was accessing her stocks of knowledge before accessing her notebook or textbooks for support or verification. She was trying to recall from memory while others were searching through their notes and textbooks. Although Michelle tried to clarify her call (utterance 03) by asking, "What are the major differences between the cells"? that was then followed by "What are the major differences between plant and animal cell"? (utterance 05), Michelle could have assisted Nix to reformulate and/or reconstruct her attempt to construct knowledge by providing repair rituals such as adjusting the tone of her voice and lowering her rate of her speech in utterances 05 and 08. Nix attempted a repair ritual in utterance 04 when she said, "Oh, the cell"? Prosodic analysis showed that Michelle's pitch (fundamental frequency (f_0)) remained high (above 300 Hertz (Hz)) with intensity (loudness in decibels (dB)) averaging 77 dB compared to Nix's utterances with pitch slightly above 200 Hz and loudness averaging 66 dB. Michelle's utterance 05 lasted 3.4 seconds and utterance 08 lasted 7.1 seconds compared to Nix's lower intensity utterance 07 which lasted 5.0 seconds.

From utterances 03 to 08 (see p. 96), Michelle and Nix spoke without lag (wait) time between turns at talk. This interaction was fluent (i.e., timely, appropriate and anticipatory). Science fluency was also exhibited in this interaction as Nix tried to explain the differences. However, the fluency of science knowledge production was breached because there was no solidarity between Michelle and Nix toward a common and appropriate science content expectation; Michelle was asking for microscopic differences

in the cells while Nix was trying to explain macroscopic differences between plants and animals. Nix's responses were timely and anticipatory and would have been considered appropriate had Michelle not been expecting a difference type of answer for the kind of questions she was asking. This curricular misalignment generated primary emotions of assertion-anger in both Michelle and Nix as indicated by the bemused facial expression on Nix, the anger in Michelle's facial expression and her continued prodding to shape the type of answer she wanted. The lack of successful interaction and curricular entrainment toward science knowledge production between Michelle and Nix increased the valence of their negatively charged emotions. This caused Nix to shut down and Michelle not to hear Chica when she volunteered one of the answers Michelle was asking for. Curricular misalignment between students and teachers commonly occurs in classroom where traditional teaching methods preclude classroom stakeholders from coproducing knowledge and from sharing individual goals and collective motives.

Teacher's Voice

When Michelle started the class, she opened with the call-and-response discourse strategy that had students scrambling through their notes and textbook (trying to access resources) in order to respond to her calls. Michelle's voice came out loud and strong (as indicated by Michelle's pitch and intensity compared to Nix's and other students' voices (see the previous page or page 109). In engaging her "teacher's voice," Michelle said her intention was to create an aura of authority and to establish control over the classroom and the discourse that was to take place. What was interesting was that while Michelle's "teacher's voice" was familiar to her students, it still invoked trepidation as from an authority figure with the social, cultural and symbolic capitals embedded in her role

identity functions. What was contradictory was the fact that in normal conversations with the same group of students, individually, apart from when the lesson was in session, Michelle's regular conversational voice was more congenial as a partial transcript of a cogen discussion below indicated.

> Michelle: Alright, and it is not just change for you guys; it's also a change for me because, uhm, I don't know if you guys know (216 Hz, 68 dB) (0.7) but I was seated (210 Hz, 69 dB) (0.9) in a, I guess, a round-table cogen with Femi; (199 Hz, 65 dB) (0.8) and we actually showed the video of the class (211 Hz, 71 dB) (0.9)

During normal conversation, Michelle's pitch averaged 209 Hz and 68 dB in loudness compared to an average pitch of 357 Hz and intensity of 77 dB in Episode 1 (p. 96). However, the moment a lesson began, Michelle, like most teachers, assumed a different tone of voice and commensurate role identity that might invoke trepidations in the students. Part of this tendency was conscious while the other part was unconscious perhaps as a result of teacher's belief system or knowledge about the difficulties encountered by teachers who teach in urban school districts compared to those who teach in suburban school districts.

Michelle's "teacher's voice" was loud and strong and imbued with primary and secondary emotions (Turner, 2002). For example, prosodic analysis as shown briefly in the last section indicated that students spoke softly and almost in undertone as they responded to Michelle's calls. She also was talking at the students as she acknowledged during a cogen in which she said, "…But my ultimate goal is not to do what we saw on that video, me talk at you; I want the interaction; and that would be my goal…."

Students claimed that Michelle was yelling at them; hence Dreana's charged during a cogen, "Yea! You stand there and start yelling and then talking." Taylor also

added to this when she said, "You shout just like my mother when she comes home from work, everything we do is wrong and she starts yelling, kicking furniture." Yelling was a form of negative sanction that engendered negative emotional energy (Turner, 2002); a precursor to asynchrony and lack of solidarity. Engaging the "teacher's voice" endangered solidarity in the classroom. The perception of students that Michelle's "teacher's voice" amounted to yelling came from the fact that Michelle's utterances were at least 10 dB higher in intensity (loudness) than those of her students. For every 10 dB (1 Bel) increase in sound output, it has been demonstrated that sound intensity increases 10 times and there is an approximate doubling effect of sound loudness perceived by hearers of the sound (http://www.phys.unsw.edu.au/jw/dB.html). That meant that the intensity level of a 70 dB sound would be approximately twice as loud as that of a 60 dB sound (using a common algorithm of $y=10^x$ or $x=\log y$ (http://www.cnx.org/content/m19181/latest/)). The intensity of normal human conversation was often rated at 60 dB while that of a noisy office or busy street corner was registered at 70 dB. Hence the doubling effect of Michelle's utterances was perceived as yelling by her students because it was, in most cases, higher than that of a busy street corner. The perception of yelling did not engender positive and productive interactions from the students' understandings of the prosody of a respectful working relationship.

"I thought I was supposed to project my voice," Michelle said during a cogen. Using a strong voice provided Michelle with a sense of having good classroom management. However, her students might have felt intimidated as indicated in prosodic information (see Appendix B), by how most of them responded in lower pitch and intensity of their voices to her calls. From my personal experiences while teaching science in NYC, "teacher's voice" is a type of hegemony and could be considered a form

of verbal abuse (i.e., social violence). Traditional teaching practice tried to provide rationale for teachers raising their voices. Michelle's "teacher's voice" mimicked the ways parents speak to students at home when parents are not too happy or are angry at the student. As such, there is structural resonance to students' experiences at home, as Taylor indicated on the previous page (see p. 105), when Michelle talked at such high pitch and intensity to students. Therefore, Michelle's "teacher's voice" readily afforded the production of negative emotions similar to those that were created in the home field or lived experiences of students when parents or other adults were angry causing students to develop resistance or coping mechanisms that were then enacted in the classroom to contradict learning of science.

The prosody (pitch, intensity, periodicity, wait (lag) time between turns at talk), of Michelle's "teacher's voice," could be employed as student control mechanism to truncate or afford students' agency and/or structure students' actions or responses thereby structuring social relationships and interactions between her and her students. It could also be used as resources to encourage students to enter or discourage students from entering an encounter. I argue therefore that prosody of the "teacher's voice" could be consciously and/or unconsciously enacted by the teacher (the enactor) and could initiate and maintain positive or negative emotional energy (reactions) from students (the listeners).

Michelle's prosody ('teacher's voice" marked by higher pitch and intensity) was her attempt to keep students' attentions focused on her "so they [students] would not have time to get off task or engage in unnecessary discussions," she said during a conversation. Michelle said during one of our several discussions that she was afraid of students

engaging in discussions because they might stray from the task at hand and it might be hard for her to get them back to refocus.

Verbatim Regurgitation

When Michelle started the pre-cogen lesson activities (see p. 96) by calling on students to, " … explain animal cell. Somebody explain the differences between plant and animal cells for me. What are the major differences"? (utterance 01), it appeared that she was challenging students to reproduce and transform their science stocks of knowledge from the previous day's lesson. That was what Nix attempted to do when she responded without accessing her notes or textbook as she responded to Michelle's call by saying (utterance 02), "Animals, you could walk but plants grow like grass, sort of …." As Nix was trying to formulate her answer, Michelle changed the structure of the questioning. Instead of providing students with opportunity to reproduce and transform their learning by being able to formulate answers in their own words (as Nix attempted to do), Michelle reverted to the traditional questioning structure that solicited a one-word laundry list of organelles.

Michelle had ended utterance 01 with a "What are the major differences"? A demand call she repeated in utterance 03 with clarification, "What are the major differences between the cells"? while she was looking in Nix's direction. While there was no direct eye contact (a type of reinforcement or repair ritual) between Michelle and Nix to 'mutualize' their interaction and connect actions in entrainment, Nix realized through Michelle's tone of voice that she (Nix) had been negatively sanctioned and that Michelle's expectation was different from her initial call out. This prompted Nix to offer a kind of 'discourse changer,' a repair ritual in utterance 04, "Oh, the cell"? Even though

Nix did not want to change her structure of the discourse and persisted in trying to explain, rather than list, the differences in her own words (utterances 06 and 07), "Animal can, animal can reproduce and plant, well, it can repro..., well, it's easier to begin with …," she continued to get sanctioned by Michelle (utterance 08). Nix eventually realized that Michelle wanted her to regurgitate verbatim a laundry list of differences without transforming that knowledge (as demonstrated in the excerpt of the vignette below). Nix might have persisted because she felt that her agency was not being expanded as Michelle changed the structure of her questioning and switched the power differentials back as she was the one controlling the discourse. Nix's negative emotional energy had started to build up and was revealed in the changing facial expressions (from enthusiasm to disappointment) Nix wore.

Episode 2 below is part of Episode 1 (see p. 96). I chose this part to provide evidence to support the claim that in her tradition methods of teaching, Michelle continued to solicit from students the reproduction without transformation (verbatim regurgitation) of the science knowledge she taught them the previous day.

Episode 2[6]

(Prosodic values are for entire utterance, not just the ending word; the question marks are not for prosodic interpretation and the square brackets represents words spoken in overlap; this applies to all episodes)

16 Michelle: What are the major differences? (379 Hz, 78 dB)

(3.0s)

17 Chica: Plant has a nu:c:leus (243 Hz, 67 dB)

[6] Note: In this episode as in all others, the camera was stationary, located on the sink bench in the back of the room. Prior to cogen, Michelle's movements were limited to the upper half of the classroom. In this episode, the closest person to the camera was MaryJ.

(7.8s)

18 Michelle: Ok! What am asking for, what about things that are not the same? (377 Hz, 78 dB) (1.2s) What are those structures that are different from a plant cell and an animal cell? (365 Hz, 78 dB)

(0.8s)

19 Chad: Plant has [cellwall] (175 Hz, 63 dB)

20 Nix: =[Green stuff] and uhm (199 Hz, 66 dB)

21 Michelle: One, one at a time. Plants have? (329 Hz, 78 dB)

22 Chica: =Green thing (216 Hz, 63 dB)

23 Michelle: =What's the green thing called? (329 Hz, 76 dB)

(0.4s)

24 Chad: a leave (139 Hz, 59 dB)

(1.5s)

25 Michelle: What're (352 Hz, 81 dB) [those green] (367 Hz, 80 dB)

26 Chica: =[Chloroplast]

27 Michelle: [organelles called] (361 Hz, 80 dB)
((Michelle finishing her sentence))

28 MaryJ: =[Chloroplast] (189 Hz, 68 dB)

(1.2s)

29 Chad: [Organelle] (159 Hz, 70 dB)

(0.6s)

30 Chad: No! (234 Hz, 67 dB)
((saying something to Nix))

31 MaryJ: =Whatever (284 Hz, 67 dB)
((giving up in resignation because she felt she wasn't heard or recognized))

32 Michelle: =Starts with a C; keep going (364 Hz, 78 dB)

(0.3s)

33 Chica: Chlo:ro:plast (212 Hz, 76 dB)

34 Chad: =Chloroplast (178 Hz, 76 dB)

35 Michelle: =Chloroplast (414 Hz, 82 dB)

36 MaryJ: =I just said that (412 Hz, 72 dB)
((MaryJ reacted with a jolting chuckle feeling like she was cheated because she was not acknowledged when she first said the correct word))

(.)

37 Michelle: =Plants cells have chloroplasts (399 Hz, 79 dB)

In this episode, Michelle continued to maintain very high prosody (i.e., pitch and intensity of voice) compared to those of the students who were responding to her calls. Many other students in the class were either looking through their notes and/or textbooks or disengaged. Chica and Chad continued to access their notes and textbooks as resources to keep them participating in the capital exchange helix. However, their prosody (Chica averaged 233 Hz, 67 dB while Chad averaged 162 Hz, 67 dB) were very low, especially Chad's prosody, compared to those of Michelle (average of 337 Hz, 79 dB). I interpreted Chad as lacking confidence (symbolic capital) in his answers because Michelle did not create structures that reward (acknowledge or affirmation) students for their cognitive contributions to the discourse. It took repetitions from other students for Michelle to acknowledge what students like Nix (utterance 20) and Chica (utterance 26) had said earlier. Though, Michelle provided very long wait time between turns at talk, students had difficulty 'entering' the capital exchange helix due to lack of cultural (stocks of science knowledge) and/or symbolic (confidence) capitals.

The excerpted transcript provided in Episode 2 demonstrated a type of "give-me-what-I-gave-you" traditional methods of teaching that does not provide students with the structure and/or agency they needed in order to think critically. Students were not able to reproduce and transform their science knowledge because Michelle was more focused on getting a list of differences. She was expecting Nix to list the differences one after

another and was not satisfied because Nix failed to do so. Lack of micro success generates negative emotions that build up to lack of fluency of encounter and asynchrony. Hence, when Chica, after accessing her notes as a resource to reinforce her stocks of knowledge, found a correct answer, "Plant has a vacuole," and volunteered it in response to Michelle's call, she did not acknowledge Chica's contribution and efforts to participate. However, Chica's stocks of knowledge and access to resources from her textbook provided her with confidence that sustained her continued participation after utterance 17 (see utterances 22, 26, and 33). While Chad was talking in very low tone of voice (low frequency averaging below 162 Hz and 67 dB), a sign I interpreted as tentative responses lacking in confidence, Chica was loud enough averaging 233 Hz and 67 dB, with intensity well above conversation level of 60 dB.

Traditional teaching practice often expect students to regurgitate answers verbatim the way teachers taught them, (i.e., produce what the teacher produced rather than reproduce and transform what the teacher produced). It is teacher-produced because traditional teaching is teacher-centered. In theorizing teaching and learning, Tobin (2005) had theorized teaching as cultural production, and learning as cultural reproduction and transformation, thus they existed in a dialectic as production|creation of culture. The "give-me-what-I-gave-you" teaching approach often draws negative sanctions when teacher's expectations are not met. Many teachers do this without conscious awareness and often have to perform self-checks or view a video of their teaching to consciously identify and work at overcoming this practice of failing to allow students to create or cocreate knowledge and/or pedagogical practices with their teacher in the classroom.

Preachified/Speechified Discourse

As the pre-cogen lesson progressed and students were scrambling through their notes and textbooks to access resources in order to find answers they needed to respond to Michelle, the dialogic discourse turned into 'preachified' or speechified discourse. Students pointed to this preachiness as a contradiction during cogen. Michelle was repetitive; saying the same question or phrase in various forms over and over again. Students considered these utterances as preachy utterances because they were uttered in high pitch and high intensity "teacher's voices" some without wait time between questions or phrases to change turns (see Appendix B). A few examples of utterances where Michelle was considered speechy or preachy are listed below.

