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13. EMOTIONS AS MEDIATORS OF SCIENCE EDUCATION IN AN URBAN HIGH SCHOOL

Abstract This research employs multiple methods in a multi level investigation of the ways in which emotions afford interactions and participation in a science class and an associated cogenerative dialogue (cogen). A teacher researcher identified a vignette involving an altercation he had with a student in which anger and frustration mediated what happened. We highlight the importance of cultural adaptation in enacting high quality science education. Notably, negative emotions generated in the class were reproduced in cogen involving the teacher, student, and other coteachers and students. We show how synchrony, entrainment, and shared mood facilitate the emergence of solidarity among subgroups within cogen and marginalize the teacher. Interactions in the science class and cogen highlight the ambiguity of laughter, which served the purpose of sustaining positive emotional energy and catalyzing resistance to the teacher.

Ethnicity and social class are categories that segregate and stratify urban schooling. Recent estimates suggest that between one-third and one-half of minorities do not earn a high school diploma (Education Week 2007). Graduation rates are related to race; approximately 40% of black and Hispanic compared to about 70% of Asian and white students graduated from high school in New York City (NYC). This is a problem since it is practically impossible for individuals lacking a high school diploma to earn a living or participate meaningfully in civic life (Neild, Balfanz, and Herzog 2007).

In 1989 the State of New York initiated a program called School Under Registration Review (SURR) and since that time about 70% or more of the schools identified as non-compliant are from NYC, many from the Bronx. City and State resources are allocated to improve the performance of schools on the non-compliance list and more than 20% were turned over to the control of private firms. Schools on the SURR non-compliance list that do not improve markedly within a given time are closed. New York High (NYH), which is the site of the research reported this chapter, is situated in the Bronx in a building previously occupied by a school that was closed.

Students from the Bronx have priority for admission to NYH, which offers medical internships through its partnerships with area universities and businesses. Many of the students are immigrants (or the children of immigrants), from Puerto Rico and the Dominican Republic. The Department of Education web site lists

K. Tobin et al., (Eds.), Transforming Urban Education, 205–223.

the racial distribution of the students at the school as 3% white, 46% black, 51% Hispanic and 1% Asian American. Statistical data suggest that at the time of admission students were average to below average in terms of achievement. Possibly because of the school's emphasis on health sciences, the first cohort of students admitted to NYH was more than 90% female. The first class of seniors from the school graduated in 2007.

RESEARCH METHODS

Our multi-method approach to research employs interpretive research (Erickson 1986), augmented by conversation, discourse, and prosody analysis (Harrigan, Rosenthal, and Scherer 2005). We use sociocultural theory as a framework for the micro level, which is constantly unfolding, allowing resources to be appropriated as actors unconsciously enact operations (Roth and Lee 2007). Our approach uses video analysis, which affords frame-by-frame analysis of events separated in time by hundredths of a second. We use Flipcams to digitally record lessons, cogen and interviews. We then use QuickTime to create separate and combined electronic video and audio files.

We adhere to Guba and Lincoln's authenticity criteria, largely due to the standpoint of not privileging theoretical knowledge over other knowledge forms. Hence, we expect to learn from research (i.e., create new theory), educate participants about one another's perspectives, catalyze positive changes in the institutions being studied, and ensure that all participants benefit from the research equitably (i.e., the research embraces social justice and we help those who cannot readily help themselves to benefit from their participation in research). The approach we adopt maintains a connection between schema and practices and gives equal priority to producing positive, equitable, and democratic changes in the classroom and the generation of fresh theoretical insights on the teaching and learning of science.

DATA ANALYSES

Reynaldo Llena, coauthor of this chapter and science teacher at NYH, selected three video vignettes considered salient to the teaching and learning of science in his special education science class. Each vignette was between 7–9 minutes duration. The first vignette was selected from a science lesson on the conversion of units (i.e., 79 mm is 7.9 cm). The vignette involved an altercation Rey had with one of his students. Rey considered the emotion of anger as a productive area for research from which we could learn how to improve the quality of classroom learning environments. Also, Rey selected two vignettes from a cogen that occurred directly after the lesson on conversion of units. Rey was not a participant in the first vignette and he was a principal participant during the second vignette.

We used StudioCode to analyze the three vignettes. The first step was to set StudioCode to capture video 15 seconds each side of a keystroke, which recorded

an event as salient. We then adjusted the length of the clips to ensure that each represented a meaningful event. In some cases, events were longer than 30 seconds and in others they were shorter. We selected five events from the lesson vignette and one event from each of the cogen vignettes. Consistent with William Sewell's event oriented sociology, we used narrative to provide a context for interpretive research and numerous microanalyses of the electronic files. Microanalyses combined frame-by-frame analysis of the video files with computer-aided analyses of the acoustic waves for each event. We used PRAAT to measure time intervals between utterances in seconds (s), the fundamental frequencies of the acoustic waves in Hertz (Hz) and the acoustic intensity (i.e., the amount of energy of a sound wave in the air standardized for time and area) of utterances in micro Watts per square meter (μWm^{-2}). These measures, together with subjective assessments using interpretive methods were a basis for comparing the characteristics of utterances for a given speaker and those of different speakers.

