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ORIGINAL PAPER

Toward solidarity as the ground for changing science education

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Abstract In science education, reform frequently is conceived and implemented in a top-down fashion, whether teachers are required to engage in change by their principals or superintendents (through high-stakes testing and accountability measures) or by researchers, who inform teachers about alternatives they ought to implement. In this *position paper* on science education *policy*, I draw on first philosophy to argue for a different approach to reform, one that involves all stakeholders—teachers, interns, school and university supervisors, and, above all, students—who participate in efforts to understand and change their everyday praxis of teaching and learning. Once all stakeholders experience control over the shaping and changing of classroom learning (i.e., experience agency), they may recognize that they really are in it together, that is, they experience a sense of solidarity. Drawing on ethnographic vignettes, science teaching examples, and philosophical concepts, I outline how more democratic approaches to reform can be enabled.

Keywords First philosophy · Ethics · Science education policy · Reform · Difference · Alterity · Democratic change

Since the first wave of reforms in response to the launch of Sputnik, science educators have done a lot to improve the teaching and learning of science. There has been development work concerning materials leading to a slew of curricula known mainly through their acronyms, therefore frequently referred to as "alphabet curricula," including Science Curriculum Improvement Study (SCIS), Science a Process Approach (SAPA), and Elementary Science Study (ESS). Science educators also evolved theoretical approaches for rethinking the way in which students are taught, including behaviorism, cognitivism,

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Piagetian and neo-Piagetian approaches, conceptual change, and (radical, social) constructivism. Structured laboratory tasks were replaced by open-inquiry, and foci on skills and facts were replaced by approaches fostering understanding. Despite all of these changes, however, the fundamental structure of science education has not changed: teachers plan the curriculum and, taking responsibility for what happens and how students achieve, enact it with the latter; superintendents and principals monitor and evaluate teaching performance; and university-based science teacher educators train future members of the profession, sometimes supervising them during their internship.

In contrast, some recent reform efforts in science education have fostered the close collaboration of *all* stakeholders concerning both what happens in the classrooms and attempts in changing them (e.g., Gallo-Fox et al. 2006; Tobin et al. 2005). By collaboration here is meant that all stakeholders actually participate in classroom-level events, bringing together some or all of the following: students, preservice teachers, regular teachers, heads of school, university supervisors, and methods professors. That is, rather than delegating the responsibility for science education to teachers alone, members of society with different institutional positions and orientation enact collective responsibility for science education and change (e.g., Ritchie et al. 2007). To allow readers unfamiliar with such approaches to understand, I begin with a vignette that illustrates how some science educators go about involving multiple stakeholders—this vignette, which somewhat follows a description of an intervention program I recently heard about at a conference, shares features with numerous science education change initiatives that I have direct or vicarious experience with. Many science educators probably recognize aspects of their own reform projects in this vignette, for example, the use of summer workshops (institutes) and the roles of participants.

Vignette: Students as change agents

A group of science educators presents the results of an ongoing study conducted in a school district serving a diverse student population; the researchers have extensive experiences with multicultural education, teacher education, science education, and learning technology. The leader of the group presents the substantial elements of the project:

> In this project we were interested in infusing computing technology into science education and providing schools with such technology. We used a social constructivist approach as a resource for understanding and directing our change effort. This theoretical orientation to teaching and learning affirms that knowledge is socially constructed and mediated by cultural, historical, and institutional contexts. We also decided to draw on our positive experiences with students as change agents; we therefore wanted to enable them to contribute to the implementation of computers in their science classrooms. To direct our inquiry about the change effort, we asked ourselves questions such as "What factors enable/constrain the integration of innovative learning technologies with teaching practices both culturally relevant and social constructivist in nature?" "How do expectations—e.g., learning technology use for enhancing student learning—mediate teachers' professional lives?" and "What are the overall challenges emerging from collaborative engagement in change work?"
>
> Working with culturally diverse schools, we began our intervention by offering a collectively planned summer institute to participant teachers. Adhering to social constructivist theory, we modeled the teaching of science and focused on the

integration of technology into the science curriculum. During the summer workshops, the teachers developed science units that are inclusive with respect to gender and culture and are inquiry-based. When we actually implemented the units, we made available to participating schools a cart holding 10 computers; we also had funds to supply digital cameras, video cameras, CD burners, and probes to collect and analyze data. During the year, when we visited the participating classrooms, we supported teachers in the classroom; we also gathered data to better understand the process of implementing change. To keep teachers on board, we provided them with stipends not only for participating in the summer institutes but also for participating throughout the year.

As we began this project, we realized that progress was going to be slow due to competing demands on teachers; we were troubled by the slowness of our progress in most of the teachers' classrooms and by the incongruence between teachers' espoused beliefs and their beliefs in action. We tried to address this slow progress by involving students in a number of ways to facilitate the use of learning technologies in their classrooms. For example, when students complained to us that they didn't use the computer often, we told them to go to their teachers and request more computer time. We also trained some students to become tech wizards (students proficient with computers) and used these tech wizards to be tech coaches for peers and teachers alike. We encouraged teachers to share artifacts their students created and asked students to share assessments. We also asked students to organize a night for parents. Thus, we involved students directly using their own voices or used students' voices to effect change.

Our results indicate that overall teachers increased their science content knowledge and technology skills. The teachers valued their participation in the project and felt that they were making good progress toward the professional goals that they had set for themselves. However, whereas we acknowledge this growth and teachers' efforts, we still felt that the majority of them were working at a pace for integrating learning technologies and culturally relevant issues that was incongruent with their stated beliefs. We asked ourselves, "What would it take to bring about a better connection between beliefs and actions?" Whereas we have the strong support from the principal, it seems that bottom-up change needs the support of top-down mandates that make clear that the integration of technology has to be achieved within a given time frame.

In sum, we realized that impacting teachers' practices is much more difficult than what some politicians, administrators, and teacher educators believe. We hope that our own strategies will ultimately bring about long-lasting change and have a greater integration of technology in a science curriculum that also is culturally adapted.

While sitting in the audience and hearing about this science education change effort, I felt that the science educators had not involved teachers in an equitable way. They were talking about using *top-down* approaches, about *impacting* what teachers do, and how slow the progress of teachers was. A lot of decision-making was done without consulting with the teachers; and the researchers were critical of the teachers because they were not changing or not changing as quickly as the researchers expected. I felt that the evaluations of teachers were demeaning and inconsistent with the principles of evaluation laid out in *Fourth Generation Evaluation* (Guba and Lincoln 1989). More so, I thought that it was inappropriate to use children—by asking them to go to their teachers and request more time

with computers—to be appropriate in a situation that appears to call for open, democratic dialogue among all stakeholders, in this case, students, their teachers, and the researchers who funded the change project. Nevertheless, the group of science educators suggested that the students in their study had become agents of change. On the surface, their approach is reminiscent of the strategies that Erickson and Tobin enacted in Philadelphia during the 1990s, when they asked high school students from inner-city schools to become teacher educators. The latter did so while responding as panel participants to questions such as "How do you educate people like me?" (Tobin et al. 1999).

But on closer inspection, I noticed that the approach chosen by the presenting group of science educators was different from what Tobin and his team had done, among others, involving all relevant stakeholders in cogenerative dialogues, a form of praxis in which (new and experienced) teachers, (elementary, middle and high school) students, and other stakeholders (researchers, supervisors, administrators) meet in small-group or whole-class settings to talk about collective strategies they would enact the following day for improving teaching and learning in their classrooms (Tobin and Roth 2005). In all of these situations, individuals (e.g., students) heretofore uninvolved in thinking about and enacting reform in schooling actively contribute to bringing about changes in the conditions of schools, which constitute a major context of their everyday life. That is, over the past decade, shifts have been evident in science education specifically from imposing change to evolving change models in which not only teachers but also students shape the conditions of their everyday collective work and change these conditions and the ways these are shaped (Elmesky and Tobin 2005).

The students in the vignette were not truly involved; what they did and how they could do it was controlled in essential ways by the researcher, who decided, for example, who could contribute to preparing a parent night and who could not. As I was listening to the researchers, my own recent experience with doctors and the medical system came to my mind, where decisions were made, where I was sent from office to office, without any possibility of getting involved despite all my knowledge of science and despite all the knowledge I have about my own health and body. My own sense in hearing about the project was that it was disrespectful of the participants just as the doctors had been disrespectful of my own experience. In my view, the students ought to have been more centrally involved in decision-making, just as the doctors should have involved me, drawn on my expertise to assist me in becoming healthy again. I thought that there should have been a more open dialogue involving principals, teachers, students, and researchers to bring about a change and associated evaluation process in which everyone could have bought in, just as there should have been a more open dialogue between the various doctors and me, their patient.