Utterance	Speaker	Words Spoken
47	Michelle:	So, the major difference between plant and animal cells are what? There are three substances that differ (.) What are they? (373 Hz, 78 dB)
51	Michelle:	Now! (340 Hz, 78 dB) (0.9s) And now, remember we have(411 Hz, 80 dB) (1.0s) another classification (405 Hz, 78 dB) (0.5s) We have cells that can be classified as prokaryotic or eukaryotic (395 Hz, 78 dB) (0.4s) What is prokaryotic? (425 Hz, 79dB) (2.7s) What are those prokaryotic cells? (389 Hz, 79 dB) (4.1s) Does any one remember what prokaryotes [are]? (370 Hz, 78 dB)
53	Michelle:	What are they? (374 Hz, 80 dB) (13.3s) What are prokaryotic cells? What do they have or what do they lack? (379 Hz, 79 dB)
60	Michelle:	So, what does prokaryote mean? (399 Hz, 79 dB) (3.9s) What does prokaryotes mean? (390 Hz, 79 dB)
64	Michelle:	Okay. What do we …(371 Hz, 78 dB) (0.9s) What do we say eukaryotic mean? (400 Hz, 78 dB) (5.1s) The word eukaryotic (383 Hz, 79 dB)
66	Michelle:	Remember we talked about … (0.3s) the prefix EU

(377 Hz, 77 dB) (1.3s) Remember we talked about the prefix eu (0.5s) and we said that (363 Hz, 78 dB) (0.3s) a word that has the eu in it is eulogy (376 Hz, 79 dB) (1.3s) Remember what a eulogy is? (376 Hz, 79dB) (1.1s) What is eulogy? (370 Hz, 77 dB)

68 Michelle: =Where have you heard of eulogy? (382 Hz, 79 dB) (2.0s) Where's eulogy is given? (407 Hz, 76 dB) (3.4s) What is a eulogy? (384 Hz, 76 dB)

70 Michelle: Where have you heard of eulogy before? (380 Hz, 77 dB) (1.9s) Didn't we create this yesterday? (409 Hz, 76 dB)

74 Michelle: What do we say eu was? (394 Hz, 77 dB) (0.4s) eu (260 Hz, 75 dB) (0.4s) It means what? (365 Hz, 77 dB) (0.4s) The prefix eu … (343 Hz, 74 dB) (0.6s) for eulogy. Where is a eulogy done? What is a eulogy? (395 Hz, 77 dB)

From the above examples of Michelle's utterances, the classroom discourse was teacher-dominated. Only a few students were able to 'enter' and participate in the encounter (discourse) taking place in the classroom; and those who were participating were talking mostly in undertones (pitch averaging about 200 Hz and intensity averaging about 65 dB), compared to Michelle's "teacher's voice." In Episode 1 (see p. 96), Michelle's prosody (i.e., pitch and intensity of utterances) averaged 347 Hz and 77 dB. In Episode 2 (see pp. 108-110), Michelle's prosody averaged 337 Hz and 79 dB. In this above composite of Michelle's utterances from the latter part of the pre-cogen classroom activity, Michelle's prosody averaged 381 Hz and 78 dB. This prosody confirmed video images that showed increasing negative emotions of anger and frustrations being generated and expressed in Michelle's gestures (i. e., body orientations, gesticulations and facial expressions including blank and wondering stares) as she wondered why many students failed to participate and contribute adequately to the discourse.

While Michelle spoke in multi-phrase or multi-sentence utterances and 'stayed' in the encounter longer, students spoke in one-word or short-phrase utterances, 'entered' and 'exited' the encounter quickly. Students did not 'stay' long in the encounter. The length of time participants 'stayed' in an encounter may be determined by the structure of the encounter and how the agency and capital each brought into the encounter structured their interactions. Students' responses were averaging pitch (f_0) of 100 Hz and loudness of 10 dB below those of Michelle's utterances. The prosody of students' voice could be interpreted as a form of trepidation or uncertainty or tentativeness that indicated that students were not speaking with confidence (symbolic capital) because they were not sure whether their answers were correct or not as Michelle did not offer much validation, if any. Cogen provided the structure that brought this speechiness to Michelle's consciousness and she was willing to transform this practice as indicated in the excerpted transcript of cogen in, particularly utterance 02, episode 3 below:

Episode 3

01	Smiley:	So, do you see a change in, like, you[r] teaching skills?
02	Michelle:	Do I see a change? I feel that I have made change. I want to continue to change because I think, uhmm, every situation requires something differently and every day is not the same day. But my ultimate goal is not to do what we saw on that video, me talk at you; I want the interaction; and that would be my goal. Smiley said that she would love to see everybody doing their work. But for me it's not just the silence; I used to be afraid of the talking. But if you go around the group, it's a meaningful conversation about the content;
	((Femi moving his head up and down in agreement with Michelle))	that conversation has substance. That's what I, that's what I enjoy; and it's happening. If you guys take a second; if each one of you, say on Monday, step away from your group and just go ear-hustle, whatever you are going to call it, and listen in on other people's group, you will hear that there are meaningful conversation going on about biology

03 Femi: =that's right

04 Michelle: =and for me, that's wonderful; and guess what? You are having these conversations, and who is not yelling at you?
((students consider Michelle as yelling or shouting because, in her "teacher's voice," she speaks one-one half times at higher frequency than students))

05 Taylor: =You *((Taylor pointing finger at Michelle))*

06 Michelle: Who is not repeating the same thing four or five, sixth and seven times.
((Michelle tends to repeat the same question or variations of it multiple times in rapid succession))

07 Taylor: [=Or speaking in our ears]
((Pointing towards Michelle))

The preachiness or speechiness of Michelle's utterances was not without reason. It was part of Michelle's repertoire of traditional teaching (i.e., teaching the way she thought she was supposed to teach) strategies aimed at keeping students from engaging in side talks or other discussions, as Michelle revealed during cogen. Michelle, in responding to Smiley's question, "So, do you see a change in, like, your teaching skills"? commented that she used to be afraid of student talking while she was teaching (see utterance 02, above). She thought that by talking more, she could keep students focused on her teaching. This Episode 3 revealed the transformation that had taken place following cogen with Michelle and her students (see Chapter 6 for further explication of transformed practices of Michelle and her students after cogen).

Limited Direct Interaction with Students

Traditional pedagogical practice frown at teachers having closer social and working relationships with students so that teachers could equitably administer discipline without favoring one student against another. This approach was Michelle's approach to classroom encounter with her students prior to conducting cogen. Prior to cogen,

Michelle maintained limited interactions with her students. She didn't want to be perceived as a 'softie" by her students, she told me in a conversation. A 'softie' was considered not able to exercise control over or enforce discipline on students in her classroom. "I wasn't prepared to be run over," Michelle said during a conversation.

Having closer interactions with students, especially sitting down with them, to be on the same vertical and horizontal planes, and having them critique their teacher's practice so she could learn to teach a kid like them was not considered a good standard teacher's practice. Teachers were supposed to maintain a distance in their social and working relationships with their students. Traditional teaching methods and teachers' professional development still frowns at a teacher and her students coming together, in close proximity, to share and work through their experiences and differences with one another. The only exception to using proximity with students in classroom relationships is when a teacher is using "proximity desists" to control students' behaviors.

In my own experience in NYC, I once attended a professional development course organized by my teachers' union when I was a high school science teacher. During the training, the instructor sternly warned us not to interact with our students as a normal classroom practice. "They are not your children," she said, "Don't touch them with a ten-foot pole. They will disrespect you. They will think you are a "softie." Don't be soft on them." Many of us left that day accepting this notion of teaching as our *modus operandi*. This experience resonated with the culture of power and dominance I had experienced in colonial Western Nigeria that should be changed. The approach advocated by the professional developer above would have continued to subjugate and devalue justice, caring, equity and democracy in the classroom (hooks, 1994); and would

not have created the space needed for students' voices to be heard (Delpit, 1995).

As I had discussed later in Chapter 5, Michelle spent less time in the "student's space" and more time in the "general space" and "teacher's space" which she controlled and where she felt more comfortable. However, Michelle realized that that structure did not produce the kinds of results she wanted for herself and her students. Michelle came to the point where she was wondering, "There has to be a better way." As stated in Chapter 2 (p. 57), Michelle realized that without closer interactions, it was much more difficult to understand the realities of each other's lived-experiences that structure what was happening in the classroom and how to work through it and be successful.

The fact that students in Michelle's class willingly and readily embraced cogen and worked diligently with Michelle to enact cogen was evidence of the fact that students wanted closer, positive and productive social and working relationships with their teacher. That kind of relationship was achievable only through dialogues where every voice counts and equity of participation in a democratic process is valued, as Dewey postulated, and attempts are made to dismantle structures that sustain dominant ideologies.

Chapter 5

Proxemics of Classroom Interactions Before and After Cogen

As a teacher who was schooled in the traditional/conventional methods of science teaching, Michelle was teaching the best way she thought she was supposed to teach science to her students at *Fairness High School.* Michelle had a high expectation of her students and wanted them to succeed. She tried to motivate them to meet the challenges of learning science the best way she knew. However, Michelle was using pedagogical strategies that exercise control over her students, maintain dominant cultural ideologies and undermine solidarity toward individual goals and collective motives of the classroom. When her students did not continually meet her expectations of success, measured by their performance at the state science benchmark standards and classroom marking period grades, she began to search for better ways to enhance her teaching and their learning of science so they could meet and exceed the goals of science achievement and fluency as established by the standards mentioned above. Beyond these standards, Michelle also wanted them not just to pass these tests but also to become science literate.

While she meant well to have such high expectations of her students to succeed, she needed to create structures that would provide her with opportunities (resources and agency) to adequately share her goals and aspirations with her students and have them share their goals with her in mutually positive and productive ways. She was searching for ways to get her students to come together with her to generate dialogues around their shared experiences in her classroom, in order that they may share their individual goals and collective motives for successful interactions.

During a pedagogy course in her first year at the MCE program, Michelle learned about cogen and decided it might be the answer to her continued search for better ways to improve her teaching and her students' learning of science. She thought that their collective efforts to improve science literacy and achievement of higher scores at the state science benchmark standards and in the classroom grades could also be accomplished through cogen. Michelle learned more about cogen and decided to implement it with her students. To help her prepare for the enactment of cogen, I provided her with a digital camera to video one of her classes as she was teaching a lesson on prokaryotic and eukaryotic cells.

As we (students, Michelle and me) enacted cogen later, we watched the videos and clipped vignettes that were of mutual interests to us for shared analyses and understandings. These vignettes were used as our point of mutual focus for discussion during subsequent cogen. We used vignettes to garner our attention and focus discussions on practices that cohere and/or contradict science teaching and learning and therefore can be transformed. By such transformation, new culture generated during cogen could be reproduced and transformed not only in Michelle's science classroom but also in other fields, such as other teachers' classrooms, in the hallways, lunchroom, etc., within the school and in students' social lives beyond the school.

In this chapter, I explore how Michelle and her students use social space as they interacted with each other in producing, reproducing and transforming science culture in their classroom. I employ the knowledge of proxemics (i.e., how participants in encounters perceive and utilize space) to generate understandings of the tendency for Michelle and her students to establish and maintain some territoriality prior to conducting

cogen and how those social boundaries, over time, became borderless following the enactment of cogen.

The Physical Structure of Michelle's Classroom

In order to understand how Michelle's interactions affected her social and working relationships with her students prior to cogen, it is salient to look at the structure of the physical space of her classroom because space utilization has been known to affect actions and how conscious and unconscious, verbal and non-verbal actions are communicated, received, perceived and interpreted (Hall, 1963), especially in an environment like the classroom where face-to-face encounters are salient. In studying proxemics, Knapp and Hall (2002, p. 7) defined proxemics as the study of how participants in encounters use and perceive space between them. They posited that the space between the sender and the receiver of actions influenced the way such actions are interpreted. Actions are imbued with emotions and patterned actions constitute a practice.

While perceptions and use of space vary within settings and across different cultures, social markers of difference, such as, gender, religion, social and economic status and roles identities of participants often influence the distance between a sender and a receiver of actions. For example, the proximity between a student and a teacher could be an indicator of the social and working relationships between them. The "proximity desists" mode of classroom management, in which the teacher stands next to a student or near a group of students to prevent the student(s) from initiating or continuing distractive practices, uses this principle. Traditional spatial coordinates are such that the teacher stands, towering over and above the student. While in close horizontal proximity,

the teacher maintains vertical distance beside the seated student. Should the student stand up, student and teacher will be "in each other's face;" and that may be considered a threat or a confrontation that would draw symbolic and/or social violence. Using space this way establishes or sustains dominance or control over the student and may prevent the teacher and the student from negotiating practices. It is for such reasons as mentioned above that some inner city students often resist the presence or the coming of a teacher near them. In classes that use traditional teaching methods, such presence or the approaching of a teacher often triggers students' defense mechanisms. Hall (1966) asserted that body spacing and postures, which he described as unintentional reactions to sensory fluctuations or shifts, constitute social distance that correlates with physical distance. Spatial and temporal distances, sometimes demarcated by physical distance, in a traditional classroom could substantiate territoriality. Hall (1963) concluded that territoriality is an instinctive behavior that humans unconsciously display to claim and/or protect resources. Territoriality is an expression and exercise of agency and/or identity; and it is emotional.

In studying of proxemics, Hargie and Dickson (2004) identified four territorial spaces. Firstly, the primary territory, an area someone has exclusive claim to use that others cannot enter without the owner's permission, such as, the teacher's desk space. Secondly, the secondary territory, an area to which there is no "right" to occupancy; however, people may still claim some amount of ownership. For example, a seat that a student commonly occupies every day; she may become agitated if someone else occupies it. Thirdly, the public territory was identified as an area available to all, but for only a set period of time. The classroom or hallway, when class is in session, is a good

example. Even though students have limited claim over the space, they tend to want to hang around when they are not supposed to; and that often causes social violence to be meted out by a teacher or hallway patrol personnel. Lastly, the interaction territory, the space created by or for others when they are interacting; for example, when a teacher is talking with a student or a group of students to the exclusion of others who may be nearby or passing by without their been disturbed or interfered with. To interfere could elicit instinctive and unconscious, verbal and/or non-verbal actions, like some types of gestures, eye gaze or disrespect (symbolic and/or social violence according to Bourdieu (1986)).

For the purpose of this study, I divide Michelle's classroom, spatially and temporally, into three particularly functional or usage areas (social spaces or fields of encounters), namely: the "students' space" within which are the "table spaces," the "general space," and the "teacher's space" (see Appendix A, p. 186). These fields are nested within the classroom field. Social life enactment occurs as resources are appropriated across fields. Fields have the tendency of creating resonating structures that can either afford or truncate participants' agency and access to appropriate resources. For example, the science lab field that Ms. Smith created for students when Michelle was in elementary school that allowed her and other students to ask science-related questions resonated with the field of interaction she enjoyed with her granddaddy where she was able to create her science identity by asking questions about how plants grew or about the behaviors of the hunting dogs.

Prior to enacting cogen with her students, as described below, these areas were spatially and temporally restrictively utilized as indicated. The "students' space" was

utilized as public territory while the "table space" within it was used primarily as secondary and interaction territories by students. Students' territorial claims over these spaces (fields) created negative emotions that disrupted social networks and working relationships thereby generating asynchrony among students. The teacher often controlled the "general space" as a primary territory with some provisions for usage as a public and/or interaction territory. The "teacher's space" was exclusively utilized as a primary territory by Michelle.

The "Students' Space"

The "students' space" comprised about 80% of the classroom social space (field). This field was structured for students to sit and do most of their work. Within it was the students' "table space." The "students' space" was made up of seven "table spaces" arranged in three rows (two rows of two tables each and one row of three tables) with two aisles in between the three rows of adjacent "table spaces." Each table had four chairs, two chairs on each of the long sides of each table except the first and last tables, which had five chairs each. These fields were structured spatially and temporally to function as the secondary, public and interaction territories.

Michelle commonly came into the "students' space" but does not interact closely with her students. She does not sit with the students. She also does not stay long. She raced through the aisles. When Michelle stayed within the aisles, she maintained horizontal and vertical distances between her and the students in their "table space." She maintained her "distance" in accordance with traditional teaching practices. She used the "students space" more as a public territory (field) instead of an interaction territory. In the characteristic traditional method of teaching, Michelle paced (roamed) around the

aisles, meandering and walking fast past students' "table spaces" and looking from a vertical plane above the students to keep eyes on them and to give them the feelings that she was everywhere and watching everything they were doing. This was her way of maintaining classroom management and securing control over the students. She would start a sentence or phrase in one location and trail it through the aisles ending the sentence in another location. She also had her favorite spots where she would stop for a short while before running again through the aisles. There were no focused or engaged encounters with her students. As such, encounters were transient and so were emotions. Solidarity was not engendered because, as indicated in the transcribed video clip below, students, represented by Dreana and Taylor, believed that Michelle just "stand there and start yelling." This created resonating structures that reminded students of similar lived experiences at home fields where parents often talked loudly (yell) at them (see Chapter 4, p. 105) and from where students have developed various forms of coping mechanisms of resistance, which they reproduced in the classroom.