The transcription conventions we used (Table 1) were adapted from those advocated by Paul ten Have (2007).

Table 1. Transcription conventions

Convention	*Description*
(0.4)	time in seconds of a pause between utterances indicated as a numeral
((Students … felt))	comments from us are provided to provide context
=	no pause between successive turns
[	start of overlapping speech
{2.4}	time in seconds for preceding utterance
\ 12.1 μWm^{-2}\	the power of an utterance in the air measured in μWm^{-2}
ha:	lengthening of preceding phoneme by approx one tenth of a second for each :
(.)	noticeable pause of less than 0.10 s

INEFFECTIVE TEACHING CAN CREATE NEGATIVE EMOTIONAL CLIMATE

Ms. Fereny was assigned to coteach a science class with Rey because the class contained a number of students classified as special education (mainly as emotionally disturbed). However, Fereny was not a certified special education teacher and, although she was a certified teacher of English as a Second Language (ESL), there was a problem since she spoke French and most of her students spoke Spanish. Rey noted that Fereny's background in science was not strong and many students disrespected her because she was perceived to be ineffective and unhelpful.

Due to illness Rey was absent from school for two days prior to the lesson we analyzed. In Rey's absence Fereny taught the class and confused many students about how to convert from one unit system to another (e.g., convert 3 cm to mm). Fereny administered an achievement test focusing on conversion of units and a number of the students did not perform well. These students were frustrated with their teacher's inability to help them learn science and when Rey returned the students asked him to re-teach how to convert from one system of units to another.

WHY SO MANY TEACHERS?

At the beginning of the science teaching vignette, Markist was completing a task on the whiteboard, watched closely by Rey, who was standing at the whiteboard holding a large wooden pointer. For more than five seconds several students laughed loudly as Markist finished his work and returned to his seat. Although the laughter was not necessarily directed at Markist he broke out into a wide grin as he sat down and adjusted his cap. Rey looked annoyed as he stopped working at the whiteboard and began to interact with the class. Event 1 involves 26 seconds of whole class interaction that followed the completion of the laughter. The interactions in Event 1 address teaching, critique of the number of teachers in the room, and a query whether the extra teachers positively mediated learning.

Event 1

Turn	**Speaker**	**Text**
01	Rey	we are going to speak with her. take that. I′m going to tell Ms. Fereny ((the special education assistant)) what we′re how do you do it. (0.4)
02	Male	now we know. (0.2)
03	Female	will you tell anyone
04	Female	=mister. why do you have three helpers? (0.4)
05	Female	find some kind of help.
06	Female	yeah. so many people [in this classroom.
07	Female	[why have three helpers?
08	Male	[one don′t count
09	Female	=they′re all
10	Rey	=oh you can answer that? (0.3)
11	Female	all right
12	Female	=anyway
		{2.4} ((collective effervescence))

13	Female	all those guys distracted me. (0.5)
14	Female	[yep.
15	Rey	[you can answer that.
16	Female	[he actually likes you pretty much.
17	Female	=I can tell you why they
18	Rey	=I don't know
		{ 0.5} ((female laughs))
19	Female	=what would you ask
20	Rey	=answer that. (0.7)

Turn 01 addressed the need for Rey to re-teach conversion from one unit to another. Rey assured students he would speak to Fereny about how he taught them to do conversions, presumably so that there would be consistency in the approach adopted by coteachers. In turn 02 a male student affirmed that students now know how to do it and a female student raised a question about whether Rey would let others know that he had to re-teach the lesson. The remainder of Event 1 consisted of quick exchanges as different students made points about the quality of teaching.

A female asked why there were three teachers in the class in addition to Rey (one was Fereny, and the other two were new teachers from a science teacher education program at a nearby university). Subsequent comments indicated that some students regarded three extra teachers as too many while others indicated they could use even more help. At turn 08 a male implied that Fereny didn't count, an indication that even though there were three extra teachers, there might just as well be only two. When a female asked why have three teachers Rey spoke much louder than he had done previously as he said, "Oh you can answer that," (1.4 μwm^{-2} at turn 01 compared to 21 μwm^{-2}at turn 10).

Two instances of collective effervescence, which occurred after turns 12 and 18, were signs of the risky nature of what was being discussed. The first instance seemed to resonate with Rey's loud utterance concerning why there were so many teachers in the class. The duration was 2.4s and the power in the air was 11 μwm^{-2}, consisting of calling out and several students laughing. Coinciding with the conclusion of the collective response a female at the front of the class commented to Rey, "all those guys distracted me."