Reflecting on someone else's work, such as the intervention study I was told and represented here in the opening vignette, requires an explicit referent: without such a referent, statements about a work are judgments that lack grounding—which would be similar to judges in courts of law that pronounce decisions without articulating the laws on which the decisions are based. To do justice in my discussion of and reflections on the science educators in the introductory vignette, I have to take a detour—even within the limits of a text such as this—and articulate a philosophically and empirically grounded framework that constitutes the referent that is the unavoidable background to my writing/thinking. I describe my framework in the previous section, grounding it in an understanding of *ethics as the condition for Being* (Levinas 1998). This ethics has a "one-for-the-other" (p. 136) structure; it is an ethics of care, for the Other and the Self. "*The-one-for-the-other* is the foundation of theory, for it makes possible relationship, and

the point outside of being, the point of disinterestedness, necessary for a truth that does not wish to be pure ideology" (p. 136). This one-for-the-other structure underlies *solidarity*, the fact that all members of a community are perfectly united in some dimension. This dimension, as I show here, is responsibility for others generally and for their actions specifically. Responsibility and ethics are integral to and constitutive of the nature of actions, and therefore agency, the power to act.

My aim for this position paper concerning reform policy is to propose a philosophical framework for grounding *democratic* change processes in science education. This philosophical framework begins with a form of human relation characterized by the phrase *the-one-for-the-other* (Levinas 1998); this phrase inherently implies an *ethical* relation that comes with responsibility. Because of its symmetrical nature, *the-one-for-the-other* relation implies collective approaches to change efforts, leading to an ownership of change to those who simultaneously are agents of and subject to the effected change. My argument takes the following trajectory. First, I introduce first philosophy, which recognizes ethics as a condition of Being. In the second step, I link the ethical relation of *the-one-for-the-other* to democratic change. In a third step, I articulate nine principles suitable for setting up democratically oriented change. Then I move on to a critique of the events in my introductory vignette, which is followed by concrete recommendations for how the group of science educators might improve upon their project to make it more inclusive. I conclude with a call for more dialogically oriented, democratic approaches to change efforts in science education.

Ethics as the condition for being

In this section, I provide a concrete demonstration of the ethical nature of participating in society and then ground ethics in first philosophy, where it is considered to be a condition of and for Being: our capability to think is due to our common existence with others in groups (societies), which means we are indebted to others for the capacities to be conscious, to think, and to speak. It is only by way of the generalized other—i.e., the *Other*—that we can have anything like a self, consciousness, and subjectivity (Nancy 2000); and no Self ever could become conscious of itself if there were not other Selves (Franck 1981). The situation therefore is not as constructivists theorize it, where the individual Self, caught as it is within itself, constructs the other in its own image as *alter ego*; and the situation is not in the way social determinists theorize it, where the Self is the conditioned outcome of social influences. The following illustrates the nature of *the-one-for-the-other* relation that makes us responsible for the actions of others, ineluctably and undeniably. Because we are mutually responsible for one another, we also stand in a relationship of solidarity. We therefore have to embrace responsibility for others as a condition of collective (societal) life.

A concrete illustration

We *are* responsible for the actions of others, ineluctably, whatever our religious beliefs and even if we are agnostics (Bakhtin 1993). This is readily apparent from the following illustration and analysis of an interaction involving Nina, an environmentalist providing informal science learning experiences to elementary students, and Daniel, an elementary student who, together with his classmates, has come to a saltwater lagoon to engage in

Fig. 1 At the saltwater lagoon, an environmentalist and an elementary student engage in an exchange about measuring temperature and using a thermometer. The exchange inherently involves responsibility for the actions of the Other