Unbeknownst to Michelle, students knew her favorite spots and where she would go next from a particular spot. Students also knew her emotional status and prosody (i.e., the tone of her voice). They could forecast what she would likely do when she becomes frustrated by their actions. For example, during one of the cogens, in the vignette excerpted below, students pointed out some of the conscious and unconscious, verbal and non-verbal patterned actions (practices) that Michelle often exhibited.

```
01 Dreana:  =But you do come around now.  You come around to
            groups.  You don't stand in front of the room all day
            and yell; you walk a::ro:und now; you don't just
            stand in one place; you go around the groups; you
            talk to the groups

02 Taylor:  not just stand there
```

03 Dreana: =Yea! You sta:nd there and start yelling and then talking

04 Taylor: it would be the same spot; there, there, right back there and then go over right here by the board

((pointing to three different locations in the room where Michelle is accustomed to standing in the class))

05 Dreana: =in the back and then go right there

((Both Dreana and Taylor turned around pointing to the same locations where Michelle habitually stands; Michelle was smiling and then laughing, almost in embarrassment that these students could identify her habitual locations))

06 Dreana: And now she go around to each group, like around, and now because we are doing this, she'll go to the groups; sit down, have a sit!; talk to the groups, then she'll, sit down

((head nodding to confirm emphasis with both hands pointing and motioning downwards; Femi also nodding with Dreana))

In the last utterance (06) by Dreana, she said, "… and now because we are doing this…." In this statement she was referring to what Michelle began to do following our enactment of cogen. She was comparing Michelle's practice before cogen and the changes that have taken place since we started cogen. Before we enacted cogen and generated new, interstitial culture of better interactions with students, the spatial and temporal distances (spaces) in terms of vertical and horizontal distances (planes) were wider between Michelle and her students. Michelle talked at her students from a longer distance, even when she was standing next, in horizontal proximity, to their tables; she remained erect, towering over them, maintaining a vertical distance, as indicated by Dreana, "Yea! You stand there and start yelling and then talking." Dreana had a very strong emphasis on the word "stand" and differentiated between yelling and talking. Michelle rarely broke through the invisible boundary of the field ("table space"); it was as if she was standing outside a "bubble" surrounding students' "table space."

Before cogen, Michelle assigned students to specific seats and tables. She would not change students' assigned seats except something drastic happened. As such, students treated their assigned seats in their "table space" as their secondary territory and would defend it and enact social violence on any "intruder" thereby generating negative emotions and lack of affiliation and sense of community.

Students also treated their "table space" as their interaction territory and inter-group discussions were not encouraged across the boundary of "table spaces" as it often invited social and/or symbolic violence, a form of negative sanction according to Turner (2002) from other students and even the teacher. For example, Chad, an African-American male student, was reaching across his "table space" to help Taylor, an African-American female student (she also identifies as a Moslem), a member of another group in an adjacent "table space." Chad was suggesting the right answer to what seemed to be a perplexing question in Taylor's mixed group of two African-American females and three Asian males. Taylor did not appreciate Chad's "butting-in." So she (Taylor) negatively sanctioned Chad, shouting at him to mind his own business. Chad was trying to generate repair rituals by making light of the moment when Michelle, unaware of the details of what was transpiring between Chad and Taylor, called out Chad and strongly told him, "Chad, Nix is your group member. You should not be having a discussion with the next person behind you. Ok"? Instead of fostering collaborations between Chad and Taylor, Michelle reinforced Taylor's rebuke (negative sanction) and disrespect of Chad. Michelle's action inadvertently enhanced Taylor's symbolic capital while generating increased negative emotions in Chad, as indicated by his facial expression. Meanwhile, Chad's group was inadvertently non-functional. Other students in his group were absent

and his only partner at his table, Nix, was not collaborating with him. So Chad appeared more frustrated and resorted to himself.

The confining of students to working only within their groups by Michelle, without the opportunities of accessing outside, inter- or trans-group resources, truncated students' agency, limited their learning. This approach also failed to create the space for student-centered pedagogy and the building of social and working networks requisite for collective success. Without the knowledge of critical pedagogy (Kincheloe, 2008) and sociocultural sensitivity to students' cultural identity and dispositions (Ladson-Billings, 1994), Michelle, like many other teachers, failed to provide students with legitimate access to resources and the classroom became a site for power struggle (Bourdieu, 1990). Power differentials between a teacher and her students are often sustained by traditional pedagogical methods and provided structures for Michelle to enact social and/or symbolic violence in her classroom.

In Michelle's class, the traditional teaching methods did not foster inter- or trans-group interactions during cooperative learning sessions because each group would have to present its work independently. As a result, most students did not get to know each other across groups because students were always competing against one another (another source of power struggle) in the classroom. This structure, that allowed competition instead of collaboration, reinforced some of the deficit and stereotypical perspectives that students had of each other, often just because of social markers of difference such as gender, culture, race or ethnicity, religion, and especially academic competency. Competitions stimulated negative emotional energy that sometimes undermined synchrony and solidarity (Collins, 2004) in Michelle's classroom.

This was the structure of student-student and student-teacher interactions prior to cogen in Michelle's 6th-period biology classroom. This structure was counterproductive as it fostered negative emotions and asynchrony amongst students and between students and Michelle. It did not engender positive and productive learning environments, as there were conflicts due to space utilization and territoriality. Michelle acted as if she was more vulnerable in the "students' space" but more secure in the "teacher's space" and the "general space" where she spent more time.

The "General Space"

The second space is the "general space" field that comprised about 10% of the classroom. This was the space located to the northwest part of the classroom between the "students' space" and the wall on which the chalkboard and the *Promethean* electronic whiteboard were located. Even though this space ought to be used as a public and an interaction territory (field), Michelle used it primarily as her primary territory, an ancillary to the "teacher's space." Prior to cogen, she spent more time in the "general space" than in the "students' space" conducting her chalk-and-talk method of teaching. She told me during a discussion that she felt more comfortable there than in the midst of the students.

Before cogen, in her traditional way of teaching, Michelle exercised control over the "general space." She would occasionally call up students, usually one at a time in order to control students from misbehaving, to come up and interact with the *Promethean* electronic whiteboard and to point out something salient about the materials beamed or written on the interactive board. Some students often responded (accessing the structure) and used the opportunity to come forward into the "general space" to interact with the

electronic board and to produce knowledge. Others were less trusting and often reluctant to come up into that field because of the tendency of being put on the spot and/or being subjected to possible social violence by some students who would likely make sarcastic remarks at them if they failed to get the correct answer. Sometimes, it was the conscious or unconscious tone of Michelle's voice (her prosody) and/or her gestures at such students that inflicted social (intended) and/or symbolic (unintended) violence. Michelle's traditional teaching approach was a little problematic, as it did not create the opportunity for students to coproduce knowledge collaboratively.

The experience of Chad described below was an example. Following Chad's experience (explained earlier in this chapter (p. 126)), Michelle called up Chad, who was still negatively charged, emotionally, from the previous encounter in which he was rebuked by Taylor and then Michelle, to come up to the "general space" to point out an organelle and describe its functions using an analogy.

Michelle called up Chad

01 Michelle: Chad, go pick a structure. What [does] the structure points to?

02 Chad: What structure are you talking about?

03 Michelle: Any of your structures. Any of your organelles.

04 Chad: How many is there already?

((Chad got up sluggishly, tried to talk to Nix and walked very slowly toward the whiteboard))

05 Michelle: Alright! What are you going to identify?

06 Chad: Ain't, really quite know.

07 Michelle: Chad, what are you identifying, babe?

08 Chad: Uhmmm, this. Relax! This one right here. I forgot if I've seen that.

((pointing to the chloroplast at the top left corner of the plant cell with his finger. Realizing he needed the stylus to interact with the Promethean whiteboard so that the name of the organelle could pop up, Chad looked away from the plant cell

image on the screen to his right to pick up the Promethean stylus, and used it to touch the image)).

09 Michelle: What job?
((a student repeated what Michelle just said, "what job"?))

10 Chad: This one.
((looking at the screen and touching the chloroplast on the cell image with the stylus, expecting the name of the organelle to pop up))

11 Michelle: Somebody already did the chloroplast.

((responding quickly and turning to face Michelle, without looking at the whiteboard screen, Chad pointed to and touched the central vacuole and said))
12 Chad: This one then!

13 Michelle: Somebody already did the central vacuole!
((Chad looked momentarily at the screen to pick up another organelle. He pointed to and touched with the stylus on the cellwall))

14 Male voice: Wake up!
((directing his comment to Chad))

((Chad looked back at Michelle and looked the more embarrassed, tone of voice slightly dropping while still touching the cellwall with the stylus))

15 Michelle: What is that?

16 Chad: Cellwall!
((Chad quipped, looking at Michelle, with the blunt end of the stylus touching the white space below the cell image while the tip was pointing into space;))

17 Michelle: =Ooops! Someone did the cellwall.

18 Chad: Oh, my God!
((reeling away from the Promethean backwards and recoiling away from camera, said in a down tone))

19 Class: Ha, ha, ha, ha
((laughing loudly and sarcastically with a male voice making a clatter sound))

20 Female Voice: The smooth ER
((likely Smiley trying to assist Chad))

21 Michelle: Where is the smooth ER?

((coming back to the Promethean whiteboard))
22 Chad: Yes, smooth ER, right here.
((pointing with his finger at first and then switching to the stylus))

23 Female voice: Oh, my God!
((a different from the previous one, sounds like Taylor))

24 Michelle: Where is the smooth ER?

25 Chad: Right here.
((touching the smooth ER with the tip of the stylus. Pushing harder on the interactive Promethean whiteboard with the stylus, even though he was pointing to the correct organelle, a different name popped up. Unknown to him; and Michelle could have come to his rescue to let the class know that the Promethean whiteboard probably needed to be recalibrated. It appeared the calibration has shifted by this time. Because of the shift, if one points to one object, the name of another object may pop up as the Promethean "thinks" one is pointing to an object slightly to the right or left)).

26 Class: Ha, ha, ha, ha!
((class erupted in laughter; Chad joined them by laughing with them as he recoiled backwards and came back to the Promethean whiteboard looking at the name that popped up))

27 Michelle: What [is] the difference? Shhhhhh!
((Michelle quieting the class)).
What is the difference between a smooth ER and a rough ER? What is the difference in the way they look?

((Chad seemed to have had enough and moved toward where he could drop off the stylus. As Chad faced my camera on his attempt to return to his seat, I could see the embarrassing look and frustration on his face)).

28 Michelle: What's that red stuff on it?

((Chad, on his way back to his seat, tried two times to repair his fractured respect and dignity, seeking affirmation by "slapping hands" with his buddy, Sporty, who did not respond because he was not attentive to nor participating in what was going on))

29 Students: The ribosomes

30 Michelle: The ribosomes. The rough ER has the ribosomes. The smooth ER does not

31 Students: *((talking to each other))*

32 Michelle: We have one more structure to identify

((Chad returned to his seat very sluggishly with head bowed and looking embarrassed; he stood still))

33 Michelle: We have one more structure, two more structures. What's the structure? Go point to it. Huh? So, we have already identified the

rough ER, now, Taylor is coming to identify the smooth ER.

((Michelle called on Taylor who walked pass Chad's table as he stood at his chair, looking down. As Taylor passed by, they exchanged gaze funnily. Taylor continued towards the whiteboard and Chad eventually sat down))

34 Michelle: The smooth ER. The smooth ER. Again, describe what the smooth ER looks like.

((Taylor pointed out the smooth ER, class clapped in collective effervescence and the bell rang to end the class))

Chad had been actively participating in the call-and-response discourse that Michelle was using to engage her students in this biology classroom (see Appendix B, from utterance 19, from p. 187). When Michelle called on Chad to go up to the "general space" to represent his team and to point out and describe an organelle with its associative analogy to a lived-experience phenomenon, he was still trying to cope with the social violence he experienced from Taylor and Michelle (see p. 126). So, he was hesitant and slow in responding. He walked up sluggishly (as the video clip revealed). He tried to liaise with Nix, who did not collaborate with him on the assignment Michelle had given the class, as she ought to. Chad also tried to clarify what was expected of him from Michelle (utterances 02, 04, and 06), but got little help. When he got to the whiteboard, he pointed out organelles that had previously been pointed out by someone else and Michelle negatively sanctioned him each time (utterances 11, 13 and 17). Chad's lack of success in interacting with the whiteboard, in the "general space" caused the class to giggle and laugh at him (utterances 19 and 26) thereby increasing his embarrassment and challenging his science identity and fluency. In addition, being laughed at is a form of social and/or symbolic violence, which also valenced Chad's emotional energy more negatively. As I mentioned earlier (see p. 128), coming into the "general space" was uncomfortable for some students, even when Michelle "allowed" them to come up to

interact with the *Promethean* whiteboard. This can be attributed to the climate of the classroom prior to cogen and the tendency that a student may experience social and/or symbolic violence, as Chad did. As Pitts (2007, p. 134) posited, "the disposition of a participant to act is afforded or constrained by structural resonance present (*or absent*) in a field." Analyzing this vignette during cogen brought to conscious level the disposition of participants to act and the need to transform spatial and temporal structures that sustained hegemony and constrained successful social and working relationships across markers of difference in their classroom for Michelle, Taylor and other participants.

The "Teacher's Space"

The "teacher's space" (field) made up the balance of 10% of Michelle's classroom. It was located to the south of the "general space" and southwest of the "students' space" (see Appendix A on p. 186). It was the location of Michelle's desk that was placed perpendicular to her desktop and laptop computers sitting on separate tables. Before cogen, Michelle structured the spatial and temporal distances of the "teacher's space" exclusively as her primary territory. Michelle gave access only to some select students to use the space and have access to the computers. Pitts (2007) indicated, in analyzing the structure of the field of social encounters, that the manner in which social actors enter and leave a field exemplified the resonating structure of the field. Any "intruder" that enters the spatial and temporal locations of the "teacher's space" attracted social violence from Michelle and/or the 'agentified[7]' student(s) she had permitted to produce culture in that field. This was where Michelle retreated more often. It was her "comfort zone."

[7] To be "agentified" is to be empowered to act on behalf of another, formally or informally, by taking up the role identity of the individual.

Next to the "general space," Michelle spent more time in the "teacher's space" than in the "students' space." Even though Michelle felt more secured and comfortable there, she still felt vulnerable because she rarely sat down (see Michelle's reflection on this issue in Chapter 6, pp. 140-141). Michelle was always standing so as to indicate to the students that she was always watching them, she said during an interview. For her, it was her way of retaining control over the classroom and what students were doing.

Proxemics After Cogen

Following enactment of cogen, the existence and sustenance of the various spatial and temporal distances (the "student's space," the "general space" and the "teacher's space") were brought to the conscious awareness of all participants. After that, concerted efforts were made to dismantle these spatial and temporal boundaries (structures) that restricted access to resources and truncated individual and collective agency. As indicated by the vignette transcribed below, from a cogen discussion (a continuation of earlier vignette; see p. 125), students also noticed changes in Michelle's patterns of action.