The interactions in Event 1 unfolded as Rey enacted frustration and appeared anxious to get on with his re-teaching of unit conversions. Rey used repetition and intensity of his utterances to communicate that he was not going to comment further on the presence of multiple teachers. Each of these structures afforded student laughter, which was likely created without deliberate intent – that is, features of Rey's conversation, prosody, body stance, gesture and gaze were resonant structures for individual and collective enactment of laughter. It is not clear whether the laughter in these two instances projected happiness or an

apprehension about the direction in which events were unfolding. It is likely that all participants in the class had a sense of the game that allowed them to anticipate that Rey was becoming angry and the students' utterances and Rey's reactions continuously produced structures that forecast the emergence and/or continuance of a negative emotional climate.

A NORMAL INTERACTION PATTERN

Event 2 followed on directly from a pause of 0.7s that concluded turn 20 (Event 1). As Rey taught from the front of the class, he projected his voice so that everyone could hear him. Event 2 provides a sense of what Rey's prosody was like when he taught normally.

Event 2

Turn	**Speaker**	**Text**
01	Rey	okay. { 0.8} \15.6 µwm^{-2}\
02	Student	I agree (0.7)
03	Rey	how many jumps do we have in here to go from milliliters to liters? { 5.0} \9.8 µwm^{-2}\
04	Student	three liters (0.8)
05	Rey	three right? { 0.7} \12.5µwm^{-2}\ (0.3)
06	Rey	three liters. { 1.7} \4.2 µwm^{-2}\

To get the students' attention Rey initiated the utterance with "okay," with power that was above his average during this event (10.5 µwm^{-2}). The student comment at turn 02 is probably directed to the discussion in Event 1 about how to benefit from three extra teachers and whether they were of value. The pattern in turns 03–06 is consistent with the initiate-respond-evaluate (IRE) chain observed in traditional science classes (Lemke 1990). At turn 03 Rey commenced an utterance with high power and as the utterance progressed it diminished in power. Rey used above average power when he wanted to emphasize a correct answer (e.g., three right?) or get someone's attention. His affirmation of the correct answer in turn 06 had lower power and was a structure that afforded others getting involved – a sign that Rey had completed his turn at talk.

TROUBLE BREWING

Rey selected Kelly to answer a question "because she said she understood." As Rey called her name most of the class laughed. The initial exchange between Rey and Kelly was loud but good-natured. Rey jokingly remarked that Kelly was just the first to be selected in this way and that others would follow – the implication was

that Rey would call on others who did not have their hands raised. Event 3 involving Kelly's expression of annoyance, provides insights into what was to become an altercation.

Kelly reacted aggressively to Rey asking her a question. She remarked, "Why you picking on me for? You see 20 hands and yet you pick on me." As she delivered her utterance Rey overlapped the words "on me for" with his own utterance "stop rubbish."

Event 3

Turn	**Speaker**	**Text**
01	Kelly	why you picking { 0.4}
02	Kelly	[on me f { 0.7}
03	Rey	[stop rubbish { 0.7}
04	Kelly	=or { 0.5}
05	Kelly	you see 20 other hands up and yet you pick on me. { 2.7}

The entire episode had power in the air of 9.4 μwm^{-2}. In Event 3, turn 01 contained most power at 39.7 μwm^{-2}, turns 02–03 averaged 15.6 μwm^{-2}, and turns 04–05 averaged 7.5 μwm^{-2}. That is, power diminished as Kelly's utterance progressed. Looking more closely, the first two words that began the initial turn at talk had most power – "why" at 68.7 μwm^{-2}, and "you" at 61.6 μwm^{-2}. Hence, Kelly began loudly and then the power in the air trailed off to less than the average for the entire event. Possibly the diminished power was attributable to Rey's exhortation to "stop rubbish" or perhaps it was because of the effort needed to sustain a turn at talk at such a high power level for more than just a short time. It is plausible that Kelly did not want to convey too much anger in her delivery for fear of the consequences.

Interpretively, what we experienced was that Kelly spoke with emotion, using synchronous gestures with the left hand, head movements, and cadence of her utterance. The emotional content of her actions involved more than prosody and included her body movements as well. Other students' actions appeared to be entrained with the unfolding structures associated with what might initially be considered a playful joust between Rey and Kelly. Notably, Amber was giggling as Kelly spoke and Cindy, the female immediately in front of Kelly, turned and smiled encouragingly when Kelly raised her voice, indicating her frustration at being called on when she had not volunteered to be involved.

Rey continued to teach the class how to change units from centiliters to milliliters. As he spoke about the task he was doing he expressed his annoyance with Kelly (see turns 01 and 03 in Event 4).