community-based everyday environmental science. Daniel just has pulled a thermometer from the water when Nina asks him, "What is that?" (turn 1). Daniel answers in a roundabout way, describing that it was for "how hot (cold) it is" (turn 2).[1]

```
1 N: `what is? that.=
2 D: =how cold it is⌈or how hot it is.⌉
3 N:                ⌊yes; its called a⌋thermometer. (0.37) so; (0.36)
    ⌈'read the red? (0.15) where it is?
    ⌊((points to thermometer [Figure 1.a] , withdraws hand))
4 D: its: a:::t ((looks at thermometer, holding it in both hands
    [ Figure 1.b] ))
5 N: dont; (0.22) dont touch the⌈bottom;⌉=cause thatll affect the
    temperture.
  ≤((points to the thermometer with a rapid pointing gesture
  [ Fig. 1c))]
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Overlapping Daniel, Nina utters an affirmative; she names the object Daniel holds in his hands and then asks the student to read something (the stained alcohol column in the center) that is red (turn 3). As he looks at the thermometer in the apparent attempt of reading it, Daniel holds the instrument in both hands (turn 4). Beginning with the repeated auxiliary verb "don't" that flags an interdiction, Nina then tells Daniel not to touch the bottom (turn 5).

To understand how we are responsible for the actions of others, even if we are not conscious of this fact, and even if we want to divest ourselves of this responsibility, let us take Daniel's first utterance in the episode—i.e., turn 2—as the starting point. Daniel says, "How cold it is or how hot it is." As any utterance, this one has a performative moment[2]:

[1] The following standard transcription conventions are used: (0.51)—pause in tenth of a second; (.)—distinguishable pause of less than one-tenth of a second; um::—colons indicate drawing out of a syllable about one-tenth of a second per colon; headlands—underlining denotes emphasized part of speech; °or°—degree signs enclose considerably lower than normal speech volume; .;,?—punctuation marks are not grammatical markers but indicate slightly falling, strongly falling, slightly rising, and strongly rising pitch toward the end of an utterance or unit, respectively; ˋ ´ ˇ—diacritical marks indicate falling, rising, and falling-rising pitch within the word that follows; [ ]—square brackets in consecutive turns indicate overlapping speech;–(n-dash)—sudden stop; ((turns))—transcriber's comments are enclosed in double parentheses.

[2] In dialectical philosophy, the term *moment* is used to denote aspects of a larger whole that cannot be understood independently of all other aspects that together make this whole. Moments therefore cannot be elements, because the former change with the mix of moments.

the utterance only exists in and as a production that requires a complicated set of unconscious operations to produce sounds that others (here Nina) hear as words. I consciously choose the denotation *performance*, as the utterance does not constitute a completed action (i.e., an act) but, in fact, simultaneously is tied to the previous and the subsequent performances, which, here, both are produced by Nina (Roth 2007a). There is an interlacement of participants and turns that does not allow us to reduce anything said to any individual; rather, each turn can be understood only as part of a collective production of which individual contributions are constitutive moments. It is as if language (alternatively, culture or society) speaks—rather than speakers—drawing on the two participants to realize itself. It is in this double allegiance to prior and subsequent (discursive) performances that the ethical nature of Being can be found.

First, Daniel produces *this* rather than some other utterance in response to Nina's preceding utterance. Naïvely we may assume that Nina asks a question. This, however, is not the case. Her and Daniel's performances *collectively* make this a question–answer sequence; it is only as part of the sequence that the question becomes a question and the answer an answer. In the light of Daniel's utterance, "how cold it is," Nina's utterance "what is that" can be heard as a question. This is rendered even more poignant when we consider the fact that the pitch of Nina's voice drops toward the end of the utterance (see pitch-indicating punctuation symbols in turn 01), as this would be the case for utterances heard as propositional statement. Her pitch moves up while uttering "is?" That is, the utterance violated the convention that the pitch rises toward the end of a question but falls toward the end of a statement. Despite this break of the convention, the utterance comes to be completed and reified as a question, which is part of a question–response unit consistent with conversation analytic (e.g., ten Have 1999) and speech act theoretic approaches (Austin 1962) that I take here. It is Daniel who completes Nina's performance, which thereby *becomes* a speech act *after* rather than *while* the utterance is performed. Nevertheless, this speech act—which is always completed over two adjacent turn pairs and therefore is a collective achievement—will be ascribed to Nina, the person producing the sound of the first turn in an irreducible pair of turns. However, in *this* situation the nature of the performance as question—rather than as insult, rejection, or invitation—is available only in and through Daniel's performance—in the same way that the case is undecided until baseball umpire's call constitutes a throw as a "ball" or a "strike." That is, Nina initiates what will become a question–response pair, but it is through his performance, that Daniel completes the turn and therefore the speech act subsequently attributed to Nina (i.e., "the question"). Because his vocal production is a once-occurrent event that he cannot undo, he is accountable and bears *responsibility* for it (Bakhtin 1993). He is responsible for the effect his performance has on the performance of the Other; and he is responsible as well for retrospectively completing Nina's performance to make it a question.

The reader may doubt the form and result of such an analysis, claiming instead that the speaker alone is responsible for the utterance (whereas I take a dialectical and phenomenological approach where individuals and collective are understood as being irreducibly intertwined). The following may allay the concerns of these readers. We all are familiar with social situations, where one person utters something (e.g., a White male science department head saying to a Black female teacher, "You are a smart cookie."), followed by the other person saying, "You hurt [insulted] me!" (e.g., taking the comment as a racist or gendered slur). The first person may say, "This was absolutely not my intent. I am (deeply) sorry." In this situation, what the first speaker has done is constituted only in and through the subsequent performance that publicly announces the effect (more technically, this effect is called the *perlocutionary* dimension of the speech act). Rather than becoming a

statement, the utterance of the first person comes to be an injury or insult *in and through the performance of the second person*. By saying "this was not my intent," the first speaker acknowledges that the perceived intent has been other than the speaker's (more technically, the intent is the *illocutionary* dimension of the speech act), and therefore, the very nature of the action has changed. That is, a speech act cannot be reduced to any one individual; it is a collective phenomenon requiring conversation participants to collaborate for bringing it about. And therefore, conversationalists mutually are accountable to and responsible for each other. Returning to the episode, Nina's utterance becomes a question when we understand Daniel as producing a description of the thing in his hand as something that measures temperature. Daniel therefore bears responsibility for turning Nina's utterance into a question. But his responsibility goes even further.

Following and partially overlapping Daniel's roundabout description, Nina produces what can be heard as an affirmative ("yes") and then makes a statement in which the thing in Daniel's hand ("it") comes to be associated with another sound heard as the word "thermometer." If Daniel previously had said, "this is a thermometer," Nina would not have had to name the instrument prior to asking him to read its display. That is, Daniel's performance produces a situation that Nina develops further in a very specific way using the cultural and linguistic resources at her hand. Daniel therefore is responsible for his performance (i.e., what he says) in the sense that it sets up possibilities and opportunities for the next speaker. Had he said something different, the conversation would have taken another course and evolved differently—much like the voyage (life) of Robert Frost's traveler in *The Road not Taken*. It is precisely because of this concrete irreversible impact our actions have on the course of events, their real and once-occurrent character, that we are answerable for each and every act (Bakhtin 1993). What she does makes no sense if Daniel were to have said, "it's called a thermometer," that is, unless there would have been a sense of uncertainty in Daniel's voice, in which case an utterance such as "yes, it is called a thermometer" could be heard as a confirmation. Daniel is also responsible for the next part of the utterance ("read the red, where it is"), as it would have been unnecessary and in fact could have been heard as an irony had he said, "it's a thermometer and it reads ten degrees right now."

Until this moment, I have not even considered the fact that Nina is an adult environmentalist involved in providing a special workshop for elementary students during their fieldtrip to a saltwater lagoon. The teacher, who has set up this visit to the saltwater lagoon as a "fieldtrip," is somewhere at the site, but not involved in this episode. Although Nina and Daniel do not talk about the fact that this event is a fieldtrip and that it is part of regular schooling, both know about it because the teacher, close to and having worked for a long time with Nina, has said so; and this knowledge is a resource for what they do (say) and how they do (say) it. (Articulating what is common knowledge in fact is a way of behaving that participants are held accountable for.) Thus, in producing their utterances, Nina and Daniel also produce what any onlooker can *recognize* as a fieldtrip episode; and because onlookers and participants recognize that this is a fieldtrip episode, they reproduce a fieldtrip episode (we can only *re*cognize something as something if we have cognized it before [Husserl 1939]). That is, Nina and David are accountable—and therefore responsible—to one another for the recognizable production and reproduction of a fieldtrip in and through their interaction and talk. If Daniel were to engage in a different kind of performance, one that threatens the recognition of this event *as fieldtrip* (e.g., as a "chaotic event"), he would be held accountable for it: the teacher may then decide that he alone or the class as a whole would be prohibited from further fieldtrips. That is, Daniel and Nina are responsible to each other for producing this particular, societal form of event as

recognizably such. How can it be that we are responsible for one another's actions in this way? More so, at which point does this responsibility come into our lives?

Ethics and first philosophy

The short answer to the questions that ended the previous section, if *one* (single) were truly possible, is this: responsibility (ethics) is more ancient than the most ancient of our thoughts, more ancient than humanity, more ancient than our (conscious) Being and Self (Levinas 1998). This latter immediately is apparent to anyone considering how parents change what they do in the course of interacting with their babies even at their tenderest age, prior to any capability of conscious thought, prior to all words. That is, a one-month old baby's cry when taken on the lap will be a different resource for the parent's subsequent actions than a "joyful" squeal; and in repeated interactions of this kind parents change what they do with this child and with children in general. The child has been mediating the changes in parental behavior even prior to being conscious of itself, the parent, and the world they inhabit together. More so, because the parents, too, realize culture in and through their concrete actions, culture itself has been changed with the baby's presence. In fact, children not only become social (societal) in and through the patterns in these exchanges, eventually producing patterned performances rather than the early squeals from their vocal cords and random gestures with their hands; they participate the very social and societal nature of the transactions that are resources to their own becoming. Eventually consciousness emerges, and this consciousness is thoroughly human, shaped by interactions that precede the child's consciousness. Further, at the very moment the child says "I" contemporaneously with an emerging consciousness and subjectivity, the Other has co-emerged. This is so because, for example, "I cannot identify the behavior of the other as angry without first adopting an external viewpoint on my own affects, that is to say, the one of another him- or herself. Under this sole condition can I understand such a bodily manifestation of another as something indicating anger" (Franck 1981, p. 157, my translation). This also means that the self-presentation of my body is mediated by a re-presentation, the one given in the viewpoint of the Other; the relation to the Other to my own body therefore is a constitutive moment of my body's sense.