06 Dreana: And now she go[es] around to each group, like around, and now because we are doing this, she'll go to the groups; sit down, have a sit!; talk to the groups, then she'll, sit down

((head nodding to confirm emphasis with both hands pointing and motioning downwards; Femi also nodding with Dreana))

07 Femi: [=sit, sit down!]

08 Dreana: [=Yes, sit down

09 Taylor: [=She used to be like this to take the roll.

((Taylor standing up to demonstrate how Michelle used to stoop over her computer to take attendance while keeping her head up watching over students; all to Michelle's gleeful smile and laughter))

10 Taylor: Now she actually sits in the chair.

11 Dreana: =Yes! and she'll start talking to us and she'll get up and she'll ask us, "are we ok"? She don't be in the front; she'll be sitting down with us. Then she'll, then she'll keep going around to every group. Then she'll start talking to everybody. Then she'll let everybody start doing what they have to do.

From the transcribed vignette above, Michelle was no longer territorial as she did before cogen. She felt secured in the "students' space" enough to break the "bubble" surrounding students' "table space" and to sit down with students and interact successfully with them. There was a general breakdown of the rigid partitions between these spatial and temporal spaces. The social spaces (fields) became structured differently and territoriality (marker of hegemony) melted; and all the nested fields in the classroom became blurred and fluid. All spaces became structured as "community space" for all students and Michelle to access in communal and shared ways that respected individual and community purposes (goals and motives) and afforded individual and collective successes. Sense of affiliation, solidarity and identity generated through cogen, produced borderless nested fields within the classroom and allowed participants to enact social life across multiple fields of encounters with resonating structures that generated positive emotional energy and synchrony. For example, sitting arrangements became less rigid and much more flexible and interchangeable as student leaders, having become change agents and cultural brokers, had the agency to restructure seating arrangements as they saw the need in order to maximize solidarity and social and working relationships to enhance students' learning. There was no more staking out of territories and all participants were free to produce culture in various fields of the classroom.

In accordance with Harvey (1990, p. 241), changes in Michelle's and her students' sense of space and time that were developed during cogen, as they sat in close

horizontal and vertical proximities with each other, they generated new cultures that were correlatively reproduced and transformed in the classroom. Michelle began to sit at table with her students without realizing it until students pointed it out during cogen (see vignette on pp. 124-125). Following cogen, there was a radical shift in how Michelle and her students interacted in the social space of the classroom. In addition, there was also a radical shift in how and what activities they spent time was on. This brought about the interweaving of differences and similarities into the same social space and time fields, making all these structures available as resources to produce successful interactions|transactions for the teaching and learning of science. Michelle and her students were able to embrace their diversities and use them as resources to generate solidarity around successful science learning and fluency.

Chapter 6

Participants' Practice Upon Enacting Cogen

The primary goal of conducting cogen in the urban science classroom was to transform teacher's and students' practices in order to improve the teaching and learning of science. Earlier works done on cogen in Philadelphia by Ken and associates focused on using cogen as a method of getting pre-service science teachers to learn how to teach. Other works done on cogen in the urban science classroom by Gillian Bayne, Chris Emdin, Ed Lehner, Ashraf Shady and Wesley Pitts in NYC focused primarily on transforming teaching and learning of science with emphasis on improving students' practices, science identity and fluency. The studies done by Martin, Milne and Scantlebury focused on implementing cogen as a methodology for formative and summative assessments of in-service science teacher preparation program at PennSTI.

While this study was situated in Philadelphia and in the context of the MCE program at PennSTI, I focused primarily on transforming an in-service science teacher's practices as catalyst for transforming the culture of her science classroom in order to improve her teaching and her students' learning of science (biology). By implementing cogen, Michelle would be able to provide the structure and the agency needed for her and her students to generate new, hybridized or interstitial cultures. Generating new cultures creates opportunities to initiate and maintain positive and productive teaching and learning environments, which engendered individual and collective successes of Michelle and her students as learners.

In pursuit of this goal, I collected and analyzed pre-cogen classroom activities and practices of Michelle and her students as indicated in previous chapters. In this chapter, I explore two major areas of cultural production, reproduction and transformation by Michelle's interactions and curricular engagement with her students in the 6th-period biology class; namely, cogen interactions and activities and in-cogen classroom activities and interactions. By in-cogen classroom activities, I mean classroom activities conducted while we were conducting cogens; these were sites for determining what worked and what did not work.

Experiencing Cogen as Transformative Encounters

Cogen was a focused encounter nested in the corporate unit of the teaching and learning of biology in Michelle's classroom. Turner (2002) described corporate unit as a group that has division of labor and specific goals. I argue that the biology class was a group with division of labor and goals. The division of labor in which the role identity of participants was structured by what they do, (i.e., the teacher teaches and the students learn science (biology)); and the goals for all participants to succeed individually and collectively. Turner posited, "what transpires in an encounter is very much constrained by the nature [i.e., structure] of the corporate units in which it is lodged, …" (p. 35). He went further to define encounters as episodes of face-to-face interactions, which are valenced with emotions and need states. Turner stated that "individuals experience feelings about self, others, and situations; and both consciously and unconsciously, individuals emit gestures to others that contain varying levels and types of affects," (p. 39). He added that individuals get into encounter to fulfill certain 'need states.' All of

these assertions came together in the transactions that happen in cogen; and in the purposed outcomes of such interplay of the triple dialectics of structure|agency|passivity. In cogen, the feelings and 'need states' of participants help structure their participation and the production of new or interstitial cultures. Such new or interstitial cultures can be enacted across fields where resonating structures create opportunities to transform practices. The goals and motives for such transformation were to generate positive emotional energy and entrainment to solidarity and individual and collective successes through reproduction and transformation of new or interstitial cultures in Michelle's biology classroom and beyond.

Producing and Enacting New Cultures

As we continued to conduct cogen, over a period of time, we began to notice that the structure of interactions during cogen and in the classroom began to change from teacher-initiated and teacher-dominated to student-initiated and collaborative dialogues. Sewell (1992) conceptualized that structure, a dynamic, continually evolving matrix of a process of social interactions, is dialectically related to agency. Agency is the ability to appropriate resources to meet individual and collective goals (i.e., the power to act) in a situation. Structure and agency, exist in a dialectical relationship presupposing each other. Roth (2006) added that passivity, agency and structure exist in a triple dialectical relationship in which all three presuppose one another. He posited that passivity is a form of receptivity. Therefore, as the matrix (structures) of social interactions between students and their teacher (Michelle) and between students and their peers (other students) began to change during cogen and subsequently in the classroom, so did the agency, passivity

and receptivity entrenched in such social interactions. And these changes led to the production and enactment of new or interstitial cultures in the science classroom.

Changed Schemas and Associated Practices

Seeing Michelle in the classroom before cogen, the frustrated facial expressions and the disappointed gestures on her face (as observed in videos clips), compared to the cheerful, expressive smiles she was wearing after we started cogen pointed to the transforming powers and possibilities of cogen. “It was as if a heavy load had been lifted off my shoulders,” Michelle said during a chat. Following cogen, Michelle started to freely intermingle with her students, giving ‘hi-fives,’ sitting down with them at their tables, facilitating and coconstructing knowledge as they asked her questions in order to finding solutions on their own (exercising agency) as they shared their understandings of the concepts with each other. What difference cogen can make! Below is Michelle’s recollection that I obtained during a conversation.

> Prior to the implementation of cogen, I would not sit down. I would walk around the room. If students had questions I would bend [stoop] over them or their table to answer them. Even when taking roll on the computer I would never sit down. I was afraid to sit down because I thought I would lose control of my class. I needed to know their every move. They needed to know that I was paying attention to them. I needed to show them that teachers really do have eyes in the back of their heads. I was not willing to loose control of my class. I needed to be on top of my game and stay a step ahead of them. Now that we have implemented cogen in the classroom I feel more comfortable about sitting with the individual groups or individuals. I know that the class will continue working

> on task and if they don't, one of the students will say, "okay guys we need to refocus." I like how they keep each other on task. Like Po mentioned, I feel the students have my back, too. I did not realize how important it was to the students to have me sitting face to face with them discussing the topics. Well it does make sense now. I am talking with them and not at them or down to them. The students have made mention of this on more than one occasion that I actually sit down with them and not just stand, "She actually uses the chair." How powerful this one simple act is. When I am sitting with one group I still make conscious efforts to be aware of the other groups and any questions they may have. One thing for sure is I know the class "got my back."

The structures (schemas) that afford and expand students' agency also produce associative positive interactions and transactions that decrease hegemonic power relationships and promote solidarity in the classroom. Decreasing hegemonic power structures also reduces student resistance, which decreases the tendency, by Michelle, to exercise control over students. These affordances create resources that further structure improved coherence of interactions and transactions in their science classroom. Improved coherence generates interaction ritual chains that entrain to increased synchrony and more solidarity between Michelle and her students (Collins, 2004). For example, there was a time when Sunshine came to complain about cogen and wanted Michelle to stop cogen and return to chalk-and-talk pedagogy. Sunshine found herself alone in that quest. She was not able to garner negative emotional energy to overcome the positively valenced emotional energy already generated in the classroom by the coherence of interactions structured by cogen. No other students supported her. In addition, Michelle's

response was positive and productive that Sunshine did not find any structural resonance to aide her negatively valenced demand. After that incident, she asked if she could join us during cogen and soon became an active participant in cogen.

According to Sewell (1999), as schemas of encounters in both the cogen and the biology classrooms were gradually being transformed, so were the associated practices of the teacher, Michelle, and her students. It was evident that cogen, as the seedbed for cultural production according to Tobin (2005), had generated new or interstitial cultures in Michelle and her students. Some of the new or interstitial cultures that were generated during cogen by students and Michelle included positive and productive attitudes; critical thinking; patience (learning to wait for others, to take turns); empathy (sharing others' viewpoints, appreciating others' similarities and differences); public speaking; advocacy (advocating for self and others); confidence (overcoming self-pity, fear of self and others); reflective practice; sense of belonging, affiliation and community; and the "can-do" spirit. All of these new or interstitial cultures were generated as a result of changed ontology that minimized fears of self and others, changed teaching and learning environment that produced cultural sensitivity, acceptance of polysemic and polyphonic perspectives, coteaching, distributed leadership amongst students and students acting as change agents and brokers of youth cultures. The other outcomes included improved learning of science demonstrated by improved science discourses, exemplified by Shaggy, Scarface and others, as stated in previous sections (see Chapter 1, pp. 26-27).

In engaging students in conversational dialogues about issues relevant to teaching and learning of science and classroom practices, Michelle and her students became cognizant of, and receptive to, each other's practices, especially in the areas of

unconscious verbal and non-verbal communicative actions and practices (ritualized actions). Upon becoming aware, conscious efforts were made to address these unconscious practices because they triggered negative emotions that entrained to asynchrony in the past. For instance, Michelle became conscious of the effects of her tone of voice and her facial expressions that denoted being discomfited. She was made aware of the fact that she ran through the aisles ("student space") and rarely sat down with her students.

Many students also became aware of their own roles in the dynamics of the classroom. Students began to trust Michelle as they saw the transformations she was making in her practices and her interactions with them. They began to believe that their concerns were being addressed and that their roles in addressing their issues were recognized and valued. In addition, students responded in appreciation for being afforded the structure that allowed them to expand their agency and to actively coconstruct curriculum and pedagogy with Michelle as well as participate in their own learning. The climate and culture of the classroom was being transformed and was becoming more positive and productive than before. Michelle and her students were able to utilize the diversity of the biology classroom as resources to generate and sustain their successes in the science classroom.

In-Cogen Classroom Practices of Participants

In this section, I address some of the new cultures, mentioned in the previous section which were produced in cogen that became reproduced and transformed during classroom encounters by Michelle and her students as they enacted curriculum and

pedagogy in the classroom. It is important to note that producing new cultures greatly improved working relations, expanded students' and Michelle's agency, improved their identities and roles in the classroom and in other fields of social life. Producing and enacting new or hybrid/interstitial cultures by Michelle and her students broadened and increased their opportunities and levels of success in the classroom and beyond (Tobin, 2007).

Transformed Practices of the Teacher

As I said earlier, cogen was the seedbed for producing new or hybridized/interstitial cultural. The cultures, produced during cogen, became embodied in improved interactions encouraged by teacher's improved sense of being and becoming a better teacher in the classroom. A process of changes in ontological perspectives about teaching and learning science and about social and cultural understandings emerged. Changes in teacher's ontology structured changes in teacher's identity and how she interacted with her students across various markers of difference. Successful interactions between Michelle and her students during cogen produced successful interactions in the science classroom. Below are some of the new or interstitial cultures that transformed Michelle's practices.

Minimizing fears

Enacting cogen produced in the teacher ways of gaining the self-confidence (i.e., symbolic capital) she needed to minimize her fears of urban youths. Fear is a negative emotional force that mitigates against synchrony and solidarity. Michelle, like many teachers, dreaded talking with her students about their shared classroom experiences. Michelle said during interviews and casual discussions with me that she thought she was

going to lose control of the class, be disrespected and be harshly criticized by students who she thought were less qualified to evaluate her teaching. In addition, she also thought that she would be regarded as using an unprofessional approach to pedagogical development because traditional teaching methods and standard professional development practice frown at having dialogues with students.

However, when Michelle conducted cogen and had meaningful, productive dialogues with her students, she did not lose control of the classroom nor was she disrespected. She actually gained more respect (i.e., symbolic capital), respect being the currency of social interactions according to Anderson (1999), from her students. She earned the right to teach them (Tobin, 2005) because students saw her as caring and approachable, resources for justice and equity. Michelle received from her students such meaningful and constructive suggestions on to how "to teach a kid like me." She developed social networks of students (she got their ears and they "got her back" according to Tobin (2005)) (i.e., she got the supports and cooperation she needed to teach her students effectively and she was no longer alone in the classroom (Davis, 1997). Students were afforded the agency to step in and help her manage the activities (cultural production) of the classroom (distributed leadership (Emdin, 2007)). Michelle became constructivist, liberated from the constrictions of the traditional teaching methods (see pp. 134-135). Michelle was no longer afraid of students holding discussions in the classroom. She became confident (symbolic capital) enough to share her fears (emotions) with her students and was able to confidently say that she had overcome her trepidation over time.

Other new cultural enactments that Michelle started to produce because she had overcome her fears included radical listening (Tobin, 2009). Michelle was able to listen

better and more attentively to the conversations (conversations are forms of cultural production) her students were having and was able to recognize that her students were actually discussing issues (constructing knowledge, (i.e., reproducing and transforming culture) central to what she (Michelle) was teaching them and not just making noises. Michelle was also no longer talking over and above her students in efforts to gain control over classroom interactions (I theorize talking over and above students was a form of truncating students' agency). She was no longer repeating herself many times over and over because her initial fear used to make her think that her students were not attentive and were distracted; Michelle used to think that by repeating herself over and over, she would regain her students' attention. Part of what was demonstrated in this vignette was the changes in ontology as described below.

Change in ontology

Michelle's ontological perspectives and her inclination for deficit perspectives began to change as she enacted cogen with her students. She began to see her students differently and more as resources than liabilities. Michelle began to recognize and accept that teaching and learning are social and negotiable practices; and that the classroom space is a social and negotiable space. She started to understand that the structures that shape and enable classroom encounters, interactions and transactions, are not rigid, that those structures could and should be adjusted by the teacher and her students readily to shape the outcomes of their interactions and transactions. Michelle realized that she did not have to continue to perpetrate the status quo; that she could transform it.

Cultural sensitivity

Following enactment of cogen, Michelle became culturally sensitive to the social and cultural injustices in her classroom. She became conscious and conscientious of structures that perpetrated disadvantages for her students, even beyond her classroom, and worked at restructuring or eliminating them in accordance with the tenets for culturally responsive pedagogy espoused by Ladson-Billings (1994). Michelle became a critical pedagogue, an enactor of redemptive educational practices (Elmesky and Tobin, 2005). For instance, when the class wanted to conduct dissection labs, Michelle called parents of Moslem students (African-Americans and Pakistanis) and obtained parental permissions to allow their children to dissect piglets. Michelle said in a discussion after the lab.

> I would never have done that before. I would have just excluded the students to avoid troubles; just have them do something else. But now, I have confidence in these kids; plus why should the Muslim kids have to miss out if they wanted to experience and learn from it [pig dissection]?