Event 4

Turn	Speaker	Text
01	Rey	I can't believe this ah girl doing this ah ((laughter))
02	Kelly	although.
03	Rey	I don['t believe
04	Female	[ha. ha. ha ha ((laughter)) {0.6}
05	Rey	=very many ((laughter)). I dunno ((laughter)) how big a unit? ((laughter)) A milliliter? (0.4s) ((laughter)) {0.4}

In less than the 10s it took for Event 4 to unfold there were six instances of individual and collective laughter. It is possible that this laughter, some of which was intentional and some of which seemed like involuntary responses to others laughing at the risky nature of the unfolding events, contributed to sustaining a shared mood of playfulness that became an affordance for Kelly's response to being called a "rude student." Furthermore, the sixth laugh, from a female sitting next to Kelly, may have acted as a resonant structure for Rey's next utterance. Although the laugh had only power in the air of 2.3 μwm^{-2} and short duration, as it occurred it sounded shrill and was separated from Rey's previous utterance by a pause of 0.4s.

Following the sixth laugh the following interaction occurred between Rey and Kelly.

Event 5

Turn	Speaker	Text
01	Rey	you're such a rude student.
02	Kelly	oooo. you have every nerve to call me a rude student when you have twenty million hands in the air {5.3} \12.9 μwm^{-2}\
03	Rey	excuse me. [That's what you're doing {1.9} \30.5 μwm^{-2}\
04	Kelly	[just say you
05	Kelly	come on. I won't say I'm sorry. I won't take your class.
06	Rey	=temp, temp, temper ((Kelly overlaps this turn of talk with indecipherable words))

07	Rey	temp, temp, temper. that's what you are doing. temp, temp, temper.
08	Kelly	exactly ((class giggles))
09	Rey	((mimics)) you said exactly. temp, temp, temper ((prolonged class laughter))

The altercation continued for about 25s and the power of sound in the air was 25 μwm^{-2}, well above either Rey's average or the class average. Rey and Kelly both uttered words and phrases that exceeded their average power in the air. For Kelly the most notable was: "Oooo. You have every nerve to call me a rude student when you have twenty million hands in the air (5.3s, 12.9 μwm^{-2})." This utterance was relatively lengthy and above the class average power in the air for utterances (9.4 μwm^{-2} which included the teacher's talk). The evidence that the verbal exchange was heating up is the relatively high power in the air of words and phrases.

Kelly's utterance of exactly (0.6s, 9.6 μwm^{-2}) was followed by Rey's sarcastic remark, "she said exactly. Temp. Temp. Temper" (2.0s, 9.9 μwm^{-2}). Kelly and Rey uttered the two syllables of exactly with similar duration, 0.2s (eggs) and 0.4s (sactly). Rey injected more energy into the first syllable, using intonation to provide a sarcastic lilt. The word exactly followed the phrase "she said" (0.3s, 7.4 μwm^{-2}). The power in the air of "she" (0.2s, 1.5 μwm^{-2}) was far less than "said" (0.1s, 21.7 μwm^{-2}). Rey began his utterance relatively softly, inserted more power into "said," and then mimicked "exactly." Rey's taunting of Kelly during the interactions may have been intended to show he was in control and unafraid of Kelly's verbal tantrum. Prosody, facial expressions, body orientation, and upper body movements conveyed the idea that Rey was taunting. It was as if he dared Kelly to "bring it on. Give me your best shot."

Kelly's tone was accusing and disrespectful and Rey's words were taunting. The students appeared to laugh at the scenario in which Kelly stood up to an authority figure and used words and prosodic features that would land her in trouble with school administrators. Some students seemed to use laughter to goad Kelly into escalating the altercation while others laughed collectively at the risky and unusual circumstances of both actors, whose actions violated the norms for teacher-student interactions. A high pitched giggle by the girl next to Kelly (also the perpetrator of the sixth laugh in Event 4) seemed forced and intentional – with the possible goal of encouraging Kelly to prolong and escalate the angry exchange with Rey.

POSITIVELY VALENCED EMOTIONAL CLIMATE

Because of Rey's anger following the science lesson, which occurred in the morning, he was anxious to schedule cogen. He invited three students who had participated regularly in cogen to be involved. The three were buddies, Amber the

leader, and Kelly and Cindy, two peers for whom Amber assumed responsibility. Two new teachers from Lehman College, who were coteaching with Rey agreed to begin cogen while Rey finished packing up after the completion of the science class. Accordingly, the initial part of cogen took place without Rey being present. Only one of the coteachers, referred to here by the pseudonym of Felicia, was actively involved. Felicia, an African-American, was in her third year of undergraduate study, and close in age to the three female participants from the class. The other new teacher, a white, graduate student, was older than the other participants and did not participate orally in cogen.

BUDDY SYSTEM

In an effort to adopt collaborative approaches to teaching and learning Rey devised a buddy system in NYH's second year. Students identified buddies to whom they would provide academic support. The buddy groups operated across the classes to which they were assigned for science. Amber, Kelly and Cindy were a buddy group from the same science class. Among the roles of buddies were to encourage peers in their group to come to school on time, turn up to class, participate actively, and do their homework. Also, they acted as advocates for those who were in their buddy group.

