

Fostering Science Learning In Diverse Urban Settings

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Abstract. This paper describes how the uses of cogenerative dialogue can afford the creation of learning communities in which difference is respected and regarded as a resource for advancing learning of the collective as well as individuals within the collective. I describe what we learned from a ten-year program of research in which cogenerative dialogues were used in urban high schools to create productive learning environments in which student achievement increased equitably for social categories such as ethnicity, class, and native language. The route toward higher achievement was paved by expanded roles for science teachers and students.

Keywords: collaboration, cogenerative dialogue, sociocultural theory, cultural adaptation

PACS: 01.40.-d · 01.40.Ha · 01.40.gb

THE CONTRADICTION OF URBAN SCHOOLS

When I moved to Philadelphia it was to address the problems of teaching and learning science in urban high schools. As my research focused on re-segregated, neighborhood high schools in high poverty regions of the city it was apparent that matters were far worse than I had supposed. My observations of classes were deficit ridden and I perceived very little productive teaching and learning going on. Furthermore, as a teacher educator I faced an odd dilemma. The resident science teachers in the urban high schools in which we placed our student teachers were unwilling to give up their classes for fear that the students were uncontrollable. Finally, I received a challenge from one of my student teachers who was assigned to teach science in the *Opportunity Center* (hereafter *Opportunity*) of a neighborhood high school. *Opportunity* was one of 10 small learning communities within a larger school. *Opportunity* catered for students who were experiencing difficulties and were in danger of dropping out. The student teacher taught all day and came to the university for classes in the evening. In a science methods class with me he asked, "Does any of this work? Can you come and show me?"

I readily accepted the challenge since it provided a perfect segue into a study I was planning. Fortunately a science teacher in *Opportunity* agreed to collaborate in a study on teaching and learning in which I undertook a primary teaching role in his physical science classes. The research on my teaching of

science is well documented [1] and I do not dwell on it here, except for several issues salient to the development of cogenerative dialogues [2].

I was instantly unsuccessful in being able to teach in the way I wanted or envisioned I could. To my astonishment the students hardly acknowledged my existence, and ignored my requests to participate in labs, which I considered to be interesting. The students were unresponsive, mostly inattentive, and seemingly resistant to me teaching them. An examination of videotape shows my teaching to be deliberate and slow paced as I made efforts to clearly enunciate words so that they would understand my Australian accent. My teaching practices were belated since I did not anticipate what to do until it was too late, hence setting the stage for a reactive style of teaching. My efforts to be proactive were not rewarded, as students ignored my questions and invitations to participate.

My problems were primarily due to cultural differences between the students and me. Compared to my students, I was older, and differed from them in terms of race, ethnicity, and social class. Even though we all had English as a first language, I could not understand their dialect and they could not understand mine. I asked them to repeat what they said to me and they appeared unwilling to make much of an effort to understand me. Some students found amusement in the failure to communicate effectively, others were frustrated, and most were seemingly disinterested. In the circumstances, my knowledge of physics and years of experience of teaching physics and science education appeared irrelevant. My knowledge in action was ineffective.

IMPROVING MY SCIENCE TEACHING

Several key breakthroughs appeared to catalyze changes for the better. First, I read about the centrality of respect in urban sites, especially when African American youth were participating [3]. Second, a colleague suggested my ineffective teaching might be considered as a breakdown of habitus. Bourdieu referred to habitus as dispositions to act in a particular social field, somewhat analogous to having a sense of the game—knowing what to do without having to think too much about it [4]. Third, I hired a coach, Tyrone, from among the students.

My coach was often in trouble with authority, had a quick temper, and his aggression was a problem for adults and students in the school. Tyrone was regularly absent from school and believed he was suspended as often as he was because of his thug-like appearance. Although Tyrone was smart, he failed consistently and repeated grade nine for three years before dropping out of school. I felt that Tyrone was perfectly placed to give me advice on how to better teach kids like him.

Tyrone gave me numerous different forms of advice, including face to face feedback during class time, reviews of videotapes of me teaching his class, and conversations in my office, at school, and over lunch. I learned about the role of respect, including how to earn and lose it. An important way to earn respect was to show disrespect for someone in authority (like me). Tyrone pointed out that in my efforts to get unwilling or reluctant learners to engage I created many opportunities for them to show their disdain for me and thereby earn the respect of their peers. However, as valuable as Tyrone's advice was, his suggestions for improving my teaching often involved throwing out transgressors from the class, using corporal punishment, and imposing harsh penalties on them. I quickly realized that I should not privilege or reify Tyrone's voice, but should ensure that students' voices informed ongoing conversations about teaching and learning of science.

USING COGENERATIVE DIALOGUES

Cogenerative dialogues (hereafter cogens) emerged from the idea of students having a voice in how to "better teach kids like me." We realized that participants in dialogue should focus on a shared experience in which each accepted responsibility for his or her part in achieving the outcomes, including stepping forward to do what it takes to accomplish agreed to changes in roles. In cogens, the conversation is about what happened during a recent lesson, including any contradictions that occurred. Often participants will identify an incident that exemplified

something that needs to change. The dialogue can then focus on obtaining different perspectives on what happened and endeavor to learn from different standpoints. The goal is to reach agreement on changes to improve the learning environment. In arriving at agreed-to decisions it is important that individuals are respected and retain the right to be different.