So, Michelle was able to utilize religious sensitivity as a resource to afford the learning of her students. Also when Po brought up the issue of him being neglected in the class because he was a quiet student during cogen, Michelle's emotional awareness of quiet students in the class became heightened. It dawned on her that students from certain cultural background (mostly Southeast Asian and some Hispanic students) belong in that category of quiet and ignored students who would keep quiet even when they did not understand a concept. Those students would not ask questions because culturally they do not question elderly or authority figures. Michelle became conscious of them, spent more time and paid more attention to them. She consciously solicited their input and

contributions to discourses, affording their agency to enact culture. Using diversity as resources for working with her students successfully became salient in Michelle's science classroom.

Polysemic and polyphonic perspectives

What Michelle, like many teachers, dreaded as possible criticism of their practices was a form of cultural production in the classroom that valued different (multiple) ways of constructing knowledge (i.e., perceiving the same object or pursuing the same objectives). As Michelle enacted cogen, she started to generate the understandings that teaching and learning of science was not a singularity about her being the teacher; it was more of a collective of her and her students becoming successful individually and collectively. She was not the only one experiencing the classroom. As such, she should not be the 'lone voice in the wilderness.' Michelle started to learn to accommodate, actively solicit and appropriate other peoples' (her students) perspectives and value their voices. Davis (1997, p. 10) reiterated that, "Teachers need perspective." Students' perspectives are essential structuring resources that would help the teacher and provide opportunities to afford and expand the agency that students need to transform rules, roles and associated responsibilities (structures) in the classroom. Rather than loathe multiple perspectives and multiple voices, especially those of students who share the same classroom experiences with her and are equal stakeholders in the outcomes of classroom transactions, Michelle began to court, embrace and value multiple viewpoints and outlooks in order to be well equipped to serve her students better. With the new polysemic and polyphonic cultures generated during cogen, Michelle and her students were no longer threatened by other peoples' (difference of) opinions. They were able to

tactically catalyze changes that insured the production and incorporation of multiple voices into generating agreed-to plans of actions during cogen and the collective implementation of such plans in the science classroom for their individual and collective successes.

Negotiating difference

In pursuit of working through sociocultural markers of difference that often plagued teaching and learning of science in the classroom, and to orient their interactions and transactions toward production of solidarity, Michelle and her students crossed various diversity boundaries to work together on an equal power basis, i.e., to share power and decision making processes. They agreed that no one voice or opinion was going to be valued more than any other; and that respect for one another was salient, to be given and received reciprocally. They considered all issues of concern to all participants as salient for deliberation; and that negotiated solutions would be enacted collectively and collaboratively. Outcomes would be reviewed and necessary adjustments made as needed.

The markers of collective and collaborative participation, such as patience, empathy, advocacy, reflective practice, power sharing, respect, sitting together in close spatial proximity with students, and willingness to learn from others, became evident. These became resources for Michelle to structure her own cultural productions in synchrony with those of her students. In addition, appropriating these new or interstitial cultures to produce change by expanding science-learning opportunities for her students decreased students' resistance and increased Michelle's capitals (social, cultural and symbolic), not only among her students but also, among her fellow teachers and

administrators at *Fairness High*. For instance, other teachers noticed the positive transformations of students who have experienced Michelle's classroom when they come into their classes. Some other teachers, even though they resisted conducting cogen themselves, acknowledged cogen's transforming power as they noticed the new cheerful and positive dispositions Michelle displayed. In addition, the school administrators enjoyed coming to visit Michelle's 6th-period classroom because students were congenial and demonstrated that they enjoyed learning. Over a period of enacting cogen, Michelle's transformations were much more evident. Michelle and her students have become change agents and good at negotiating their differences as they produce positive and successful interactions evident to others in the school.

In the sub-sections below, I address three main areas of Michelle's transformation that were salient to the purpose of my study, namely; accepting and learning from difference (Tobin, 2009), classroom control and empathy. I chose these because Michelle's transformation of these practices was afforded by her willingness to conduct cogen with her students and for allowing her students to critic her practices.

Accepting and learning from difference

In the five years Michelle have been teaching at *Fairness High*, she had accumulated enough capitals (social, cultural and some symbolic capitals) to be certified to teach these students. She had earned the science degrees, built the social networks and gained some respect among peers and superiors. However, until enacting cogen, Michelle had not built the social networks amongst her students nor earned the respect she needed to have the rights to teach students like them. This resulted from the traditional teaching methods' tendencies to pay tinker's damn to difference, to have control over students and

to set students in competition against each other. By tinker's damn, I meant the slightest amount of care, heed or value. These tendencies contributed to students' resistance and the disruptive behaviors in Michelle's class. These tendencies were also indicators of the fact that she did not get to know her students beyond their school records and did not build a social network with them. The school record of students was a seedbed for legitimizing and exacerbating differences, such as students' behaviors, gender, ethnicity, race, dispositions, language proficiency and academic achievement, by the classroom teacher.

Following enactment of cogen by Michelle and her students, she was made aware of, and became sensitized to, the devastating effects of maintaining the status quo on sociocultural and academic differences in her class. This awareness resonated with Michelle's experience in post-graduate school where she was studying plant pathology before dropping out. She dropped out because she felt out of place, unwelcome and unappreciated in an environment opposite the nurturing and caring ones she was accustomed to, at home and in her previous colleges. Michelle got to recognize and acknowledge these differences not as liabilities but as resources in her classroom. Michelle began to appropriate these differences to enhance her teaching and her students' learning of science.

When the issue of Po and some students being marginalized was brought up at cogen, Michelle and cogen participants recognized that Po was not alone. They realized that other students, who were English language-challenged, were often quiet in class and do not readily participate in classroom discourses. So, a plan of action was agreed-to that allowed the voices of those students to be heard and respected in class. Michelle agreed

to be more patient with them, and with other students. She agreed to allow them more time to discuss among themselves, in their vernacular, to formulate their answers in their language and then to translate their response into English, which they then shared with the class. Students agreed not to make jest of anyone due to their limited language proficiencies.

Bong and Chang really benefited from this change in classroom structure. In a similar incident, Michelle had also allowed Anita, a cogen participant from the 3rd-period class, a Hispanic female, to write a lab report in Spanish so she could be successful on a science project. Michelle realized that Anita had really worked hard on the lab and she understood the concept except that her English language proficiency was at that time limited. That opportunity made Anita intensify her learning of the English language because she felt she did not want to be the only student in the class who had to always write her papers in Spanish. In order for teachers to accept and learn from difference, according to Tobin (2009), it is imperative for them to have some working knowledge of the cultural backgrounds of their students. According to Weinstein et. al (2004), cultural responsiveness requires cultural content knowledge as delineated by Sheets and Gay (1996, p. 92).

Vernacularization/Creolization of science discourse

As I discussed above, Michelle and cogen participants, in recognizing that some students were being marginalized, had agreed to encourage them to creolize their science discussions in their vernacular (Chinese language) and then share with the class, in English language, what they discussed. Below are some examples of such discussion. In Figure 1 below, Bong and Chang were discussing protein synthesis in their vernacular

(Chinese). Bong was explaining Deoxyribonucleic Acid (DNA) as a double stranded helical structure and Chang drew a representation of it as a ladder, with the word “DNA” written on top, and the nucleotides as ladder rungs connecting the vertical sides. They were using a small,

Figure 1. Bong and Chang creolizing the DNA as a double-stranded helical structure. Chang draws a ladder on the portable whiteboard

portable rectangular whiteboard slate and colored markers provided them and other teams by Michelle.

In Figure 2 below, Bong and Chang continued to discuss, in their vernacular, how messenger Ribonucleic Acid (mRNA) works to unzip DNA.

Figure 2. Bong and Chang discussing RNA. Chang draws RNA as a single strand structure.

Chang drew schematics of RNA as a single strand with nucleotides sticking out as they continued their creolization of protein synthesis in Chinese language in Figure 3 below.

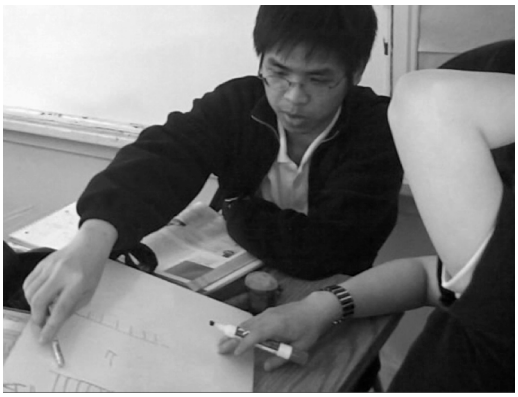


Figure 3. Bong and Chang continue their creolized science discourse

In Figure 4 below, Bong and Chang explained their understanding of protein synthesis to Michelle, before sharing with the class.

Figure 4. Michelle joins the discussion

In Figure 5 below, Michelle asked some questions to clarify some of the concepts. Bong and Chang explained how transferase works with RNA producing tRNA that helps generate codons, which are then read to make protein.

Figure 5. Bong and Chang explaining, in English language, to Michelle how transferase works with RNA to generate codons.

And they were comfortable and satisfied with themselves and their contributions in Figure 6 below.

Figure 6. Bong and Chang appear to enjoy the opportunity to creolized their science discourse.

As the bell rang to end the class for that period, Michelle collected and saved the whiteboard with the schematics for the Bong and Chang and other students doing similar things so they could explain it to the class when next the class met. The schematics that

Bong and Chang drew illustrated that they understood the concept better when they were permitted to creolize (Halls, 1990) the science concept of protein synthesis in their own vernacular (language) to gain better understandings of the concept before hand. Michelle facilitated this process by leaving them to work on their own after she had explained the fundamentals of the concept of protein synthesis to the class. She then came back to the group to ask them questions in English language, which the students understood and responded to without fear or trepidation. Michelle allowed them to articulate the process and gave them the space and resources to demonstrate what they were capable of learning when provided with a culturally responsive environment. Michelle said that she would have frowned at allowing them to do this had she continued to teach the way she used to teach previously. "No way would I have allowed this if not for cogen that opened my eyes," she said during a discussion.

Classroom control

In searching for ways to teach her students better, Michelle had come to realize the futility of trying to establish control over her students because they continually resisted her. She was not able to create positive and productive learning environment when she tried to exert control over students. So, one of the new cultures that emerged from cogen was that as participants began to learn to take turns at talk they, including Michelle, learned to be patient with each other and to wait for others to finish their thoughts as they advocated for self and others. They were no longer afraid of being criticized or challenged. As they learned to reflect on their experiences and practices, they learned to respect and appreciate others and their viewpoints. They also learned to receive and acknowledge respect from others in return.

As these interplays of emotions continued to unfold, cogen participants, including Michelle, were consciously and/or unconsciously sharing power and role identity. Over a period of time, they took turns to assume and relinquish leadership. Doing so provided structures that afforded others' successes. In the process they were distributing leadership and authority that enabled each other to manager power equitably. It became obvious to Michelle that students willingly assumed leadership roles; and they were willing to accept leadership from others when a teacher creates the structure that affords individual and collective agency. In essence, just as the control of cogen interactions was not vested in one person, but was communal, so was the control of the class. Control of the classroom became communal and distributed, in a dynamic flux, among the students. Control over students was no longer tenable nor regarded as desirable.

Having produced this new culture of critical awareness, Michelle freed herself from the stranglehold of hegemonic power struggle with her students. The traditional methods of teaching had made control over students the mantra of good classroom management strategies that was supposed to produce successful teaching and learning outcomes. The use of power in the classroom when control was concentrated solely in the hands of the teacher was a fomenter of symbolic or social violence. By being transformed and distributed, the use of power had a structural flux and fluency to it that was emancipative to Michelle and her students and in accordance with bell hooks' (1994, p. 44) construct of "mutually engaged pedagogy." hooks' construct was that of a classroom context in which students and teacher share power. Such sharing of power then helps participants to shape the trajectory of classroom discourses and creates opportunities to make the hermeneutics and epistemologies of science teaching and

learning emancipative. hooks was an advocate of dialogic interactions that enables students to envision their roles as participants "worthy of voice."

By structural flux, I meant an interchange of participatory leadership roles and identity that afforded opportunities for all students to assume and relinquish leadership timely, appropriately and anticipatorily, (i.e., fluently). For example, when Michelle was teaching or when any of the students was coteaching with Michelle, as classroom discussions often became animated, noise level was often raised. As the noise level exceeded a certain threshold that students considered contradictory to learning, a student or a group of students would call the class to order by simply saying, "Quiet!" or "Common people, are we here to learn or what"? Following such calls, students kept themselves in check and the class quiets down. The 'quieter,' whoever called the class to order, often then motioned Michelle and/or the coteacher to continue teaching. Sometimes the 'quieter' would say, "You can continue to teach now," or "Ms. W., over to you now" (as students did often to help a student-teacher, Ms. W., learn how to teach). Students in the 6th-period class did this in such a rotation structured by their sense of communal identity and affiliation. No student resisted the other from carrying out this function. Through receptivity, passivity, and respect for self and others, different students at different times simply assumed this role.

By fluency, I meant that the use of power was timely, appropriate and anticipatory. Davis (1997) reiterated the fact that the classroom being a busy place, teachers were often preoccupied with many things; that teachers were not always aware of all that was happening in their classroom. As a result of not being able to see all that was happening in their classroom, teachers often misinterpreted what was happening and

meted out disciplinary interventions unnecessarily, untimely and inappropriately. Because Michelle, like many other teachers, was not always aware of all that was happening in her classroom prior to enacting cogen (see example of Chad in Chapter 5, p. 126, when Michelle chastised Chad without the knowledge of what was transpiring), it made sense for Michelle to share power with her students through distributed leadership and youth culture brokering. By enacting cogen, Michelle provided structures for students to help her see what she could not see in the classroom. She also provided students with the agency they needed to, in a timely manner, manage the classroom community appropriately, with her, in ways that are anticipated by community affiliation or membership.

In essence, Michelle provided structures in which the control of the students and the classroom was by the students for the benefits of the students. Thus, the power sharing through distributed leadership was emancipative for Michelle and her students because it was democratic, culturally responsive and ensured social justice pedagogy. Such use of power was not coercive nor did it take advantage of those who lacked power. Rather it was, "the practice of freedom, for it allow[ed] students to assume responsibilities for their own choices," in accordance with hooks (1994, p. 207) construct of power usage in the classroom. For Michelle, this new culture of distributive power sharing, generated during cogen and was being reproduced and transformed in the classes, ruptured traditional pedagogical boundaries. As such, it freed Michelle and her students to embrace and embody critical pedagogy as advocated by Freire (1970).

Empathy

When Michelle was young, she loved science and wanted to be a veterinarian. Her parents and granddaddies soundly encouraged her. Her parents bought her science books and a microscope. Michelle adopted and took care of sick and abandoned animals. She competed in science fairs in school. She was raised in a caring and nurturing home environment and she cared for others who lacked power. When Michelle went to college, she was nurtured in caring, productive learning environments until she started post-graduate education where the environment was not as caring and nurturing as she had experienced at home and at the previous institutions she had attended. The changed structure at the post-graduate institution caused her to drop out of her doctoral program. When Michelle started to teach, she wanted to create for her students structures that resonated with the nurturing and caring she experienced growing up. However, she experienced limited successes due to various factors that constrained teaching and learning of science in the inner-city ecology.

Michelle's empathy (a form of symbolic capital) for her students started to resonate after we started cogen. By empathy, I meant the ability to share in another person's emotions and feelings, (http://en.wikipedia.org/wiki/Empathy). Michelle remembered how she was treated well as a child and a student; how she learned and what strategies helped her to learn. She remembered how she struggled as a student; how she appropriated resources to succeed and what roles different teachers played in her success. Michelle remembered how she felt before dropping out of postgraduate school because she felt unaccepted and unappreciated and her agency truncated. With such structural

resonance, Michelle developed empathy towards her students and rededicated to finding better ways to insure the successes of her students.