Event 6 is based on 15.5 seconds of cogen. Although one of the students, Amber, spoke for most of the time, Felicia provided encouraging remarks, usually by overlapping Amber's speech. Kelly only spoke toward the end of the segment, describing Rey's emotional state as "crazy as hell." Cindy, affirmed her description, portraying Rey's emotion as cranky. In turn 10 Cindy and Amber showed empathy when they commented "down" (power in the air of 0.2 μwm^{-2}) after Felicia had stated, "really" (power in the air of less than 0.1 μwm^{-2}). Use of the word down is evidence of the students' entrainment as they spoke in unison. The meaning of down is ambiguous since it might be a sign of agreement or they may have been describing their teacher's emotional state (i.e., as depressed). At the moment of utterance the students did not have eye contact, were not looking at one another, and the emotional climate was somber.

The first event from the cogen reflects a shared mood of serenity. The power of the sound in the air was relatively low throughout the entire segment with an average of 0.4 μwm^{-2}.

Event 6

Turn	**Speaker**	**Text**
01	Amber	But um (0.4) we not bad we just
02	Felicia	[No::
03	Amber	[like

04	Amber	loud and (0.4) we like t[o
05	Felicia	[express
06	Amber	=yeah and I mean when Mr. Llena′ s like (1.1) like when he′ s teaching
07	Kelly	=he′ s crazy as hell
08	Cindy	=yeah he′ s been cranky lately
09	Felicia	really (0.3)
10	Cindy & Felicia	down

Turns 02 and 03 overlapped with Amber uttering "like" as Felicia began to say "no" – uttering the n and just beginning the "oh" part. When Amber finished saying "like," Felicia was half way through saying the word no. F_0 was 175 Hz – that is, Felicia spoke softer and lower than Amber and her speech had a calming effect on the environment. At turn 05 Felicia completed Amber's sentence, showing entrainment with her. She uttered the word "express" in 0.6s. The power of the word in the air was less than 0.1 μwm^{-2}. When Amber finished uttering "to" she completed the utterance at 189 Hz and when she commenced with yeah, she began at 230 Hz. The higher frequency was heard as increased emphasis.

Turns 09 and 10 suggest that Felicia was emotionally neutral, evidence being a virtually flat intonation of "really." The average frequency was 178 Hz. A relatively flat pitch trajectory and a downward sloping end to the intensity curve conveyed a sense of low key and matter of fact – emotionally neutral. Given that Felicia was a teacher and the students had just described Rey's emotional state using colorful language it was not surprising that she would try to suppress emotions in a short, low power turn at talk.

In Event 6 the relatively lengthy pauses within utterances of 0.4s and 1.1s were not resources for a change of speaker. This may reflect the rules of cogen, to share turns and time of talk and it definitely was consistent with the low stakes dialogue that was unfolding. The participants were willing to listen and were not competing for turns at talk. In all instances of change of speaker there was virtually no pause between speakers. It was as if participants anticipated the completion of an utterance and began to speak without a need for a pause. This was an example of entrainment and cultural fluency. As the Event unfolded the students, who were in the frame of the camera, showed entrainment in terms of head and upper body movements, eye gaze, facial expressions, and gestures.

RESPECT, TRUST AND SOLIDARITY

Although Felicia was a new teacher, she showed the benefit of being African-American and relatively youthful. She understood the centrality of respect and used the term as she described how she perceived these students. Kelly inadvertently turned on a water faucet affording Felicia' comment: "it's okay. You can mess around.

It's fine. It doesn't reflect on how you guys truly are on the inside." The utterance took a little over 5.2 seconds, at a very low power in the air at 0.2 μwm^{-2}, and mean pitch of 206 Hz. She continued, "cause you guys, you know, on the outside people would say like you guys are disruptive blah blah except that you guys are just peeped as kids, students actually, and just want to express themselves right? So, if someone says something disrespectful to you, you're just going to come back at them."

Felicia asked the students, "so tell me, during class today, what was … what was going on?" In the moments that followed Amber spent a considerable amount of time explaining how Rey paid a lot of attention to her during class time. There were contradictions. On the one hand he told her she was his favorite student, and on the other hand she was frequently involved in trouble. Amber used colorful language to explain how in class today, Rey "spazzed a little" and after she told him to "calm down! I am listening," he praised her for being a good student. Amber remarked that she informed Rey that it was difficult for her to hear what was going on because there were other people "talking and screaming." In response to some short questions from Felicia the three students discussed whether Rey "picked on them." Kelly noted that, "he never picked on me in his life." This was salient because when Felicia asked "what happened in class today?" she was referring to the altercation between Kelly and Rey. Amber and Cindy acknowledged that it was rare for Kelly to be picked on, joking that Rey usually picked on Amber.