During anthropogenesis (i.e., the process of becoming human), consciousness, too, co-emerges with the simultaneous recognition of subjectivity and intersubjectivity; at the very moment that a first human being has discovered its Self, it also has found itself among other Selves. It understands itself as Other to another Self, so that the Other, the other Self, is the heart of the Self. To return to the example of speech, in the very moment a first human being has opened its mouth to make an utterance to address another, it has presupposed that the Other is capable of understanding the utterance; it makes little sense to address the Other if we cannot presuppose that he or she already understands. The very first utterance, which expresses the fundamental subjectivity of the speaker, already has presupposed intersubjectivity. More so, it has presupposed that the content of the utterance, too, is intelligible so that it cannot be so new after all. Speaking, therefore, never is a transmittal of information but a *sharing* of (conscious) Being (Nancy 2000). Here *sharing* means the articulation (pointing to and out) of significance relations that precede and constitute the background for the utterance; and sharing implies that *any* utterance already is intelligible to all interlocutors. At the very moment that the first geometer articulated what nowadays is known as Euclidean (plane) geometry, he could intelligibly communicate it to others, which means, there already existed a cultural possibility for doing and

communicating geometry (Husserl 1939). Human beings became conscious because they have been *with* one another. This being-*with* now is recognized to be the condition for the emergence of consciousness, Self, same, identity, Other, objects, and subjectivity (Derrida 2005a). It is the "*we* that makes possible the very idea of an ego" (Derrida 1962/1978, p. 61, original emphasis). This *we* precedes any form of consciousness, even the recognition of itself as *we* so that prior to we there is a heterogeneous originary *with* that differentiates itself into the different Selves. And consequently, subjectivity, the recognition of the other in the same, signifies an allegiance of the same to the other; this allegiance is "a responsibility of the same [i.e., Self, identity] for the other" (Levinas 1998, p. 27).

The philosophers of difference—including Jacques Derrida, Jean-Luc Nancy, Emmanuel Levinas, and Gilles Deleuze—use the notion *partes extra partes*, parts external to parts, to theorize the possibility of consciousness to emerge as one in which Being is singular, but because plurality conditions (makes possible) this singularity, Being simultaneously is singular and plural (Nancy 2000). In other words, there is no *pure* subjectivity, because this term always implies intersubjectivity and therefore heterogeneity. To express the issue in yet another way: *because* Self implies an image of the viewpoint of the Other, the Self and Other are implicated in one another, and therefore, *Oneself* is not accessible other than *as Another* (Ricœur 1990/1992). This situation allows us to recognize that *alterity*, difference itself, constitutes the possibility of Being; alterity is at the heart of Self and identity. Therefore, each human being is part of the condition for all other human beings, which are also the condition for my own Being. In human society, these others not only are other adults but also, and essentially, the young. (This inclusion of the young in the constitution of my Being leads me to argue against their exclusion from decision-making processes about educational change.)

The fact that Being simultaneously is singular and plural makes (any) me both indebted to and responsible for the other: I am indebted because without the Other I cannot be conscious; and I am responsible because I (partially) enable the consciousness of every single Other. This leads to the recognition that responsibility is prior to all origins:

> The responsibility for the other cannot [sic] have begun in my commitment, in my decision. The unlimited responsibility in which I find myself comes from the hither side of my freedom, from a "prior to every memory," an "ulterior to every accomplishment," from the non-present par excellence, the non-original, the anarchical, prior to or beyond essence. (Levinas 1998, p. 10)

Here Levinas locates responsibility in a moment of time where we are not yet and have not yet been conscious; the moment in time precedes all notions of time because time is tied to Being (Heidegger 1977) but the form of responsibility in which I am interested here *precedes* Being. This responsibility precisely is that which I highlighted in my analysis of the episode at the saltwater lagoon. This responsibility has no limits so that "faced with the infiniteness of responsibility, one can only admit to modesty, if not defeat. One is never equal to a responsibility that is assigned to us even before we have accepted it" (Derrida 2005b, p. 79).

This *the-one-for-the-other* structure of human relationships that Levinas outlines makes us part of the conditions of each other; we also require each other to complete our mutual speech acts. This makes us solidary, which, according to the dictionary definitions, means "perfectly united along one or more dimensions." Solidarity—whether we acknowledge and feel it or not—is the condition for society: it functions because we all collude, which allows me to meet my basic need although I do not hunt, gather, or make clothing and tools. This leads to a symmetrical relation where each instant of participation contributes

both to the collective life conditions and (by means of a complex system of exchange) to the life conditions of the individual. The symmetrical condition of Being leads to democratic values, literally the power of each and everyone to contribute to decision-making processes. The voice of each person is to be treated equal—which in political arenas is implemented as the equality of votes (embodied in the principle of "one person, one vote") independent of personal particulars. The French motto of democracy also includes, besides the notions of *liberté* (freedom) and *égalité* (equality), the term *fraternité* (fraternity), which makes solidarity a requirement of democracy rather than an option.

Toward a more democratic approach to change

In the past, educational change, as change in other organizations, has been envisioned, encouraged, and implemented in a top-down fashion; there are some who suggest that the failure of much educational reform is due to the top-down nature in which change is promoted and enacted (Skordoulis 2004). The top-down approach is elitist in the sense that those with particular institutional positions and levels of schooling are thought to know better how to change the conditions of others than those other people who produced and reproduced the societally configured situation of interest. For example, changes intended to improve the efficiency and productivity of industrial shop floors were envisioned and promoted (ordered) by middle and upper management (for a collection of cases, see Whyte 1991). Similarly, changes in school environments to improve teaching and learning were envisioned, theorized, and promoted (ordered) by professors, principals, and superintendents. In this same spirit, the change initiative in the opening vignette was conceived, implemented, organized, directed, manipulated, monitored, and evaluated by the science educator group. In such top-down situations, the control over the conditions and changes therein lay with those situated higher up in the institutional hierarchies. The power to institute this control comes from the fact that positions in institutions come with agential resources that significantly mediate the lives of those at other levels: Managers and superintendents may decide whether and when to fire a worker or teacher and—as many strikes in the history of the labor movement have shown—can draw on the police to en*force* their wishes. Related to the introductory vignette, the researchers provided no evidence in their presentation or in the discussion that followed that their teachers had any input on these important dimensions of the change initiative.

In general, situations are produced and reproduced through the collective actions of all participants: a shop floor requires the collaboration of workers to actually be a shop floor and schooling requires the collaboration of students, teachers, and administrator. Not surprisingly, therefore, change has turned out to be much more effective when the people producing and reproducing a situation also are involved in redesigning it. As the examples of participatory action research at Xerox and many other industrial companies have shown, shop floors become more efficient and productive when the workers are in control of defining the problems and together with the foremen design and propose changes in the processes (e.g., Pace and Argona 1991). Much of my own early teacher-researcher work had impact because they involved students centrally in the redesign of the curriculum and gave them active voice in the publications either through member checking procedures or as co-authors. The industrial experience shows what I have been arguing for some time based on my experiences as designer of summer workshops, on the one hand, and as a department head of science and researcher-coteacher in a variety of school settings, on the other hand: the traditional conference, workshop, and lecture model—for example,

implemented by university researchers in NSF- or state-sponsored and financed teacher enhancement programs—only work under exceptional circumstances. Thus, teachers and others involved in educational processes certainly can empathize with the shortcomings of traditional job improvement models: "Being lectured to by … experts is beginning to grate a bit on the industry" or "Given the 'dog and pony show' nature of such presentations … the industry people tend to leave such conferences feeling depressed rather than energized: 'that could never work over here'" (Walton and Gaffney 1991, p. 115).

Over the past two decades, I have been involved in a number of school science improvement projects both in Canada and the US. Having grown up in extreme poverty, I am radically committed to democratic values so that my involvement in these projects was grounded in an understanding that meaningful change usually occurs when those concerned are in control of the changes and in control of the tools required for implementing them. This also has been shown in a recent Finnish study, where teachers of a dysfunctional inner-city middle school decided to take into their own hand matters that normally are in the purview of the principal and, by collaborating at many levels, turned the situation around (Engeström et al. 2002). Here, too, teachers, principal, facilitators, and researchers adhered to democratic values and shared ownership in problems and solutions. That is, those concerned need to be able to define goals, which they always will do such that the projected outcomes *increase* their control over the reigning conditions (rather than feigning commitment and then resist change, as the teachers in the vignette). This is so because the projected increases in personal control and room to maneuver have a positive *emotional valence* (a subjective measure for the chance of success [positive valence] or failure [negative valence]), which is the central feature that drives conscious goal formation and determines the selection of unconscious operations that realize the goal-realizing actions (Roth 2007b). In the process of increasing my understanding of the need to engage in science education change processes collectively and democratically, the experience and concept *solidarity* to denote the collective agency toward common (rather than partial) interests has become salient to me. However, until recently I have not had a good way of grounding this concept other than in Kant's *moral (categorical) imperative*. This grounding is weak, however, because Kant presupposes the existence of a conscious being that understands Being. Much like the (radical, social, socio-transformative) constructivists today, Kant did not theorize how the constructors construct themselves, their Selfs, identities, and subjectivities, that is, all those aspects of Being that make us humans the kind of beings that we are and whom we know to be in this way. And none of these approaches has the required theoretical concepts for dealing with the essentially passive nature of responsibility and answerability.

Principles for the transformation of science education in a democratic manner: Ethics and solidarity

In the previous section I argue for a more democratic approach to change initiatives. I illustrate how first philosophy leads us to *solidarity*, a term indissociably related to the equality (*égalité*) and fraternity (*fraternité*) of the first democratic (French) revolution. The very ideas of equality and fraternity are focal artifacts that generate collective emotions that, in the sociology of emotion, underlie the sense of solidarity (Collins 2004). Once stakeholders in science education get the idea that they are "in it together" and that reform only exists when everyone changes, this idea also may serve as a focal artifact that produces the sense of solidarity. In civil law *solidarity* constitutes the obligation toward