As Michelle continued to search for better ways to meet the needs of her students, she came to know about cogen and decided to implement it in her classroom. Cogen provided Michelle and her students the structures they needed to cross-examine their experiences and perspectives with each other, i.e., to metaphorically walk in each other's shoes. Empathy made Michelle and her students reach out to each other. This new culture brought Michelle to say during a conversation that, "It is only when they [students] are successful that I am successful. I needed to create a positive and productive learning environment like the ones I enjoyed when I was a student." Oftentimes, empathy is a resource lacking in the traditional teaching methods. Salovey and Gruel (2005) conceptualized empathy as one of the key ingredients of emotional or social intelligence. Both emotional and social intelligence have been considered to be contributing factors to an individual's effectiveness in social and working relationships, according to Zeidner, Roberts, and Matthews (2002).

Empathy fostered the type of interactions that generated successful collaborative and collective outcomes. Feshbach and Feshbach (2009) posited that teacher's empathy required that the teacher understands the student. However, that alone, they claimed, would not be sufficient. The crux of teacher's empathy, they reiterated, lies in the interaction of the teacher with the students that created productive, beneficial social networking. Feshbach and Feshbach (2009, p. 87) believed that, "through teachers communicating to students their understanding of how the students feel, the latter are

presumed to experience greater acceptance." They indicated that the Rogerian[8] model of empathy was comprised of two elements, namely: the ability to understand and identify another's feelings and perspectives; and the ability to communicate that understanding to the individual with whom one is empathizing. I argue that empathy goes beyond these two parameters. In addition to these two parameters, empathy must include taking necessary steps to work at changing the structure and providing the agency and access to resources that would transform the situation(s) or the condition(s), for the better, for the one with whom one empathizes; and that was what cogen allowed Michelle to do in her classroom.

Transformed Practices of the Students

In the last section, I discussed some of the new or interstitial cultures that were afforded by cogen. I delineated some of the salient transformations that Michelle experienced as a result of enacting cogen with her 6th-period biology students. In this section, I examine some of the new or interstitial cultures that cogen afforded students in Michelle's science classrooms.

Positive and productive attitudes

Rawr, a female student cogen participant, summarized the general attitudes in Michelle's classes before we started cogen and compared the attitudes to the present classroom climate and students' attitudes after we started cogen. Rawr wrote in her reflections that,

> Before we started doing CoGen [cogen] in [6th-period] class, a lot of the students were lost and failing. People would just put their heads down and sleep the entire period. [Michelle] would get frustrated and would talk loudly and repeat things

[8] http://en.wikipedia.org/wiki/Person-centered_therapy retrieved 10/17/2009

> over and over. When we started cogen, I was really skeptical. I did not think it would make any difference. But [Michelle] started asking what we would like to do, and what is the best way for us to learn. People really started to participate, and [gave] her constructive criticism on her teaching methods. Now, everyone in the class participates, and there are a lot of people who raised their grades. When one of us starts to become [go] off task, the class always pushes them [her] in the right direction. Our classmates make sure that we succeed. Cogen really helped this class. I wish that we would be able to do this in other classes we have.

Bo, a new student in Michelle's 3rd-period class (he transferred late in the year), who became one of the cogen ambassadors to his class, wrote in his reflection, "I thought the cogen was a good way to discuss what was going on within the bio classes. The cogen was filled with bright ideas and positive energy." These reflections revealed students' attitudes before the enactment of cogen by Michelle and her students. Students' lethargy prompted Michelle to become frustrated. Michelle's frustration structured the recursion of negative and unproductive student attitudes that contradicted student-teacher solidarity and individual and/or collective successes. Rawr said, "When we started cogen, I was really skeptical. I did not think it would make any difference." Rawr's assertion was a barometer of the general attitudes of students in the biology classrooms. That was why Michelle was searching for a better way to engage her students and to insure their successes. These reflections attest to the transformative power of cogen.

Critical thinking

When Rawr said, "But [Michelle] started asking what we would like to do, and what is the best way for us to learn. People really started to participate, and [gave] her

constructive criticism on her teaching methods," she meant that students started to thinking critically, *together with* Michelle, about what could help them succeed individually and collectively.

A phenomenon that occurred regularly during cogen was that as participants took turns to speak, others were actively listening and critically thinking. This happened because each listener would need to respond in such a way that one participant's response becomes a resource for the next person at talk and provided structure for critically addressing the issues being discussed. This provided structural linkages in cogen dialogues. Each time a person talked, her utterances structured the next person's utterances when it was next person's turn at talk until the issue was discussed to the point where a plan of action was agreed-to. For instance, students began to think critically about classroom dynamics and to determine who would benefit better by sitting in a different group; and what curricular materials would enhance their learning as they coconstruct and coenact curricular with Michelle.

Following critical dialogues, plans of action were agreed-to that structured and restructured classroom interactions and transactions as needed. Students rearranged seating to include and accommodate "other" students in different groups to enhance individual and collective learning. A commitment was also made to consciously engage the quiet students in classroom discourses; and to give them space, time and the respect they needed to "enter" the capital exchange helix.

Patience (learning to wait for others, learning to take turns at talk)

As I said above, cogen participants learned to be patient with each other. They learned to take turns at talk and not to "turn-shark" or disrespect each other. As one

participant talked, others were attentively listening so as to be able to respond appropriately when it was their turn at talk. Being patient required some skills at self-control. Students also learned to yield their turns to others. Knowing some aspects of youth culture myself, before cogen, it was not always easy to have young people wait patiently for their turn at talk in social life. By learning to take turns and to listen attentively, students learned to give, receive and appropriate respect of others and their points of view. They also learned to offer constructive suggestions, accept criticisms and contain their emotions and instinctive tendencies. Having learned to do this during cogen, they were then able to reproduce and transform these interstitial cultures in the classroom to the benefit of all.

For example, while Michelle was attending to a group's inquiry, another group would often call her. She sometimes did not leave the first group right away and may stay longer with that group. Prior to cogen, the second group could become upset and begin to cause distractions. After cogen, they learned to be patient and to wait for Michelle to finish with the first group. While waiting, students did not just sit idle like before. They had also learned to work together and sought help from their fellow students and found solutions to the problem they were initially calling on Michelle to help them with.

Empathy (sharing other's viewpoints, appreciating other's differences and similarities)

As I mentioned in some form or another in the three paragraphs above, students learned to "walk in each other's shoes." They developed an interstitial culture of empathy. Students began to see something about themselves in each other. They began to appreciate the similarities they shared. More importantly, they began to use their

differences as resources to afford their individual and collective successes. For example, empathy contributed to Keisha's desire to bring those who cut classes back to class, "so they could learn and our team could be better," she said. When cogen participants pondered Po's issues of being neglected, they were able to relate to that issue experientially. So, it was not difficult for participants to embody the social injustice and to realize the outcomes of continuing the status quo. So, they agreed to ameliorate the situation, not just for Po but all students like him.

Public speaking

By providing structures for shy students, like Po, to voice their opinions and have their thoughts appreciated and accepted during cogen, students began to gain confidence to speak up in the public space, like the classroom and beyond. When cogen participants agreed to let students coteach and coenact curriculum with Michelle, little did we realize that we were creating structures that would empower students like Smiley, Scarface, and Sunshine to copresent research with us (Michelle and I) at educational conferences. By standing in front of the class, under the glare of their classmates and interacting with the *Promethean* electronic whiteboard, students overcame their shyness and fright. They also challenged other students to do the same.

As narrated in Chapter 5, Michelle used to be very protective of the "general space" and "teacher's space." In addition, she was very protective of the electronic equipment and only allowed few selected students to interact with it under her restrictive gaze. With the enactment of cogen, Michelle opened up opportunities for students. Restrictions were removed. The use of the previously sectored classroom space became

negotiable as "community space" and interactions with the electronic whiteboard were encouraged. As these structuring resources were no longer restrictive, students' agencies became expanded and opportunities opened up that students were able to take advantage of that helped them succeed.

Collins (2004) posited that successful interactions produced interaction ritual chains that produced more successes. As students became successful in coteaching and coenacting curriculum in their local environment in the classroom, they became more positively energized and their self-confidence expanded. Smiley and Sunshine were invited to copresent with Michelle in her pedagogy class at PennSTI. Later in the spring, Smiley and Scarface copresented with Michelle and me at the New DEEL[9] international conference at Temple University. We worked together on our presentation slides and when it was the students' turn, as we took turns to present and discuss each slide, Smiley and Scarface did so well. It was unbelievable that a couple of high school kids, from the inner-city, presenting in a conference for the first time ever, could do so well to a standing ovation from the conference attendees, mostly professors and doctoral students. Towards the end of spring, Dreana, Smiley and Scarface were also scheduled to present with us at The 10th Annual Sharing Our Success (SOS) in Urban Science and Math Teaching Conference[10] at NYU. However, the students' schedule precluded them from doing so.

Advocating for self and others

Before we started cogen, students in Michelle's classes were not particularly concerned about others in the class. They perceived themselves much more as individuals

[9] http://www.temple.edu/education/newdeel/docs/2009ConfProgram.pdf
[10] http://steinhardt.nyu.edu/scmsAdmin/uploads/003/194/SOS%20Schedule%20c2009.pdf

instead of a community. They thought of themselves as powerless students who could do little to change the cultural (structure and associative practices) productions taking place in their classrooms. As Scarface said in his reflection, "… in my other classes, it is all one-way teaching. Teacher teaches, students listen. Students put no input into what is going on. Personally, I enjoy my work more if I get a say in what I am doing." When we started cogen, students became conscious of their roles and how they could contribute to their own learning. They became conscious that their individual goals and the collective motives of the class were recursively related dialectically. Scarface said,

> "… But now that we do cogen, class is more enjoyable. Instead of being alone, on everything, we're together. We work and interact with each other now. I enjoy 6th-period Biology more than my other classes because in my other classes, …"

In working together as a community of learners, students started advocating for each other. As Smiley wrote in her reflection,

> The cogen that are held started with just sixth-period. But they [cogen] started getting so good and we wanted to experience [cogen] with other classes; and now, instead of sixth-period, all biology classes are participating and putting in input. The cogen are very helpful; and since the beginning of the school [year], a lot in the class, students and teacher, has changed.

Another example of advocating for others was the "bring-a-friend" plan that Keisha suggested, which successfully brought "cutters" back to their classrooms. In addition to this, it was not uncommon, after cogen started, to have students peer-tutor each other, rearrange seating to position students who were not doing well with those who were doing well. Students often called Michelle to a table next to them, on behalf of

other students, when they themselves were not able to assist others. “Ms. [Michelle], Table 5 needs some assistance,” often came from someone on another table. Cogen participants also volunteered to help a chemistry teacher to enact cogen so her students could benefit; but she refused the proposition.

The environment and sense of collaboration and collectiveness that pervaded 6th-period biology class encouraged students to advocate for the success of others. Science learning became a collective endeavor. For instance, when a group member was not able to come to class, members of her group shared their notes and works done with her and efforts were made to bring the individual up to par with what was going on in the class during her absence. In addition, Michelle agreed to allow the student to make up any tests she missed during her absence, with or without penalty depending on the reasons for her absence. So, students were not just acting for self but also for and on behalf of others, to afford others’ success. “It’s like a small family where you are not afraid to make mistake because you know someone is going to correct you and you learn,” said Scarface as he closed our presentation at the New DEEL conference. In essence, students were able to appropriate each other’s capitals to improve each other’s learning, and associatively, Michelle’s teaching.

Confidence (overcoming self-pity, fear of self and others)

As indicated by Scarface in my closing of the last sub-section above, students in Michelle’s 6th-period class worked very well together having built a classroom community where they were not afraid to make mistakes. That meant that students trusted each other and had much confidence in each other. Confidence (i.e., symbolic capital) builds success and success builds confidence; and more confidence builds more successes

into interaction ritual chains (Collins, 2004) and the build up of positive emotional energy and verification of *self* (Turner, 2002). It was not so before cogen. Before cogen, the lethargy of classroom interactions frustrated Michelle. Her traditional teaching methods also perpetuated the lethargy and lack of confidence and trust as students interacted in the class. As indicated in Chapter 4, students responded to Michelle in undertones that underscored lack of confidence in the answers they volunteered. The traditional method of teaching also created a classroom where students and their teacher (Michelle) treated social markers of difference as liabilities rather than resources. Cogen provided the structure for overcoming suspicions associated with difference in the classroom. Negotiating difference through cogen engenders collaborative and collective social interactions that help build participants' self-confidence. Difference became a resource.

Confidence, like respect, is social as well as symbolic capital. Confidence engenders respect in social interactions; and it produces positive emotional energy, which entrains to solidarity. Depending on the structure of social and working relationships between a teacher and her student, confidence is also a resource (a commodity) that a student may or may not have the structure to produce and the agency to appropriate in the science classroom. The structure of social interactions affords or truncates self-confidence and agency. As students gained confidence in themselves and their teacher, they gained respect of and for themselves and their teacher. They also gained agency to access and appropriate resources such as the use of the *Promethean* interactive electronic whiteboard in Michelle's class. Confidence often determines the outcomes of an encounter. Confidence is an affirmation of *self* or *identity*. According to Turner (2002, p.

101), "self is always emotional; one does not have a view of self without emotional valence." I argue that confidence or *self*-confidence is always emotionally valenced.

Reflective practice

Cogen is a field of social encounters where participants interrogate shared experiences of prior classroom encounters. Interrogating or cross-examining shared experiences involved reflective practices. In cross-examining shared experiences, participants engaged in reflective practice, a kind of hind-sight perspective, to determine what worked, what did not work, and why. By conducting such reflective practices during cogen, participants developed critical individual and collective reflections of their practices as they interacted in the science classroom. Having produced such interstitial culture of reflective practice with Michelle during cogen, students were then able to reproduce and transform reflective practices in their classroom.

When Smiley wrote in her reflection that,

> I believed that these cogen[s] changed everybody. It was a little difficult at first. But we constantly made changes. And at the end of each cogen, we all shared goals that we wanted to accomplish; and our goals became a success,

she was not only reflecting, she was also referring to the fact that those changes came from individual and collective reflections by those who experienced prior changes. The power of reflective practices is that they can be constructive and structuring.

Sense of belonging, affiliation and community

Enacting cogen provided opportunities for Michelle and her students to come together collaboratively and collectively to enact change; the kind of changes that Smiley said "… changed everybody." Smiley said in the previous section that, "It was a little

difficult at first. But we constantly made changes ....” What Smiley did not detail was that most of the changes that took place among cogen participants were in their individual|collective dialectical relationships. It was changes in the being|becoming|belonging triple dialectics of *self*, i.e., changes that transformed participants from *being an individual* in the class to *becoming a member of a collective* and *belonging in a community*; from pursuing *individual goals* to embracing shared and *collective and community motives*.

When Smiley said, “It was a little difficult at first,” she meant that coming together as a collective in the classroom required negotiating social markers of difference, which also required negotiating changes in participants’ individual ontologies. By successfully negotiating differences, participants were able to interact successfully during cogen and in the classroom. Successful interactions and transactions produced outcomes such as confidence, trust, corespect and change in identity (role and self identities) as students produced agreed-to plans of action needed to improve the quality of science teaching and learning in their classrooms.

Cogen participants produced and enacted culture collaboratively, in synchrony. Doing so produced the sense on affiliation, communality and collective identity that enabled positive emotional energy to be generated. It was such an emotional energy that attuned and bound individuals together (Turner, 2002) into social and working relationships that fostered individual collective and community successes in Michelle’s classroom. According to Scarface’s written reflection on cogen,

> … But now that we do cogen, class is more enjoyable. Instead of being alone, on everything, we’re together. We work and interact with each other now. I enjoy

6th-period Biology more than my other classes because in my other classes, it's all one-way teaching."

Scarface was right when he referred to the affiliations structured by cogen as a small family.

CHAPTER 7

Conclusion

Like A Small Family

As I conclude this dissertation, one thought came to mind that I want to reflect on. It was a thought espoused by Scarface, a cogen participant, as we concluded our presentation at an international conference at Temple University, Philadelphia, PA. Scarface summed up all our discussions that day by creating a construct of cogen as "… a small family where you are not afraid to make mistakes because you know someone is going to correct you and you learn." We presented a paper titled, "Cogenerative dialogues and coteaching: vehicles for developing and practicing democratic, ethical, [and] educational leadership in the urban science classroom." We weaved our presentation around the four ideals of the organization and the theme of the conference. Using the acronym in the tenets of the New DEEL organization, we structured the title and embodiment of our presentation around these four major ideals that are equally embedded in cogen: namely, democracy, ethics, education and leadership (DEEL) and had discussed each as shown below.