Kelly and Cindy also identified fairness as an issue. They described a contradiction associated with a student whom they implied was involved in cogen and research because of what she could get out of it. The insinuation was that there was something underhand going on – something that insiders knew about and acknowledged with eye contact and knowing smirks. In making this claim there was evidence of solidarity through collective laughter and non-verbal entrainment. Although Kelly wanted to pursue the issue further, Amber wanted to move on. Both accomplished their goals through overlapping speech and Kelly was encouraged to say what was on her mind by short affirmations, such as "wow!" from Felicia. According to Kelly and Amber, during cogen sessions the student they thought was treated with favor identified inappropriate practices from the class, and then when she was in class she spoke continuously and disrupted others. They noted that whereas Rey picked on some disruptive students, he allowed this student to act inappropriately without reprimanding her. The students did not condone Rey's perceived bias and regarded his practices as unfair, reducing their motivation to try hard to succeed in his class.

Speaking calmly, softly, and with self-assurance, Felicia showed a deep understanding of the culture of the youth participating in cogen. She listened attentively, commented affirmatively, and maintained prosody that was non-threatening to any of the participants. In keeping with the goals of cogen she provided spaces for participants to say what was on their mind, identify contradictions, and make suggestions about what was wrong, what was right, and what might be the case if changes were made. The students discussed the science class, the ESL teacher, and Rey, but did not stop there, discussing many teachers and school administrators as well.

Even though Amber monopolized the amount of talk and turns at talk the other students were involved with occasional short utterances and a considerable amount of synchrony in terms of their upper body movement, gestures, eye gaze and eye movements, and frequent bursts of collective effervescence, usually laughter – providing evidence for a shared mood. For the most part there was mutual focus and the participants stayed with issues until there was consensus. Most likely the five females would have accomplished even more if Rey had not entered the room directly after the discussion about favoritism.

ANGER AND DIALOGUE

Kelly looked back toward Rey who entered the room and she commented: "Hello. Why you so cranky? Why you so cranky?" The three-part utterance occupied 4.4s and had power in the air of 0.1 μwm^{-2} and average F_0 of 299 Hz. Rey's response was slow paced, measured, and emotional. He remarked, "I'm sick for like since last week and the more the more people aggravate me, I become sick." During his response Cindy made an effort to show empathy when she remarked after the word week, "so that's when you…"

The first part of Rey's explanation had more power in the air than the second part, 7.3 μwm^{-2} compared to 3.6 μwm^{-2}. F_0 for the first part was 162 Hz compared to 152 Hz for the second part. In each case there was an emphasis on the word sick. The first utterance of "so sick" (0.3s) was shorter and had more power in the air (1.4 μwm^{-2}) compared to the second utterance (0.5s, 1.0 μwm^{-2}).

When Rey finished the second utterance there was a pause of 0.5s, which was broken when Kelly made a lighthearted comment "then smack them." The remark could be interpreted as an effort to infuse positive emotions into an environment that was negatively charged. Perhaps she sensed Rey's anger and tried to defuse it with a joke. As she spoke she gestured with her right hand, turned her head toward her peers, and smiled. Entrainment followed immediately but was short lived. Without a discernible pause Cindy laughed audibly for about 0.6s, Amber also laughed simultaneously while suppressing its intensity by moving her hand across her face, and Felicia laughed, but not audibly. The collective laughter had relatively low power in the air of 0.5 μwm^{-2}. Rey continued to speak with emotion and uttered what sounded like "Yaa" with power in the air of 8.8 μwm^{-2}. Not surprisingly, Rey's relatively high-powered utterance switched the emotional valence back to negative – the "low powered" use of humor and laughter were insufficient to sustain a switch in the valence from negative to positive.

Two social categories – gender and age served to bring Felicia and the three students together and to "other" Rey. While not determining factors, the culture associated with social categories such as age and gender continuously unfolded structures with which those who identified with those categories could resonate, show synchrony, and create instances of collective effervescence. Given several bases for similar histories it was not surprising that foundations were laid for

producing solidarity, reaching consensus, and interacting adaptively with one another. On the other hand, the same categories for Rey were sources for producing cultural difference and maladaptive practice. In these circumstances it was easy to see how social trajectories would favor othering and that effort would be necessary to reverse those trajectories to produce a higher order of solidarity that embodied the acceptance of difference.

TAKING A STANCE

Rey used cogen to present the rules for speaking in the classroom. Event 7 provides a basis for further exploration of the flow of emotions in cogen.