common responsibilities. That is, because we are responsible for the Other, we also have obligations toward the other; recognizing these obligations means to be solidary. It turns out, however, that the central ideology of much of Western culture generally and of American culture more specifically is *individualism*, being-for-oneself, the opposite of solidarity, being-for-the-other.[3] Individualism is a problem in that it marginalizes those segments of society that inherently are more inclined than White middle-class men to communalism and solidarity, such as women (Belenky et al. 1986) and African Americans (Boykin 1986); it also is a problem because, as a form of ideology, it enrolls the very people marginalized in supporting individualism, such as when an African American youth aspires to become a basketball star (like Allan Iverson, Michael Jordan) or a rock star (like Beyoncé).[4] Recent research reveals the central role solidarity as a practice and concept plays in science learning on the part of girls (Solomon 1997) and on the part of African American students attending inner-city schools (Tobin 2006). To address the needs of these heretofore underrepresented groups in science and science education, solidarity as fact and motive for my actions *ought to* ground education and educational improvement, especially if we intend overcoming inequities and injustices that are constituted along a range of constructed boundaries: race, gender, socioeconomic status, class, and, important in the present educational context, age. To redress inequities, especially along the lines of age, students in particular ought to be involved in the control over their learning and over the contexts in which it occurs. Truly democratic institutions of schooling require the inclusion of students in the control over the conditions in which they learn; and learning precisely exists in increased control over and expanded agency in one's life situation. But how do we change schools so that they become more democratic institutions involving not only administrators and teachers but also students in the production and reproduction of change? And how do we do this in a democratic manner?

It seeking answers to these questions, the Scandinavian labor context provides us with some good examples. In this context, democratic, solidary workplace reform has long been associated with democratic, cogenerative dialogue (e.g., Gustavsen 1985). I consider the following set of principles evolved to make workplaces more democratic—and implemented in cogenerative dialoguing, an important transformative practice some science teachers recently have used in inner-city school contexts (e.g., Emdin 2007)[5]—to be useful resources for the evaluation of the degree of democracy in dialogue aimed at the democratization of education and educational change:

1. *Dialogue fundamentally is a process of exchange; points and arguments move back and forth between* all *participants.* Grounded in the concept of fairness—also critical for ascertaining the authenticity of fourth-generation evaluation (Guba and Lincoln 1989)—open negotiations are required so that the viewpoints of all stakeholders can enter school change processes and the evaluation thereof. At this point in time, the organization and change of schools, however, is structured hierarchically. Thus, change generally is implemented from the outside, for example, through the regulation of science education content and teaching methods from regional or state (province)

[3] It is not surprising that the labor movement is so much weaker in the US than in European countries, especially Scandinavian countries, in which solidarity is especially valued and practiced.

[4] Individualism is a problem, too, because it does not recognize the society (culture) that both enables and celebrates certain achievements. The research actions that may be honored with a Nobel Prize are but concrete realizations of cultural and historical, that is, collective (rather than individual) possibilities; and the same collective then decides who is to be honored for concretely realizing the actions it has enabled.

[5] Other studies in this vein include Lehner (2007) and Lavan and Beers (2005a).

governing bodies. Teachers and even more so students have little or no say with respect to the science curriculum; students generally have no say in contributing to the decision making about goals for and processes of learning. In contrast, while teaching and conducting teacher-research in an eleventh-grade physics course, my students, in the context of an otherwise regular school, had complete control over how to structure the learning context given the provincial curriculum guidelines *and* where 35% of the final grade derived from peer and self-evaluation (Roth 1995). Thus, in the context of a six-week, governmentally prescribed unit on electricity, one student group conducted a series of experiments including regular, semi-, and super-conducting materials; another wrote a curriculum for teaching fifth-grade students and then, as part of the evaluation, taught the unit; and other groups wrote plays or produced comic strips teaching about electricity. In this situation, therefore, students were central participants together with their teacher in the re-configuration of their learning environment; and they were an integral part of the evaluation of knowing and learning.

2. *All participant stakeholders must have possibilities of and opportunities for participating; all stakeholders are responsible for such possibilities and opportunities*. School change projects rarely involve students, although they ultimately concern and deeply influence their lives. Sometimes students may be asked to identify current problems in their science education curriculum and indicate alternative forms in which they are to be taught and alternative topics (Roth 1998). But even in the Scandinavian context where highly democratic approaches to reform involve all teachers of a school, students had been excluded (Engeström et al. 2002b). On the other hand, there are new efforts emerging around the idea of cogenerative dialogues, where teachers provide their students with opportunities and possibilities for participating in change. One study shows that after a slow start of getting students to take up the opportunities for participating, they increasingly became interested in changing classroom structures to meet their needs by examining videotapes that they contributed to collecting and analyzing; by the end of the school year, all but two students participated openly in discussing classroom events (LaVan and Beers 2005b).
3. *However, possibilities for participation are an insufficient condition: everybody is responsible for taking the opportunities for contributing to the discourse*. The slow start in students actually taking up the opportunities observed in the LaVan and Beers studies illustrates that opportunities alone do not mean participation. A conversion of consciousness needs to take place on the part of those stakeholders heretofore excluded from negotiation and decision-making about (content-, process-related) curriculum issues. It is not surprising that a study conducted in the same city as LaVan and Beer's study produced a heuristic (checklist) for assessing the cogenerative nature of change-related discussions involving students, preservice teachers, regular teachers, school administrators, university-based supervisors, and researchers (Roth and Tobin 2002, p. 196); this checklist includes under the heading *opportunities to participate* items designed to ascertain *active* participation, including "making space to participate," "Making invitations to participate," and "Showing willingness to participate."
4. *As a point of departure, all participants are equal (despite their inherent differences in ontological terms), including students, whatever their age*. To this day, students largely have been excluded from participating in curriculum-oriented decision-making processes. But there is no reason for discriminating according to age in the same way that there are no reasons to discriminate along the lines of race, sex, or socio-economic status (Lemke 1990). This principle of *fairness* requires negotiations to be open and to

"be carried out from approximately equal positions of power, not just in principle but also in practice" (Guba and Lincoln 1989, p. 247); if the parties do not have equal skills at bargaining processes, fairness requires that "all sides have access to skilled bargainers" (p. 247). In my work with inner-city students, I could testify to the tremendous competencies and sophistication these students had for articulating the issues at hand. A central discriminating aspect in school situations lies in the different institutional positions students and teachers have, which generally is denoted by the term *power-over*. To mediate power-over situations and thereby facilitate open negotiations, some change efforts involve coordinators or heads of school who act as mediators, especially when there are conflicts between stakeholder groups. For example, in one Philadelphia school, a section coordinator and vice-principal not only promoted cogenerative dialogues involving students and their mathematics, science, and engineering teachers negotiating issues of contention, but also participated in these dialogues to ascertain that both parties articulated their viewpoints and understood the viewpoints of others (Roth et al. in press).

5. *Experience in the classroom under discussion is the foundation for participation; coteaching and co/learning are forms in which outsiders may gain experience*. Research on collaboration and workplace improvement showed that participants in change efforts need to understand each other, which often means that a common discourse has to be established that includes the mutual viewpoints. Crucial is that participants reflect on *shared* objects, situations, and experiences, where shared initially means that all have participated in the event but may have different experiences. In such situations, there is a great likelihood that all parties are in possession of the same level of information, a condition for the fairness in the evaluation of the issues at hand (Guba and Lincoln 1989). Thus, in one Scandinavian project, the newsroom workers and the designers of new computer technology for the newsroom built common artifacts and, to enable communication, developed forms of talking about these artifacts that allowed a concurrent representation of the designer and user viewpoints on a common object (Ehn and Kyng 1991). Closer to science classrooms, some teachers experiment with the use of video as mediating artifacts that constitute common conversational objects for participating students, teachers, and researchers (LaVan and Beers 2005b); here, different participants select the video-clips for discussion and make an apparently shared event present again to allow the articulation of experiences, which, because of different auto/biographical experiences, are likely different not only across but also within stakeholder groups. Because these clips can become shared artifacts, they have the potential to become focal artifacts around which a sense of solidarity can emerge.
6. *Each participant must consider legitimate the experiences of all other participants, when they enter the dialogue*. An integral aspect of the authenticity criteria of fourth-generation evaluation, *educative authenticity* denotes the extent to which, within a stakeholder group, the understanding of and appreciation for the constructions within other stakeholder groups has increased (Guba and Lincoln 1989). Inherently, therefore, *educative authenticity* implies that the experiences of all other participants including those from other stakeholder groups are deemed legitimate. In democratic change processes, *educative authenticity* aimed at understanding the experiences of other, is a condition for designing alternatives to the existing situation that meets the needs of all participants and stakeholder groups.
7. *Opportunities must be provided for everybody to develop an understanding of the issues at stake.* Akin to the concept of *ontological authenticity* (Guba and Lincoln

1989), this principle is designed to allow all members of all stakeholder groups to elaborate, improve, mature, and expand their practical and theoretical understanding of the situation. Understanding the issues at stake also means understanding the nature of the stakes for other participants. Thus, there generally are too few opportunities for students to come to understand the context within which teachers make decisions; and few teachers believe they have the time required for understanding their students, the backgrounds they are coming from, their needs, and the constraints that derive from them from other aspects of their lives (e.g., being "othermother" or being "flyy girl" [Scantlebury 2007]).

8. *As a point of departure, all those contributions and arguments are legitimate that pertain to the issues under discussion.* Negotiations involving different stakeholders that are true to fourth-generation evaluation require the negotiations to "focus on matters that are known to be relevant" (Guba and Lincoln 1989, p. 247). This principle therefore is designed to assure that negotiations remain on track by admitting all those pertaining to the relevant issues but allowing for the process of designating illegitimate those contributions that do not pertain to the salient issues.