It was our (cogen participants and me) understanding (and we worked together knowing) that cogen is a vehicle for developing and practicing democratic processes in the classroom because control-over students (discussed in Chapter 4 of this dissertation), as a way of making them conform to the dominant culture's way of social life is not a democratic practice. A classroom environment where power differentials between

students and their teacher favors the structure of interactions against students, generate negative emotional energy and lack of solidarity is not democratic.

Cogen affords and expands democratic practices in the classroom in that cogen provides space for the teacher and her students to come together in an environment created to hold critical, collaborative and collective conversations about their shared experiences. Cogen allows students to have equal say in how their classroom is being run. In cogen, participants treat each other with equity and create structures for working through sociocultural markers of difference and for employing differences as schemas and resources for accomplishing individual and collective successes. In practicing democracy through enactment of cogen, all voices are valued and heard; and agreed-to plans are collaboratively and collectively generated and enacted.

The ethical aspect of cogen is that participants endeavor to treat each other with fairness and justice, to listen critically and to enable the voices of the marginalized in the classroom to be heard. Cogen participants develop empathy for others and look out for one another in order to provide beneficence by structuring encounters with each other, during cogen and in the classroom, to afford and expand human agency and access needed to appropriate resources that would generate successful outcomes for self and others. For example, when the plight of quiet students like Po came to light during cogen, not only was he given time and space to voice his opinion, cogen participants became conscious of the plight of fellow students who have historically been marginalized. They then agree together to transform the structure that constrained other students' agency in the classroom. Through cogen, participants learn to give respect to and accept respect from others willingly as they appropriate capitals (social, cultural and symbolic) in the

capital exchange helix. Cogen participants also developed sense of pride in coconstructing knowledge through coteaching and by *working with* their teacher. As posited by Pitts (2007, p. 134), the capital exchange helix "guide[s] encounters and help[s] to create and recreate interstitial culture or new ways of being."

Cogen and coteaching provide opportunities to educate others and be educated by others as participants share their experiences with each other. In doing so they produce new or interstitial cultures (ways of being, becoming and belonging) by accepting individual and collective differences. Differences and similarities are powerful schemas that can expand or truncate agency and provide or prevent access to resources in social life as in the classroom. As stated in Chapter 3 (p. 75), solidarity requires acknowledging and accepting other's differences. Cogen participants generate new or hybridized ontologies pertaining to others as they process more (new) information through critical conversations about their classroom and lifeworld experiences. This new way of being increases and improves the level of understandings and appreciations of the constructions of others thus structuring encounters in ways that generate and promote positive emotional energy needed as resources for synchrony, solidarity, sense of affiliation, identity and positive and productive social and working relationships in the science classroom and beyond.

Through cogen and coteaching, the teacher, Michelle, developed the understanding that the classroom is not all about her; that the classroom is a collective and should be managed as a collective (see Chapter 3, p. 75). To do so requires cogenerated conversations and the sharing of control in the classroom, hence leadership

in the classroom ought to be distributed as I discussed in Chapter 6 (p. 145) of this dissertation.

Distributed leadership deconstructs teacher's control and provides for shared control of the classroom. It also allows opportunities for multiple (shared) perspectives (polysemia) and multiple voices (polyphony) as explained in Chapter 3 (p. 86) and Chapter 6 (p. 148). Distributed leadership also provides students with the structure and resources to negotiate youth culture and become brokers and agents of change in the urban science classroom thereby expanding their agency and gaining the capitals necessary to 'enter' and sustain the capital exchange helix. Distributed leadership creates access to coteaching, peer tutoring and the development of leadership qualities. Distributed leadership, and coteaching, reconceptualize students' and teacher's roles and identity in the classroom.

As I reflect further on Scarface's construct of cogen as "a small family," I realize the salience of what he said. Scarface is saying that the classroom ought to be a field of social enactment, like a family, where a member ought not to be afraid to make mistakes because it is an environment where one learns from mistakes that can be corrected with love so one can continue to learn. Like cogen and a classroom structured by cogen, the family is a place where one should not be afraid to express oneself; like Hall's (1990) concept of diaspora – a home away from home. Self-expression is salient to self-transformation and self-actualization. Self-actualization sustains success. Family is where one develops kinship, identity, sense of affiliations, synchrony and solidarity around values that sustain individual goals and collective successes in social life. The family is a place where one builds camaraderie, love, caring, justice and equity; where members by

being with and *working with* other members come to interact together generating net positive emotional energy. It was no wonder then that having participated actively in cogen and coteaching, and having grown from being an obscured, marginalized student in Michelle's class to leadership roles and transformed identity, Scarface has reasons to advocate for a classroom where he is no longer afraid to make mistakes because he is confident that somebody has his back.

Scarface is envisioning transformed classrooms where students and teachers treat each other like ideal family members with respect, love and justice that sustains opportunities to learn and to succeed. I could not have imagined what it would be like to be in a classroom, in the modern world, where students are afraid to be wrong and as a result are not learning. I can understand how it was in colonial Western Nigeria where teachers often stand behind a student with a cane in hand, raised up, ready to strike the moment a student makes a mistake. Cogen and a classroom structured by cogen remove that fear and create, over time, a sense of belonging, trust, care and opportunities to learn from others and to succeed.

What I Learn

I weave my standpoint that transforming teacher's practice is salient to transforming students' practices and improving students' science achievement in urban schools throughout the chapters in this dissertation. Through this study, I discover how important it is for a teacher to create space where she could sit down and interact face-to-face, at the same vertical and horizontal planes, with her students. I learn that when a teacher and her students share their experiences together in an environment of

camaraderie, they generate net positive emotional energy, and students respond well and accept roles that improve the quality of interactions, facilitate students' agency, reconstruct and transform teacher and students' relationships, build up a sense of self, affiliations and identity in the classroom.

I learn from this study that teachers rely on perspectives of others in order to continue to maintain self-worth and to work at transforming their practices. I learn that while perspectives from colleagues are good, it is better to seek perspectives from students who share the same experience with the teacher in the same classroom. I also learn that teaching is neither science nor art, it is both and that the teacher is a craftsworker (Moore, 1995). As I discuss in Chapter 2 (p. 52), a teacher like Mr. Raghuvanshi is a bricoleur of materials and methods using every applicable tool, individually and collectively, to bring the best out of his students' learning of science. I also discover that students are eager to actively participate in their own learning in the science classroom, if and when teachers engage them in coplanning and coenactment of the curriculum. Urban youths are willing to learn if teachers would listen to them and allow them to cocreate environments where collaboration and communality are appreciated.

I acknowledge recent studies done on cogen in NYC and Philadelphia by others from our research squads. I learned a lot from the study conducted by Gillian Bayne at *Collaborative*. Michelle and I had opportunities to meet and interview cogen participants at *Collaborative* almost two years after Gillian had completed her work at the school. It was interesting to know that cogen had such positive impacts on those students-researchers; they reminiscence about their cogen experiences with glee. They reassured

us (Gillian, Michelle and I) that what they learned by participating in cogen was positive and that the new or interstitial cultures they coproduced continued to positively structure their interactions with their teachers in the school and with their social life in out-of-school fields.

The works done by Pitts (2007) and Emdin (2007) at *New York High School* were equally educating. While Pitts focused on fluency of interactions among immigrant students in The Bronx and the emergence of fluency in science, Emdin focused on the need for cultural realignments for marginalized populations of students and for cosmopolitanism across grade levels. The impact of deficit perspectives on urban youth and standardized testing (e.g., Chemistry Regent Examinations) on the teaching and learning of Chemistry were well noted. The works done by Kate Scantlebury, Sonya Martin and Catherine Milne on the roles of cogen on formative and summative program evaluations and student-student interactions at PennSTI were instrumental in my understanding and learning more about cogen. The analysis of classroom interactions that revealed students' behavior as "turn-sharks" and "eye-rollers," which also called on science content faculty members to conduct cogens to address such issues of inequity and injustice was very substantive in my understanding of analysis of gestures and non-verbal interactions.

The use of cogen by Ed Lehner at the Suspension Center, in Brooklyn, NYC, that created opportunities for his students to creolize science learning and generate identity as successful students was significant. The study by Ashraf Shady on using cogen to ameliorate relationships between immigrant teacher and her students was an eye-opener for me. Current works by Felicia Wharton, Nicole Grime, Samuel Jackson, and Carol

Woodburn are commendable. Felicia Wharton is using cogen at an adult learning center to generate successful learning of mathematics by adult in order to pass the mathematics portion of the General Educational Development (GED) test is impressive and ground-breaking. Nicole Grime's study using cogen and coteaching in engaging some of her students at a private high school in Manhattan, NYC, indicated that teachers and their students can coproduce and coenact curricular successfully when they cogenerate ideas. The works of Samuel Jackson and Carroll Woodburn as they use cogen to improve the learning of mathematics and the social and working relationships in their classrooms in NYC are indicative of the use of cogen beyond science learning.

However, while these bodies of work focused mainly on students, my study focused on the teacher. Through this study, I was able to gain new insights into the need to improve teacher's practices and teacher-to-student encounters. I also gained further insights into the roles of emotions in mediating outcomes and in the production, reproduction and transformation of new or interstitial cultures that engender individual and collective successes in science.

Limitations of the Study

In a research of the type described in this dissertation, limitations abound. While the theoretical lenses I employed illuminated some aspects of this study, there are other aspects or phenomena that are simultaneously obscured. For example, focusing on micro-level interactions of an encounter (because social life gets enacted at the micro level) obscures the meso and macro-level understandings of such an encounter. While zooming in and out provides a way to gain better understanding of such phenomenon,

other understandings are still lost or trivialized in the process. Another limitation that exists is that in my effort to balance the triangulation of cultural sociology and sociology of emotions with critical pedagogy, emphasis may inadvertently have been focused more on one theoretical perspective over the other. As such, some interpretations or theorizing of outcomes of social life enactments, for example, students' achievements in high stake tests and/or benchmarks may not be sufficiently explicated.

Another limitation may come from the fact that even though I shared my interpretations of this study with cogen participants and sought their input, not all of them responded in a timely manner. While Michelle did her best to share her perspectives on my interpretations with me (she modified where and when needed), I only heard back from a few student participants as they handed back corrections or gave me the go ahead nod. Participants contributed in unique ways to this study; their roles are very valuable and inspiring. It is my hope that participants would individually find resonating structures in whatever fields of social life they find themselves that would provide them with the agency and resources for reproducing and transforming the cultures they have produced during this study. I have the confidence that their capital exchange helix will spiral upward. In a study like this, the end of the study could be sudden and traumatic, even when it was anticipated. However, one way or another, we will remain like a "small family" just as Scarface said.

Implications of the Study

The implication of this study is that cogen works and those of us who have experienced cogen and its coteaching and distributed leadership counterparts think that

school administrators and teacher preparation programs should adopt cogen as a methodology for preparing and supporting teachers, not just science teachers, but all teachers at all levels. However, cogen is not a catchall solution to the problems that face the teaching and learning of science in urban schools. Not all teachers have what it takes (the demeanor, the fortitude and belonging-in characteristics) to conduct cogen in their classroom. More research still needs to be done and more pedagogues need to bring cogen research and theories into practice in K-16 schools. Administrators need to support teachers who adopt cogen in their classes and provide structures for students' voices to be heard as they actively participate in their own learning. Teaching and learning is a collaborative and collective enterprise. Students have valuable perspectives they could share with their teachers if teachers would put their fears aside, as Rawr said below, and find ways to constructively engage students in critical conversations while soliciting their input.

Future Research

Having experienced cogen, Rawr, in her written reflections said (see Chapter 6, pp. 162-163):

> … [Cogen] really helped this class. I wish that we would be able to do this in other classes we have. But I think it hurts a teacher's pride at first, to have their students criticize them. But if they would give it a chance, I think teachers would like it, and would make a noticeable change in teaching styles.

I have often wondered why some teachers readily choose to conduct cogen in their class while others bluntly refuse to do so. Some of those teachers who refuse to

enact cogen in their classrooms have sometimes participated in cogen with us, as an observer. Some teachers have sat at the table with us, contributed to dialogues, witnessed students' practices transformed before them, and beheld their colleague's practices being changed with positive outcomes. Some have even attested to the human, social environment and educational transformations they witnessed and to which they sometimes expressed envy. Yet, as in the case of an older, White female chemistry teacher at *Fairness High School*, who told others of the good things happening as a result of cogen in Michelle's biology classes, said, "I can never do what you [Michelle] do in a million years; I just can not see myself sitting down with these kids." Some teachers refuse to give cogen a try; knowing it would benefit them and their students. I would want to research why some teachers readily accept enacting cogen and coteaching in their classrooms while others adamantly refuse to share roles and experiences with their students, even when they know of the mutual benefits.

Also another area of possible future research is that I would want to conduct a type of longitudinal research that would follow up cogen participants through high school and college to determine what roles cogen continue to play in their lifeworlds; a kind of long term effects of cogen on participants. When Gillian and I went back to *Collaborative* (Michelle came with us during another visit), former cogen participants quickly organized a meeting during their lunch period to have cogen with us. We were amazed at their continued enthusiasm, mental maturity and positive perspectives about school and their roles in it. They even talked of how they missed cogen; how they sometimes huddle on their own to discuss class issues; how they understood teachers better and applied themselves in various classes and focused on succeeding in school.

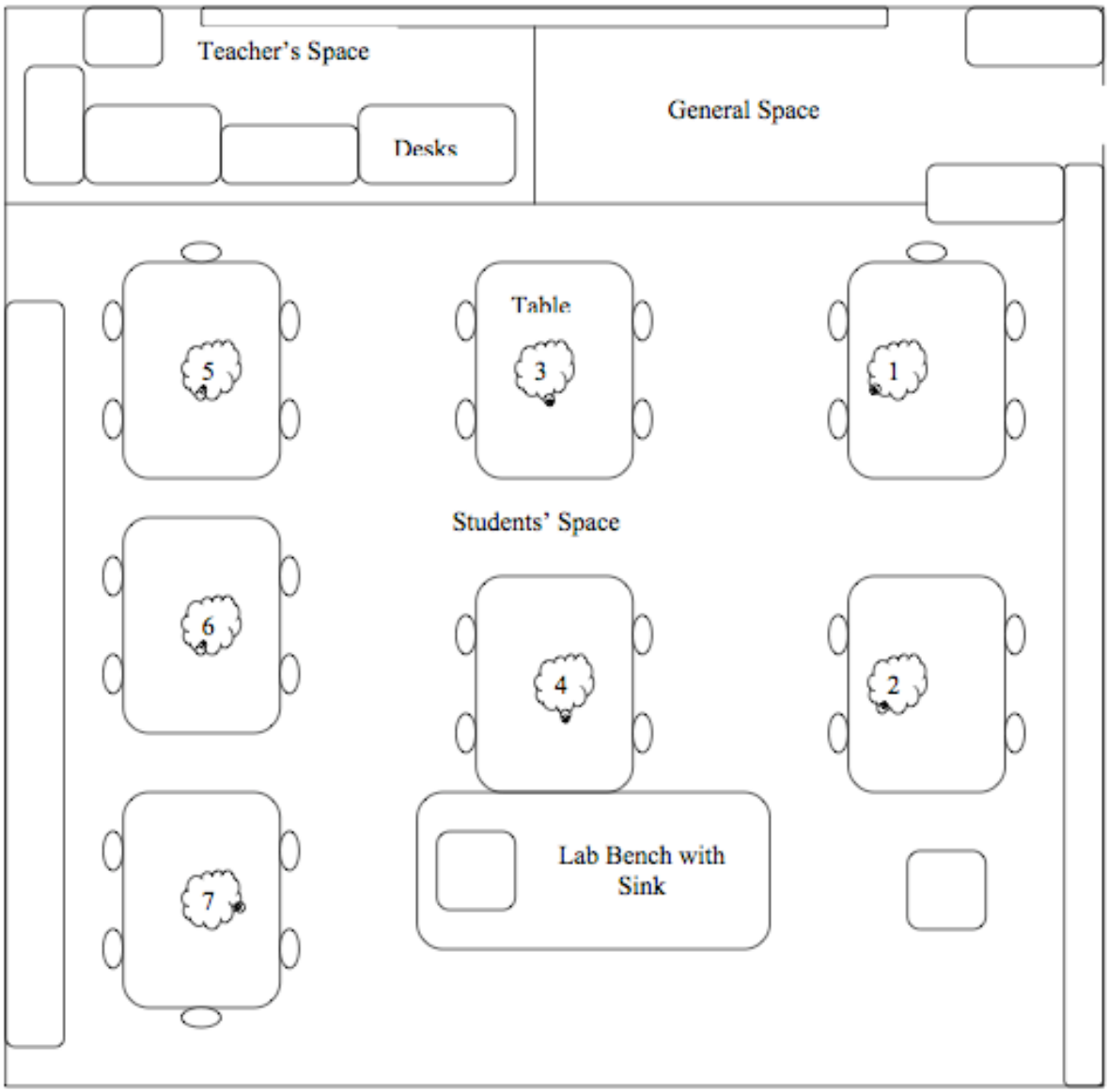
The first visit was more than one year after their last cogen with Gillian. Our second visit, which Michelle also attended, was about six months after the first one (i.e., nearly two years after their last cogen). During that visit, former cogen participants were still socially and emotionally bonded. They were as thrilled about cogen and what their experiences were as at our first visit. It would be good to conduct a long-term study with cogen participants.