The first cogens we enacted included several students, selected to be as different from one another as possible and all the coteachers from a given class. The coteachers usually included a resident teacher, student teachers, university researchers or supervisors and school administrators. We established a rule that anybody who came to visit a class had to coteach and could not observe from the side. We had to work hard to overthrow familiar roles that involved holding one teacher responsible for the quality of teaching and learning. Because of the dialectical relationship between individual and collective it made no sense at all to expect that any teacher could operate independently from the collective of a field and that goals could be accomplished solely through the efforts of individuals. Accordingly, we assumed co-responsibility for teaching roles and in cogens, the dialogue that unfolded was built on an awareness of collective responsibility and forms of activity in which the roles of different groups of participants (e.g., students, teachers) were complementary, orienting toward collective goals.

The rules we developed to structure cogens included: listening attentively; trying to understand others' contributions; showing respect for all participants; addressing previous contributions; maintaining focus; restricting time of utterances; sharing the amount of time talking and the number of turns at talk; avoiding interruptions; speaking to involve others; striving for consensus; and sharing power among participants. As an outcome of cogens we emphasized the need for something tangible to be "cogenerated." Hence, we encouraged all participants to seek cogenerated suggestions for change; that is, agreements that reflect all participants' voices.

As we gained more experience with cogens we increased the range of artifacts used to focus discussion, including excerpts selected from videotapes of a recent lesson. One or more participants would review the tape and select segments that were from 30 seconds to 3 minutes in duration to illustrate issues from which the dialogue could emerge. Other examples to focus dialogue are student work, handouts, digital photographs of work on the chalkboard, pages from a text, PowerPoint presentations, and oral narratives told by participants.

One of the first issues that arose concerned extending from the students in the cogen to the entire class. There was awareness that what was agreed in a

cogen would not necessarily be binding on the class as a whole. So, with the goal of obtaining buy in from the whole class we gradually increased the size of cogens. Half class cogens were held and then whole classes participated with one or more teachers in dialogues that used the rule structure for cogens. Arriving at consensus on the changes to be enacted within a field and adoption of the previously described rules became defining characteristics of cogens.

BENEFITS FROM USING COGENS

Improvements associated with the use of cogens suggest that teachers and students learn how to adapt to one another's' cultures and thereby produce successful learning environments. Visible changes in the patterns of participation and outcomes occurred, including increased attendance, time on task and achievement on tests. Students also showed more respect for the teacher and one another. Less time was spent on classroom management and students often intervened to remind peers to stay focused and engaged. There was evidence of shared responsibility for, and an increase in, the quality of teaching and learning. What participants learned in the cogen began to show up in the classroom. For example, teachers and students shared the number of turns at talk and the amount of talk in the cogens and in their science classes. That is, there was a tendency for culture produced in cogens to be reproduced appropriately in the science classroom.

After more than a decade of research on the use of cogens it is apparent that participants learn to interact successfully across social categories such as race, ethnicity, class, age and gender. Having produced hybrid forms of culture that afford success, the culture is appropriately reproduced and transformed in other fields, including those in and out of school. Student participants in cogenerative dialogue have shown impressive changes in their identities as they progressed from being virtual high school dropouts to pursuing college level studies and assuming leadership roles in and out of school.

Teachers also produce hybridized culture that affords more effective teaching. For example, a teacher was told during a cogen that a problem was that her teaching style was *stiff White standin'*. Students identified numerous features of her teaching that were unappealing and limiting to the ways in which they could get involved. Most of her African American students preferred teaching styles exemplified by dispositions to exhibit verve and energetic oral expressions and body movements during social interactions [5]. Students in the cogen assisted the teacher to change her teaching to incorporate

energetic body movement, gesture and engaging forms of oral expression.

An outcome from the use of cogens is the widespread occurrence of coteaching as students assume responsibility for both teaching and learning and begin to teach their peers. Hence, the roles of teacher and learner blur with all participants being both teacher and learner for most of the time. Participation in cogens increases social bonding among participants. The emotional climate improves. As solidarity builds up there is an associated shared emotion and widespread evidence of synchrony, entrainment, and sustained focus on learning. Noteworthy is that mechanical and emotional solidarity emerge in fields characterized by diversity; differences that are accepted and respected.

CONCLUSIONS

Cogens have been used to improve learning in early primary grades through graduate school. Though cogens are surely not a panacea, there seem to be few downsides to their use. Teachers can be encouraged from more than a decade of research. Perhaps the use of cogens can kick start a new era of physics education in which teachers and their students produce successful interactions in class, affording greater interest and learning; producing a literate citizenry that understands the role of physics in improving the social and natural world.

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