Event 7

Turn	**Speaker**	**Text**
01	Rey	You see you see what happens. You know me, when I want to explain, I want people to listen. When I speak nobody speak. {9.7}
		(0.5s)
		((Students endeavor to speak, but Rey continues))
02	Rey	there's one way. one. mine.
03	Many students	there's a …
04	Rey	when I caught. One at a time ((all students speak in opposition to what Rey is laying out. e.g., "How can you say that?" The group, including Felicia, smile "knowingly" as if to say "but of course it would be *your* way."))
		(0.5s)
05	Rey	when I caught ah Kelly talking …

What followed was a series of exchanges in which Rey maintained a stance of setting out the rules to establish that he was in charge and when he spoke others should pay attention and learn from him. His standpoint was consistent with the idea that there was one official teacher who had the responsibility to control the class and maintain a "one speaker at a time" learning environment. The three students wanted to discuss specifics, some of which arose earlier in cogen when Rey was not present – that is, inconsistency and favoritism. Also, when Rey invoked Kelly's name and referred to the dispute that arose during the lesson, Kelly began to defend her actions.

Kelly spoke for approximately 30s in an explanation of what she considered to be inconsistency. She argued that Rey's actions were not just and noted she was picked on because she asked her nearest neighbor whether she understood how to do the conversion of units. Her explanation pointed out that others were rowdy and some, in the presence of Fereny, were listening to electronic music via an iPod – a clear violation of class rules. At the beginning of Kelly's monologue she was supported, via overlapping speech, by Amber's remarks on Fereny's inconsistency. Toward the end of the time Rey interjected and, after a period of overlapping speech, he prevailed and Kelly sought to make points in the interstices of Rey's talk. The power of the wave in the air during Kelly's utterance was 0.5 μwm^{-2} and the average F_0 was 276 Hz. Rey had the goal of establishing rules and ensuring they were accepted within the group and the students wanted to point out that he was inconsistent in enforcing existing rules and appeared to have favorites.

From the perspective of cogen, Rey spoke more than the students or his coteachers – who did not speak at all in this segment. Felicia showed considerable solidarity with the three female students, an interpretation that was consistent with the manner in which the first part of cogen was conducted. It was apparent from the earlier parts of cogen that the students shared empathy for Rey's well-being and what was later called crankiness and anger (e.g., spazzing out). As the cogen progressed the student utterances seemed to change in purpose from showing empathy to producing solidarity and then to contesting the reasonableness of Rey's actions earlier in the day. Initially, Amber spoke for Kelly, but soon the "dialogue" became an argument in which there were points and counter points. As had happened in the science lesson, Rey appeared to taunt Kelly when she made a claim about not feeling well (for example).

Rey's anger was at odds with the way in which cogen usually is structured. Indeed, in cogen there was a striking difference in the quality of the interactions that occurred between the three female students and the two female coteachers and those that subsequently involved Rey – where negative emotions were involved. In the first part of cogen we analyzed, positive emotions and a serene shared mood was an affordance for relaxed chains of interactions that produced entrainment, synchrony, solidarity, and success. In contrast, the angry exchanges that occurred in the final segment produced asynchrony, failure, frustration, more anger, and fragmentation. Other emotions such as fear and sorrow might also have been produced during that final segment of cogen.

THE ROAD AHEAD LOOKS PROMISING

Rey noted that his displays of anger have catalyzed different forms of behavior, making it possible for collaborative roles to be enacted and flourish at a later time. While anger has been especially vilified for its presumed destructive effects on individuals and social relationships (Tiedens 2001), Rey believed that anger could potentially boost determination toward effective correction of students' misbehavior,

communication of negative sentiments and redress of grievances. Rey used his deliberate and dispositional anger in the classroom as a "nip in the bud" manipulation strategy to confront direct and indirect actions that threatened individual's status, self-concept, identity, insults, condescension, and reproach. Aaron Ben-Ze'ev (2000) provides a similar example to Rey's experience: "A schoolteacher who feels angry with students when they talk while she is speaking believes that their behavior is unjust and depreciates her position in the sense that her authority is undermined." (p. 380) Studies have shown that the display of anger is likely to be an effective manipulation strategy in order to change and engineer appropriate (desirable) attitudes (Sutton 1991). Anger is a distinct strategy of social influence and its use as a goal achievement mechanism proves to be a successful strategy.

Anger serves to inform, motivate choices and behaviors, define a sense of self, and facilitate social connectedness. The emotion of anger per se is neither positive nor negative; rather, it is simply a subjective, albeit powerful, feeling state (Thomas 2003). Anger mobilizes our energy and resources in service of goal attainment and is essential to energize and organize behavior, for it can serve to readjust and strengthen a relationship. Two people who argue and express anger at each other are apt to experience angry outbursts as distressing and unpleasant in the short run but potentially beneficial to their relationship in the long run (ten Houten 2007). Anger can provide the basis for reconciliation on new terms (LaFollette 1996). Current emotion theorists have generally agreed that emotions were fundamentally adaptive and played an essential role in adequate functioning in the social milieu (Izard and Ackerman 2000). Recent developments in emotion theory have pointed to the universality and utility of anger in human functioning, particularly in its power to communicate grievances and injustice (Tangney et al. 1996). It is in the subsequent interpretation and contingencies, i.e., the behavioral expression of anger, that the constructive or destructive function of anger is manifested.