Michelle told me recently that some of the students who participated in the 6th-period cogen last school year came back and wanted to be her teaching assistants this school year. They wanted to coteach with her for community service credits. Unfortunately, their schedules did not permit them to do so officially. However, one way or the other, they still come around when they have free time to help Michelle teach her current classes, even though they are not going to get credit for it. These same students, I was told, also wanted to help another teacher start cogen in her special education class. It would be good to research how cogen participants perform in other teachers' classes.

I end this dissertation with Rawr's words, "But if they [teachers] would give it [cogen] a chance, I think teachers would like it, and would make a noticeable change in [their] teaching styles."

Appendix A

Structure of Michelle's Classroom



Appendix B

Explain animal cell[11]

((Looking at and pointing to the image on the *Promethean electronic whiteboard,* the teacher, Michelle, called out in high tone of voice))

01 Michelle: … explain animal cell. (372 Hz, 77 dB) (0.6) Somebody explain the differences between plant and animal cells for me. (374 Hz, 76 dB) (1.1) What are the major differences? (360 Hz, 77 dB)

((After a pause, the initial undirected callout was followed by a *demand* statement and a question, in rapid succession, as Michelle walks toward the aisle between the 2nd and 3rd row of tables with both hands in her pockets))

(1.4s)

02 Nix: Animals, you could walk but plants grow like grass, sort of … (222 Hz, 66 dB)

((Without looking up, Nix attempted to answer with generalized answer almost without thinking))

(2.5s)

03 Michelle: What are the major differences between the cells? (336 Hz, 77 dB)

((looking in Nix's direction, Michelle repeated herself with added clarification and emphasis))

04 Nix: =Oh, the cell? (228 Hz, 66 dB) ((realizing her error, this is an attempt by Nix to *repair* while looking up from her note and in Michelle's direction))

---

[11] We applied Roth (2005) conversational analysis to all episodes

[	point of overlapping talk or gesture begins;
]	point at which utterance terminates;
=	equal sign at the beginning of a turn indicates no gap between two speakers;
word	underline indicate speaker emphasis;
(2.5s)	elapsed time in tenths of a second
::	colons indicate lengthening of the preceding phoneme, approximately one tenth of a second for each colon used;
-	a dash indicates sudden stop in talk;
Hz	denotes pitch, the fundamental frequency, (f_o) or speech/utterance;
dB	denotes the intensity (loudness) of speech/utterance measured in units of decibel;
↑↓	arrows indicate shifts to higher or lower pitch immediately following utterance parts
°no°	utterances surrounded by degree signs are less loud than the surrounding talk;
(())	double parentheses (italicized) are used to enclose comments and descriptions

05 Michelle: =What are the major differences between plant [and ani]mal cell? (346 Hz, 77 dB)

06 Nix: =[animal can]

07 Nix: =animal can reproduce and the plant, well, it can repro…, well, it's easier to begin with … (236 Hz, 65 dB)

08 Michelle: =<u>Think</u> about the organelles. What are the major differences between (348 Hz, 77 dB) (0.3) plant and *(animal)* cells and their organelles and <u>their</u> <u>structure</u>. (326 Hz, 77 dB)

((Nix didn't get a chance at repairing the breached dialogue as she and Michelle exchanged words without pauses and Nix appears bemused. During this exchange, other students could be observed flipping through the textbook or their notes searching for answers to Michelle's questions))

(1.0s)

09 Chica: Plant has a vacuole (230 Hz, 67 dB)

((Looking in Michelle's direction, she volunteered one of the correct answers having looked through her notes earlier, yet Michelle didn't hear nor acknowledge her. Meanwhile, Nix remains bemused))

10 Sunshine: =Ms. Michelle, repeat the question (229 Hz, 65 dB)

11 Michelle: =Yes (274 Hz, 74 dB)

(1.1s)

12 Student: Michelle (207 Hz, 65 dB)

((I replace Michelle's last name with her first name as we agreed))

(1.4s)

13 Student: I don't get that (234 Hz, 71 dB)

14 Scarface: =I don't see how that is related (170 Hz, 68 dB)

(0.3s)

15 MaryJ: Sunshine (217 Hz, 68 dB) (1.4s)

(3.7s)

16 Michelle: What are the major differences? (379 Hz, 78 dB)

(3.0s)

17 Chica: Plant has a nu:c:leus (243 Hz, 67 dB)

(7.8s)

18 Michelle: Ok! What am asking for, what about things that are not the same? (377 Hz, 78 dB) (1.2s) What are those structures that are different from a plant cell and an animal cell (365 Hz, 78 dB)

(0.8s)

19 Chad: Plant has [cellwall] (175 Hz, 63 dB)

20 Nix: =[Green stuff] and uhm (199 Hz, 66 dB)

21 Michelle: One, one at a time. Plants have? (329 Hz, 78 dB)

22 Chica: =Green thing (216 Hz, 63 dB)

23 Michelle: =What's the green thing called? (329 Hz, 76 dB)

(0.4s)

24 Chad: a leave (139 Hz, 59 dB)

(1.5s)

25 Michelle: What're (352 Hz, 81 dB) [those green] (367 Hz, 80 dB)

26 Chica: =[Chloroplast]

27 Michelle: [organelles called] (361 Hz, 80 dB)

((Michelle finishing her sentence))

28 MaryJ: =[Chloroplast] (189 Hz, 68 dB)

(1.2s)

29 Chad: [Organelle] (159 Hz, 70 dB)

(0.6s)

30 Chad: No! (234 Hz, 67 dB)

((saying something to Nix))

31 MaryJ: =Whatever (284 Hz, 67 dB)

((giving up with resignation because she felt she wasn't heard or recognized))

32 Michelle: =Starts with a "C"; keep going (364 Hz, 78 dB)

(0.3s)

33 Chica: Chlo:ro:plast (212 Hz, 76 dB)

34 Chad: =Chloroplast (178 Hz, 76 dB)

35 Michelle: =Chloroplast↑ (414 Hz, 82 dB)

36 MaryJ: =°I just said that° (412 Hz, 72 dB)

((MaryJ reacted with a jolting chuckle feeling like she was cheated because she was not acknowledged when she first said the correct word))

(.)

37 Michelle: =Plants cells have chloroplasts (399 Hz, 79 dB)

(0.8s)

38 Student: (….)((inaudible))

(0.6s)

39 Michelle: What else is about plant cell? (366 Hz, 79 dB)

(0.4s)

40 Chad: Cellwall (151 Hz, 67 dB)

(0.5s)

41 Michelle: Plant cells have a cellwall. What else do plant cells have? (391 Hz, 79 dB)

42 Student: =central vacuole (251 Hz, 75 dB)

(1.7s)

43 Michelle: a [central vacuole] (337 Hz, 78 dB)

44 Student: =[central vacuole]

45 Michelle: a central vacu…… (391.9 Hz, 78.0 dB)

(16.7s)

46 Students °You know not what. You know what°

((students chatting in the background))

47 Michelle: So, the major difference between plant and animal cells are what? There are three substances that differ (.) What are they? (373 Hz, 78 dB)

48 Chad: =[Chloroplast, central vacuole and cellwall] (178 Hz, 71 dB)

49 Dreana: =[Chloroplast, central vacuole and cellwall] (178 Hz, 71 dB)

50 Michelle: =Chloroplast, central vacuole and a cellwall (370 Hz, 79 dB)

(6.7s)

((Michelle went to open the door for Rawr and gave her instructions for the videographer))

51 Michelle: Now! (340 Hz, 78 dB) (0.9s) And now, remember we have (411 Hz, 80 dB) (1.0s) another classification (405 Hz, 78 dB) (0.5s) We have cells that can be classified as prokaryotic or eukaryotic (395 Hz, 78 dB) (0.4s) What is prokaryotic? (425 Hz, 79 dB) (2.7s) What are those prokaryotic cells? (389 Hz, 79 dB) (4.1s) Does any one remember what prokaryotes [are]? (370 Hz, 78 dB)

52 Rawr: =[Yes]

53 Michelle: What are they? (374 Hz, 80 dB) (13.3s) What are prokaryotic cells? What do they have or what do they lack? (379 Hz, 79 dB)

(0.5s)

54 Chad: They are [single cell organism] (236 Hz, 71 dB)

55 Dreana: =[single cell organism] (236 Hz, 71 dB)

(0.3s)

56 Michelle: Ok! We know they are single cell organism 368 Hz, 78 dB)

57 Chad: Has no nucleus (173 Hz, 65 dB)

(0.1s)

58 Michelle: No nucleus! (350 Hz, 79 dB)

59 Student: =No nucleus! (283 Hz, 69 dB)

60 Michelle: So, what does prokaryote mean? (399 Hz, 79 dB) (3.9s) What does prokaryotes mean? (390 Hz, 79 dB)

(3.4s)

61 Dreana: One (257 Hz, 65 dB)

(0.4s)

62 Michelle: Not one! (341 Hz, 78 dB)

(2.6s)

63 Chad: Allows more than one? (139 Hz, 67 dB)

(0.2s)

64 Michelle: Okay. What do we …(371 Hz, 78 dB) (0.9s) What do we say eukaryotic mean? (400 Hz, 78 dB) (5.1s) The word eukaryotic (383 Hz, 79 dB)

(0.8s)

65 Chad: Eukaryotic (166 Hz, 71 dB)

(0.2s)

66 Michelle: Remember we talked about … (0.3s) the prefix EU (377 Hz, 77 dB) (1.3s) Remember we talked about the prefix eu (0.5s) and we said that (363 Hz, 78 dB) (0.3s) a word that has the eu in it is eulogy (376 Hz, 79 dB) (1.3s) Remember what a eulogy is? (376 Hz, 79 dB) (1.1s) What is eulogy? (370 Hz, 77 dB)

(1.3s)

67 Sunshine: Words spoken on behalf of someone (230 Hz, 62 dB)

68 Michelle: =Where have you heard of eulogy? (382 Hz, 79 dB) (2.0s) Where's eulogy is given? (407 Hz, 76 dB) (3.4s) What is a eulogy? (384 Hz, 76 dB)

(6.9s)

69 Student: Inaudible

(2.6s)

70 Michelle: Where have you heard of eulogy before? (380 Hz, 77 dB) (1.9s) Didn't we create this yesterday? (409 Hz, 76 dB)

(1.6s)

((Working over to the *Promethean* board Michelle used the stylus to hit the *board* with a resounding thud, (78 dB), displaying her frustration as she changed screen to a Vinn diagram))

71 Rawr: eulogy? (201 Hz, 59 dB) (3.3s) ((pondering)) yea (233 Hz, 68 dB)

(1.5s)

72 Michelle: We created this yesterday! (393 Hz, 76 dB)

((Michelle pointed to the Vinn diagram showing comparison of prokaryotic and eukaryotic cell above which is the word eu and eulogy))

(0.8s)

73 Rawr: Yea, that was eulogy (233 Hz, 63 dB) (0.2s) What is … (242 Hz, 56 dB)

(0.6s)

74 Michelle: What do we say eu was? (394 Hz, 77 dB) (0.4s) eu (260 Hz, 75 dB) (0.4s) It means what? (365 Hz, 77 dB) (0.4s) The prefix eu … (343 Hz, 74 dB) (0.6s) for eulogy. Where is a eulogy done? What is a eulogy? (395 Hz, 77 dB)

(0.5s)

75 Sunshine: Don't say it (205 Hz, 61 dB)

(1.1s)

76 Student: Oh! (204 Hz, 57 dB)

((students having private conversations and giggling (230 Hz, 66 dB)))

(0.5s)

77 Michelle: No one has ever heard of eulogy? (356 Hz, 78 dB)

((Michelle's frustration was starkly displayed))

78 Rawr: Nope!

Note:

Hertz (Hz) is the pitch of an utterance. It is a measure of the frequency per unit of time or the number of cycles per second. It also allows sounds to be measured on a scale of low to high. It is the fundamental frequency (f_0) that is measured here and the number reported here is the average fundamental frequency of each utterance.

Decibel (dB) is the intensity of utterances; the power output or power-in-the-air of the utterance. It is the unit representing the loudness of the speech. The number reported here is the mean decibel for the sentence or phrase.

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Autobiography

I arrived on the shores of the United States of America in January of 1980 as a student majoring in Animal Science with the hope of continuing career in animal health as a veterinarian. I attended Texas A & I University (now Texas A & M University), Kingsville, Texas, for a year before transferring to The Pennsylvania State University, University Park, Pennsylvania, where I graduated with a BS degree in Animal Science in 1982 and an MS degree in Animal Production in 1984.

Moving to New York City in 1984, I worked in odd jobs before obtaining my green card in 1988, after which I got a job as a Research Associate at the Primate Behavioral Lab at DownState Medical Center in Brooklyn, NY. A year later, I worked as a Research Animal Care Supervisor at Merck, Sharp & Dohme Research Laboratories, Merck and Company, Rahway, New Jersey. I came back to New York City in 1990 to work at the Research Animal Facility at Beth Israel Medical Center, Manhattan and later at New York University and Weill Medical College of Cornell University/New York Hospital as Research Animal Facility Manager where I was also involved in training animal care staff and researchers in the humane treatment of animals used in biomedical research. I also taught as an adjunct lecturer at Borough of Manhattan Community College teaching Anatomy and Physiology during this time.

I started teaching high school as a substitute science teacher at Freeport High School in 1999 and later as a biology teacher at Mathematics, Science Research and Technology High School, Cambria Heights, Queens, New York for three years and then at The Legacy School for Integrated Studies, Manhattan, New York, for a year. I went

back to school at New York University – The Steinhardt School of Culture, Education and Human Development during this time and obtained a Masters degree in Secondary Science Education in 2004. I later enrolled at The City University of New York, Graduate Center, for a doctorate degree in Urban Education. While doing that, I was also an adjunct professor of science teacher education at Queens College of the City University of New York for 3 years. I also taught as an adjunct at BMCC, City College, Barnard College and Lehman College. I recently spent a year at Penn Science Teacher Institute, at the University of Pennsylvania, as an Internal Program Evaluator and science education researcher. I had a chance to conduct research for my dissertation at a high school in the Philadelphia School District. I am about to start a postdoctoral science education research at The Witwatersrand University, School of Education, Marang Center for Science and Mathematics Education, in Johannesburg, South Africa.

I have five children to whom I dedicated this dissertation.