9. *The dialogue continuously must seek to produce agreements that are platforms for future investigations and practical action*. Akin to *catalytic authenticity* (Guba and Lincoln 1989), the extent to which change-related action is stimulated and made possible, this principle intends to foster the negotiation of platforms from which the realization of common rather than partial interests can be envisaged. If each stakeholder group pursues its own, partial interests, there are possible, often-likely, and sometimes irresolvable conflicts between these interests (Holzkamp 1979). *Partial* interests are just that and therefore inherently cannot be *common* interests, and therefore work against solidarity, the requirement for seeking and enacting collective problem statements and solutions. The requirement to arrive at agreement and common platforms means that all stakeholder groups can buy into the negotiated action plans and their concrete realization in the daily school praxis. All participants know that the agreed-upon plans and actions, because they are oriented toward *common* interests, inherently do not suppress the interests of mutual others, be these individuals or (stakeholder) groups.

Agency, initiative, and change in science education

My opening vignette was constructed based on a U.S. National Science Foundation supported change effort that I recently have become familiar with; it is similar in its approach to other change efforts concerning the teaching and learning of science. The researchers in this vignette intended to change science education at the elementary school level in a context that serves a culturally diverse population. The change initiative involves the integration of instructional (computer) technologies in science education. To assist teachers in changing how science is taught in their classroom, the research team recruits students and trains them to become "tech wizards," who manage the computer cart, hook up probes, and use a variety of software packages. These wizards also are assigned to become peer tech coaches. Furthermore, the researchers initiated the planning of a night for parents around the active involvement of students in the organization. In this effort, therefore, students are placed in a situation that enables them to take a more active role in changing the culture of science education in their school.

Reform efforts such as the one intended by the researchers in the vignette are laudable, in particular because they more actively involve those in the organization of the classroom context who are the ultimately targeted beneficiaries of the change: students, that is, those members of society who constitute tomorrow's labor force and participate in the sustenance of the human life form through their contributions to the collective. There is no doubt that such an approach to reform in science education is preferable over others, where researchers alone generate knowledge and implications that are then recommended to or imposed on schools generally (mediated by the adoption of change recommendation by a superintendent, for example) and recommended to or imposed on teachers specifically (through accountability measures imposed from above). However, attentive readers notice that despite the good intentions of involving students in science education reform, there also are considerable contradictions within the vignette, at least when viewed through the lens of ethics and responsibility that I develop in the earlier sections. That is, I favor and have practiced change efforts that go much farther still in the democratization of schools and schooling. In the spirit of providing resources for moving such reform efforts ahead by locating their internal inconsistencies, I articulate several contradictions that are apparent to me in the technology-in-science-education project, which are furthermore repeated in the very form that science educators such as those in my vignette report their work (research). In the following paragraphs, I articulate my own reading of these contradictions; this reading is done to produce resources for pondering how these science education researchers in particular and the science education community more generally might want to rethink reform and reform efforts.

Contradictions

Reflecting on the story that the group of science educators in my vignette had told me about their change initiative left me with the impression of a fundamental asymmetry in the project, where different participants—researchers, teachers, students, and parents—not only are positioned differently in institutional terms but also are located in fundamentally different ways with respect to change, opportunities for framing the conditions and terms of change, goal setting, and assessment of the degree to which goals were met. The project did not strike me as very democratic; nor did the researchers' narratives express solidarity. More so, while the researchers asked elementary students to request more computer use from their teachers, it did not appear to me to constitute a legitimate move—Would the idea of "open negotiations" (Guba and Lincoln 1989) not require that the issue of computer use be discussed with *all* stakeholders present?

In a reform effort that arises from a democratically organized dialogue—i.e., one that recognizes the ontological equality of all members constituting an activity system such as schooling—*all* participants both recognize and enact collective responsibility. To me, the reform slogan "Science education for *all* Americans" has to mean *all* stakeholders are involved in the production and reproduction of science education, including its curriculum plans, teaching and learning strategies, and reform. Teachers, students, and researchers who recognize their collective responsibility in the achievement of collectively articulated, common goals do what has to be done to reach these goals. Yet setting up a project and getting external support necessitates doing things innovatively and acceptably. If the project is too radical, others may not sufficiently buy into it to contribute to the collective responsibility to realize the goals in concrete ways. If one or the other participant recognizes a shortcoming, enacting collective responsibility means that he or she does something

then and there to address the problem *with* all the others. Participants do so because they have set their goals in view of achieving goals, which are always set such that they lead to an increase in control over life conditions and an increase in their room to maneuver, that is, increase in the possibilities for acting (i.e., power to act or agency). Standing back and being disappointed, as the authors are, because *others* (i.e., teachers) do not do what *they* (authors) want them to do is not legitimate.

In the vignette, however, responsibilities are not collective, and goals are neither set nor evaluated collectively. Thus, the science educator group has written the grant and obtained the funding, which required that they set goals. There is no indication in the vignette particularly (or anywhere in the researchers more than 1-hour presentation at the conference) and in other reform-oriented funded projects generally that other stakeholders or their representatives (teachers, students, parents, principals, or superintendents) are centrally involved in the grafting of the grant. The selections of stakeholder groups and representatives are part of democratic processes, which therefore must be open to negotiation as all other aspects of a change effort. Perhaps a praxis and sense of solidarity and coparticipation is required already at the stage of writing the proposal in the first instance.

In a democratic project, all voices are heard concerning the degree to which common and collectively set goals have been achieved and the extent to which this achievement has led to an increase in the action possibilities of *all* participants. Thus, if a teacher were to complain that participation in a reform effort involves a lot of (or too much) work and seeks to withdraw from active engagement, this is an indication that the envisioned increase in control over their work condition does not occur: the outcomes do not justify the means. The description of the project in the vignette does not allow us to assess the degree to which teachers are involved in the *collective* responsibility for the assessment; rather, the researchers are evaluating the quality of progress, as evidenced in comments such as "progress across project classrooms was still not going as well as [they] had hoped." The researchers are "disappointed," which indicates that *they* evaluate the success of the project and the actions of *others*, rather than reporting a collectively achieved assessment of the project. The researchers do note the discrepancy between teachers' declarations of commitment to change and their praxis. But here one may invoke the well-known gap between praxis and talk about praxis so that the degree of consistency between the two always is an empirical matter. An analysis from the perspectives of critical theory would point out to the researchers in my vignette that talk *about* praxis occurs in a different activity system than praxis, so that teachers' statements—which are equivalent to other tools that mediate actions (Rossi-Landi 1968/1983)—of commitment may be in the service of goals unknown to the researchers.

Reform efforts such as the one described in the vignette generally provide little if any indication of how teachers frame goals for the project and assessment as to the degree to which the project goals are met. How much have teachers, students, parents, and other stakeholders seen their action possibilities increase? The asymmetry is further notable in the researchers' question whether they and school administrators should work "only with teachers who demonstrate rapid professional growth regardless of the contexts in which they work?" If teachers were an integral part of the reform effort, they would be committed from the beginning and they would have contributed to envisioning goals such that their achievement would increase their action possibilities and control over the situation. The achievement would be linked to higher emotional valence inherent in gratification that comes with increased action possibilities. That is, it would not have been necessary to provide external stimuli and encouragement, for example, in the form of stipends paid both during the summer workshops and during the year—these are not unlike the practices used

by behaviorist educators to get children to participate and learn. Those who recognize that some form of action increases control over their life conditions have inherent motives for acting, because the result of these actions lead to increases in action possibilities (i.e., control). Perhaps the less-than-fervently participating teachers in the vignette do not make use of available resources as often as researchers hoped *because* they do not see how their own possibilities for acting would increase if they actually were making more frequent use?

Why would teachers who participated in framing and in achieving a commitment to the collective responsibility for attaining the goals need to receive payment or be obligated externally to attend and actively participate in the monthly meetings? Why are there external requirements for students before they are allowed to participate in certain events? All of these questions are of an ethico-moral nature, suggesting to me the existence of a fundamental asymmetry within the project, one that leads to contradictions with the researchers' espoused "theoretical orientation to teaching and learning that affirms that knowledge is socially constructed and mediated by cultural, historical, and institutional contexts." Here, I read *knowledge* to mean not only the externally legitimated scientific knowledge articulated in the curriculum documents to be learned (appropriated, constructed) but also the knowledge about problems the reform effort is designed to address, and the knowledge about the problems emerging in the reform process.

There also are contradictions in the project concerning voice, which, in a democratic change project—as outlined in the previous section—involves *all* voices *throughout* the change process, *from the outset*. In the technology intervention project described in the vignette, this is not the case. There are some—the researchers—whose voices count more than the voices of others—students, teachers—who may be "required" by the former concerning what they can do and how they can do it. This absence of the voice of those other stakeholders (teachers, students) is mirrored in the paper the science educator group presented at a conference, which is in contrast to some of the science education reform work conducted by Ken Tobin in Philadelphia and New York inner-city schools that does in fact involve all stakeholders (e.g., Tobin et al. 2005). Thus, teachers, interns, supervisors, methods teachers, graduate students, postdoctoral fellows, and research professors take collective responsibility for the redesign of the classroom environment *and* for the communication of the change efforts in scholarly articles.

Opportunities for changing the change project