In the moment-to-moment unfolding of social life there may be instances where authority figures step forward to exercise control over specific individuals or groups of individuals within a field. The benefits of acting in this way might be realized first at the collective level, and only later for all individuals that comprise the collective. In an endeavor for the collective to meet its goals it might be necessary to truncate the autonomy and freedom of individuals who disrupt and breach legitimate activities that define the field – here, the learning of science. It is apparent from these examples that there is merit in thinking dialectically about "control over" and "collaboration with" and ways in which this relationship relates to the quality of learning science.

One week following the cogen Kelly brought her mother to the school for a meeting with Fereny, Rey, and a school administrator. Rey was surprised that the shouting incidents were not mentioned during the meeting. Most of the conversation focused on problems with Fereny, who Kelly did not recognize as legitimate. However, there appeared to be positive outcomes arising from the meeting and agreements were reached on Kelly's obligation to produce a science notebook that would be ready for grading and to work productively during the science class.

The three youth who participated in cogen advanced from being failing students in February to passing students in June. Rey argued that his anger catalyzed their trajectory out of the slump and fear of failure promoted a strong work ethic. In making this claim he seemed to underestimate the importance of the buddy system that he created, a collaborative arrangement that brought together the three students who participated in cogen. It was apparent during cogen that the three students identified with one another, there was solidarity among them, and their sense of "belonging to" was a structure that afforded their success. They helped one another to be successful, to stay focused, and to take responsibility not only for their own learning but also for the learning of their buddies. During cogen they demonstrated high levels of empathy for Rey, seeming to realize that his state of anger was not normal and that he needed assistance. The students seemed willing to work with Rey and offered good suggestions for improving the quality of the learning environment, identifying contradictions that might be removed through collaborative action, thereby improving the learning environments for all.

As a science teacher in the Bronx of NYC, Rey has access to the culture he developed in the Philippines and new culture that was created and produced by living in the Bronx and being a teacher there for more than a decade. His cultural capital was not static and was not situated in his life in the Philippines. It would not be right to see those cultural reservoirs in terms of deficits. No doubt the cultural capital produced, reproduced, created, and transformed in the Philippines is the foundation for much of the success that Rey has enjoyed as a science teacher in the United States. However, it was also likely that the cultural capital that allowed him to so fluently anticipate and enact appropriate practices in the Philippines might produce some miscues as he taught at NYH. These possibilities are consistent with habitus being enacted as structures, which unfold dynamically in a field – without conscious awareness.

A similar situation arises for youth who have ethnic histories that originate in Puerto Rico and the Dominican Republic. When they experience Rey's emotional state and enact practices they regard as appropriate, it is possible that what they do is based on a lack of history of interacting with Filipinos to produce success. Even with more than one semester of experience, it is likely that students will misinterpret highly emotional practices associated with body movements, such as gestures, and prosodic features of speech (e.g., intensity, pitch, intonation). Given the centrality of respect in many ethnic groups, and especially among urban youth who have grown up in conditions of high poverty, it is common to interpret cultural otherness as "coming at me." If a person "comes at" another, it can be seen as an act of aggression or an attempt to earn respect by overpowering an "other." It is well known among African American youth, for example, that a reliable way of earning respect is to disrespect others, especially authority figures (Anderson 1999). Also disrespect can be accrued by a person, by allowing others to overpower him/her. Hence, it is unlikely that most urban youth will readily accede to being losers in classroom exchanges. On the contrary, urban youth will do what they can to earn

respect of others by being successful in ways that are valued within the collective. This social fact highlights the importance of creating solidarity across different sub groups that comprise a class. For example, in this case there is a Filipino teacher, African American students, and students from the Dominican Republic, and Puerto Rico. Appiah (2006) refers to forging solidarity across different groups as cosmopolitanism. When cosmopolitanism emerges within a science class there is a stronger possibility of negotiating collective goals and agreeing to a division of labor that affords individual and collective success. The vehicle we have used in the past decade or so has been cogen.

Without taking a deficit view of the students' lives out of school, it is worth considering that many have experience in dealing with adults who become angry with and because of life's circumstances. The empathy the students showed Rey in the early part of cogen when he was not present and then when he was present suggest they have had experience in dealing with angry adults and perhaps angry adolescents as well. For the most part speakers did not speak over others, in the sense of using higher intensity and power in air. As Roth and Tobin (2010) showed, the youth knew how to cool the furnace of anger, by speaking "under" an angry speaker. It is worth considering that they knew how to inject humor, how to laugh in ways that would not be regarded as disrespectful, and how to tailor prosody to create and produce positive emotions. We regard it as a priority to learn more about the cultural capital of urban youth and the extent to which they can deal with anger and social violence in a variety of fields, including science classes and associated cogen.

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