How might the participants in the technology-in-science-education project work to increase their commitment to *collective* responsibility for producing and reproducing science education and change? and How might they do this in a democratic manner that does not privilege one (type of) participant over another? To begin with, any change in how the project members are to reform their project should occur itself in a democratic manner, through a continuous dialogue in which all the voices are equal (in their difference) from the outset. The dialogue might begin with establishing a set of principles inspired by the one articulated in the previous section. The project members may also talk about the very situation in which they find themselves and about the fact that in any case, the events always are the result of collective action—in the way I describe it in the opening sections. That is, the researchers are responsible not only for the successes of the project but also for its failures; they are responsible not only for the actions of the committed teachers but also for those who are less committed than desired. The process I envision

would be one of *conscientization* (Freire 1972), one in which a group empowers itself by becoming critical, transitive, dialogical, and transformative; in fact, a critical pedagogy must provide resources for the oppressed to profoundly change and improve their life situation (McLaren 2000). Empowerment is a collective, democratic event, a process intended by the person or persons themselves, and has to be experienced as such by the participants to be transformative; empowerment is something that cannot be conferred but which is co-extensive with the expansion of control over one's condition and with the expansion of one's room to maneuver with respect to changing the conditions. Empowerment is its own precondition—I need to be empowered to empower myself—but cannot come from the outside, because it would not longer be empowerment. (This is not so problematic a situation, as we have intentions that we do not intend and that are not given from the outside.) Readers may ask, is there any precedent for such a democratic process? My answer is yes, and it would be followed by articulating *cogenerative dialogue* as a form of praxis that has the potential to lead to the democratization of both industrial workplaces (e.g., Eldon and Levin 1991) and school science settings (Emdin and Lehner 2006). This form of praxis has its reflection in the metalogue genre for writing scholarly works; in this genre, the voices of individual participants can be heard and are not flattened into a collective voice.

Cogenerative dialoguing developed out of the practice of coteaching—where two or more teachers take collective responsibility for teaching—followed by debriefing meetings involving all coteachers and a small number of students. The praxis has developed to involve *all* stakeholders who have been involved in one or more science lessons—consistent with the above-mentioned principles 1 and 5 that participation of all stakeholders in a common event is the basis for and object of the dialogue. Cogenerative dialoguing is intended to improve teaching and learning and therefore provides participants with opportunities to talk about specific lessons, teaching strategies, and subject matter pedagogy as well as about teaching and learning in general. Having experienced a particular lesson from a similar point of view—i.e., as active participants rather than onlookers—and having had to make decisions in the same mode of temporality—there is no time out in the production of a lesson—participants now have opportunities to develop explanatory accounts of these shared events. That is, their different lived experiences—consistent with principle 6—of a shared event provide them with the resources for dialoguing.

In cogenerative dialoguing, every attempt is made to allow *all* participants to contribute to the conversation in equitable ways—consistent with principle 2; moreover, consistent with principle 3, individuals and collective are responsible for actively participating and for enabling the active participation of others. To achieve this practitioners of cogenerative dialoguing follow a heuristic, a sort of checklist with items that provide every participant with the opportunity to voice his or her opinion and every participant provides opportunities for others to voice their opinion (Roth 2006). Furthermore, any participant, irrespective of age and institutional position, not only has the right but also the obligation to frame issues as problematic and raise questions about practices. The research on cogenerative dialoguing in some of the toughest neighborhoods in Philadelphia and now also in New York shows that the contributions of all participants are valuable and valued and lead to ongoing change in teaching practices of newcomers and old-timers alike. In these situations, cogenerative dialogue sessions provide forums in which successes, failures, and (failed) opportunities are raised, analyzed, and taken as resources for designing change in a collective manner. Here, designing change collectively means that the goals are *common* so that *all* participants can subscribe to and work towards achieving them.

Past projects on cogenerative dialoguing situate themselves in urban science classrooms at the secondary level. Some readers may suggest that this praxis works with high school students but that it could not (might not) work in elementary-level classrooms for this or that reason. However, a doctoral student of mine currently participates in a school-improvement project where he specifically works with a fifth-grade class and its teacher to begin and evolve the praxis of cogenerative dialoguing (Stith and Roth 2007). The initial results show that cogenerative dialoguing does indeed work with and for these students, too, who are capable and willing to participate in collective responsibility not only for enacting lessons but also for changing current forms of praxis to transform the very contexts in which they learn.

Next I present some of the implications on which I personally would draw if I were a participant in the technology-in-science-education project described in the introductory vignette. As a point of departure, I would begin a dialogue with *all* the stakeholders to bring them together at the *same* table to negotiate and plan changes that *all* recognize as desirable and to which *all* can subscribe. It would no longer be possible for students to come to the researchers and complain or ask for something, followed by the suggestion, "Why don't you let your teacher know that you want…?" In such situations, true cogenerative dialogue does not occur, but researchers "*capitalize* on the students' interest" for advancing their own agenda. That is, different partial interests are used and played out against one another; this is less preferable, because it is inconsistent with democratic, open dialogue (see principle 9). However, there is consistency with principle 7, *everybody* must have the opportunity to develop an understanding of the issues at stake and, consistent with principle 1, points and arguments move back and forth between *all* participants. In the case of researchers talking to students in the absence of the teachers, only some are involved in the conversation, omitting others from taking part in evolving a *common* understanding. Thus, in the situation of students complaining to researchers and researchers encouraging students to propose change to the teacher, actions do not correspond to one or the other of the nine democratic principles.

Toward a different ontology and epistemology

This article was written based on my recognition of the laudable nature of the science education change initiatives such as the one featured in the vignette. I argue for a different approach to ontology and epistemology, an approach that allows us to understand and practice change in science education according to values that are more democratic than traditional change efforts. My text constitutes a starting point—much too limited in scope because of length constraints on journal articles—toward thinking about how to involve a greater number of stakeholders to a greater extent. It is only a starting point that cannot do justice, as if it were possible, within such limits. It is within these limits, I offer points of critique, a philosophical framework, and pointers to possible futures. Thus my articulation of the change effort in the vignette—as still having to go some distance before being consistent with the democratic principles outlined—is grounded in an ontology enabled by the ethics of the *with*, that is, an ontology that has the one-for-the-other structure characteristic of solidarity. This structure grounds the everyday praxis of education and educational change in a philosophy in which ethics is the very condition for ontology, that is, the ways and forms of conscious Being (Ponzio 2006). Such a philosophy leads us to a politics of justice. In the spirit of the ontology outlined in this text, I recognize my own part in

the collective responsibility in and for bringing about change in science education. I offer this text as an opening statement to a dialogue that ought to involve not only the researchers in the vignette but also their teachers, students, parents, and administrators. In the spirit of Shakespeare's Hamlet calling out "nay, come; let's go together," I believe that the problems we experience today have to be changed by dialoguing and by working together, both of which presuppose our original debt to the Other, acknowledged and recognized in the praxis of collective responsibility. It is in its possibility to be democratic that "Discourse presents itself as Justice," a way that defines "Discourse *as* Justice" (Derrida 1997, p. 29, my emphasis). And it is through discourse as justice that we can arrive at democratic change toward fairness and equity.

In this text, I am concerned with responsibility in and for educational change. But the philosophical framework articulated is suitable and has been used to frame ethics, justice, and politics. This framework is grounded in the fundamental recognition of the shortcoming of traditional philosophy generally and all forms of constructivism more specifically, which presuppose identity (the same) for consciousness to exist, a presupposition that inherently leads to representation and representationalism (Deleuze 1968/1994). The presuppositions of present-day learning theories including constructivism have their roots in an ontology whose "essence is always colonial, which tends, repressively and irrepressibly, to reduce language to the One, that is, to the hegemony of the homogeneous" (Derrida 1998, p. 39–40). It leads to the ideologies that underlie all inequities, including those along the lines of gender, culture, socioeconomic status, class, and age. Inequities inherently are contrary to the democratic ideals of equity and impede the sense of fraternity and solidarity; rather, inequities give rise to the formation of societal strata (e.g., social class) that pursue partial rather than common interests. The pursuit of partial interests inherently leads to societal conflict such as labor strikes and class struggle (Holzkamp 1983). That is, it leads to an ideology that the researchers in my vignette said they were not subscribing to. Inequities come from difference understood as difference between fixed identities, which is a form of difference that is indifferent—to gender, class, socioeconomic status, culture, and age. The philosophers of difference recognize and work out how it is that *difference* is primary: difference is behind everything but behind difference there is nothing. This therefore leads us to the recognition that difference can be understood as dialogical involvement and participation with other differences (Petrilli 2006). I believe this approach not only to be in the spirit of what the science education researchers in the vignette are after but also to constitute a theoretical framework that overcomes the aporia of the social constructivist approach that science educators such as those in my vignette currently use to explain their praxis. The essential difference in the two approaches is this. In (social, radical) constructivism, signs are used to make differences *indifferent* to difference, because it defines and treats difference as a derivative of sameness in terms of which it comes to be defined. In the proposed framework, difference is theorized in and for itself, as an essential aspect of identity (sameness). Here, then, difference is *unindifferent* because it constitutes a dialogical engagement and participation with other differences. This precisely is what I understand the science educator group to intend with their push for equity—which, as the philosopher Deleuze shows throughout his work, forever escapes constructivist thought, rooted as it is in the notions of identity and the same.

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FORUM

Being-through-doing: Bakhtin and Vygotsky in dialogue[6]

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This paper provides a conceptual augmentation of the notion of responsibility offered by Roth. This augmentation is predicated on the idea that Being is grounded in *actions* (or answerable *deeds*) that contribute to the unfolding collective sociocultural practices stretching from the past to the present and carrying the past in them while also incurring changes for the future. To advance this position, I consider a merger of Bakhtin's and Vygotsky's ideas that allows for a productive integration of the ethical (the 'ought') into the most basic description of human development and learning.

Keywords Bakhtin · Vygotsky · Ethical · Deed · Relationality

Wolff-Michael Roth's paper is significant in several ways. First, it offers an important reminder that the search for a truly democratic approach to reforming science education is no less important than any, even the utmost progressive and sophisticated, innovations in curriculum and teaching methods taken in isolation from the procedures of their implementation. The author's verdict on how a democratic approach to science education reform could look like is laudably straightforward and uncompromising: Unless *all* stakeholders are in control of the process and the tools required for implementing it, including teachers and students, no meaningful change is possible. A set of concrete strategies and principles is proposed for ascertaining that the reform is carried out in a democratic fashion, including those of (a) providing the space and conditions for dialogue (open negotiations) among all the participants, (b) ensuring access to participation in decision making, (c) taking responsibility for contributing to the discourse, (d) adhering to the fairness stance according to which all participants are equal, (e) treating all experiences and viewpoints as legitimate and equally worthy of consideration.

Given that today's reform in science education is still too often implemented in a top-down fashion, with changes in school environments to improve teaching and learning being envisioned and ordered by professors, principals, and superintendents (with hardly any participation by students and teachers), the message of Roth's paper is timely and useful. By judiciously spelling out and bringing together, in a systematic way, the principles of procedural democracy and by urging all involved in the school reform to adhere to them, the author does a timely service for the educational community and is likely to advance understanding and spark enthusiasm among its many members.

Yet to my mind, the strength of this paper is not only, and perhaps even not primarily, in spelling out the principles, as important and invigorating as they are, of democratizing the school reform. Rather, its strength is that it helps to reveal the deeply seated philosophical

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rationale for why these principles are absolutely necessary and, moreover, obligatory for success of this enterprise, as well as, I would add, for success in public policy in any domain as well as for the functioning of any human community striving for growth and improvement. This philosophical rationale has to do with exposing the basic features of human life and mode of existence, *how humans are* in terms of the very core of their Being. More specifically, this rationale has to do with the idea that it is the ethical dimension that forms an ineluctable foundation for the human Being. Addressing such a broad meta-theoretical question and writing at the juncture of such disparate discourses as policy of educational reform and philosophy of human existence, Roth employs an important research strategy that has been neglected for far too long in social sciences and education. Because the author does not dwell on his own strategy in any great detail, instead enacting it directly through and in his writing, I believe it is important to draw attention to its strength.

This research strategy consists in exploring and establishing bi-directional links between the broad metatheoretical (i.e., philosophical and metaphysical, or world-view level)—ontological and epistemological—premises on the one hand, and the practices of everyday life including the workings of societal institutions, on the other. The paucity of writings utilizing this strategy is striking, with discourse on educational reform rarely turning its attention to broad philosophical ideas to explore how they can and de facto always do inform practices, being enacted in them (although often unbeknownst to practitioners themselves) and, vice versa, with philosophical writings rarely exploring direct educational implications of their worldview level premises and ideas. This persisting wide gap between theory/philosophy and practice (all the traditional appeals to bringing them closer together notwithstanding) is rooted in faulty premises about the status of these two 'phenomena' and, more broadly, about the relationship between knowledge and action. Namely, when theory and knowledge are considered to be about *ideas* that exist separately from practices and actions (due to them putatively belonging to some separate 'mental' realm) and when practices are seen as a-theoretical (almost 'mindless') endeavors, then the gap between these two supposedly separate realms is doomed to remain unbridgeable and the often proclaimed appeals to close this gap—ineffectual.

It is against this background that Roth's original contribution can be addressed and understood, though admittedly not without widening the scope of discussion beyond the author's own immediate concerns and intentions. In what follows, building upon arguments developed in Roth's paper, I elaborate on the premise that the ethical constitutes the core of human Being. My main claim in this part of the present commentary is that indeed, as Roth suggests, the ethical dimension of human life needs to be reinstated, with due force, in present-day accounts of human development and education where it has been conspicuously missing in recent writings in the field. I am in agreement with Roth also in that in order to achieve this goal, a grounding concept of the human Being, alternative to those advanced in the presently dominant approaches, has to be worked out. Understanding humans as profoundly relational (social and dialogical)—a deceptively simple claim that deserves to be constantly reexamined—is an important starting point in such an endeavor, and here again I share the position spelled out by Roth. However, my strong belief is that in order to have the ethical dimension fully integrated into accounts of human development and learning, the relationality of human life has to be augmented by an understanding that human development is an *activist project* not only imbued with dialogism and interrelatedness but also grounded in answerable deeds ineluctably colored by *visions of and commitments to particular goals for and versions of social life*. Such a conceptual augmentation also allows for a more expansive notion of responsibility than suggested by Roth —namely, the notion that we bear responsibility for ourselves and others too, as well as for

the events not only in the present but also in the past, the present, and the future. This is so because our actions always contribute to the unfolding collective sociocultural practices that stretch from the past to the present and carry on the past in them while also incurring changes for the future. In arguing this point, I am suggesting a merger of (or a sort of a dialogue between) Bakhtin's ideas that are already hinted at in Roth's paper and those of Vygotsky, himself a visionary and a committed activist. In particular, I will be drawing on Bakhtin's and Vygotsky's idea (though developed by them only in an incipient form), about collective activity as the grounding for human Being in all of its instantiations, expressions, and forms. My proposal is that grounding of Being in shared activity allows for a productive integration of the ethical (the 'ought') into the most basic description of human development and learning.

The ethical as the core dimension of human life

Accounting for the ethical dimension of human development and learning is proving to be extremely difficult if not impossible in contemporary social sciences, so much so that many scholars have all but given up on this goal. This is by far not a matter of a mere happenstance or of a lack of interest in topics related to the ethics. Rather, it is the very manner to understand human beings prescribed by naturalism and social constructionism—the two approaches that happen to dominate theories of human development and education today—that dictates the exclusion of ethics and values, as well as the very discourse of responsibility and commitment, obligation and direction, and ultimately freedom and agency, from contemporary discourses.

On the one extreme, the newly resurrected naturalism (dubbed as the rediscovery of human nature) of the recent 10–15 years unequivocally states that humans are guided by rigidly pregiven, genetically ingrained adaptive structures such as brain modules that had evolved at the dawn of the evolution and became passed down to modern humans in essentially unchanged forms. The narrowly conceived tenets of evolutionary theory, such as the struggle for survival and natural selection, are called upon to explain all the intricacies and dilemmas of human life in the modern world. The solution arrived at is simple; as one proponent of this approach claims, "we're all puppets" or *machines*, under the control of genes that, in order to propagate themselves, act to instill in us a desire to procreate (see Wright 1994).

An alternative post-positivist movement, inclusive of constructivist and social constructionist theories, in a much welcomed development, shifts away from the worn out reductionist tenets such as the sociobiological ones and instead puts emphasis on the discursive constitution of human subjectivity and knowledge. Understanding the powerful role of discourse and language in the workings of social and psychological phenomena allows to debunk the modernist myth that 'knowledge', the 'self', and the 'truth' are independent from culturally and historically bound social practices. Based on this premise, important steps forward have been made by post-positivist scholars in denaturalizing and de-essentializing psychological phenomena, opening them to reflexive deliberation and critique. In stark contrast to the positivist approach, the view that human identity and experience are social constructions highlights their contingent and fluid nature, putting diversity and difference above commonality based on homogeneity. This emphasis on diversity and difference, and the associated questioning and demystification of purportedly objective scientific and other sorts of authority, is the hallmark of the social constructionism in particular as a generally democratizing movement of a vast impact in the field of social sciences and education.

However, the recent years have witnessed a rising and quite sharp criticism of the social constructivist shift (and the 'language turn' more generally), especially because in ethics, as in epistemology, this shift appears to result in a kind of relativism and even outright exclusion of any definitive standpoint and ideological commitment. At the core of this difficulty, as many authors have commented, is that social constructionism and constructivism do not seem to provide adequate answers at the level of ontology; in particular, their position is neither rich nor full enough to offer an ontological grounding to address the phenomenological and experiential realities of everyday, practical life. Therefore, as for example Williams and Beyers (2001) note, both ontologically and phenomenologically social constructionism fails to provide adequately for the ethical nature of life and relation to the other. Many writers, such as Crossely (2000), recently seem to agree that an overarching interest in discourse at the expense of a thoroughgoing analysis of non-discursive phenomena represents a weakness of contemporary social constructionist work. Alternative analytics have been offered including the ones grounded in materiality, embodiment, and analysis of power structures.

For example, one approach typifying recent revisions of social constructivism uses phenomenology of Merleau–Ponty to argue for a fundamental ontology that grasps the relation of the whole human being to the world (Burkitt 2003). Essential to this ontology are the metaphors of 'field of Being' realized in bodily perception of the sensible world, which then becomes articulated in linguistic expression. However, this and similar suggestions, although striving to represent a unified ontology of human life by going all the way back to some reality that is putatively more 'natural' and 'closer' to experiencing the world than discourse (e.g., embodied topography as suggested by Burkitt or embodied experiencing, sensuality and the like suggested in other, similar in orientation, approaches), end up with splitting this reality into interwoven but yet distinct dimensions. Taking Burkitt's work as an example, this is particularly evident in his notion that there exists "the wild *and* the cultural" (p. 336; emphasis added), that is, hybrid reality. The culturally and historically articulated dimensions appear as adds-on to the primordial 'natural' reality and Being—the one that, in Burkitt's words, is (somewhat mysteriously, I would surmise) 'constituted for humans by the natural light thrown on it by our bodies' (p. 336). But if the very sources of human Being are constituted by 'the light of our bodies,' outside of human cultural practices and discourses, then the possibility for the ethical dimensions to be implicated at the core of our being is questioned and de facto dismissed.

In my view, turning to primordial experiential reality that later on becomes extended by cultural constructions through language and other semiotic means does not offer a viable anchoring to the problem of ethics. In this case, we are back to the old, 19th century view of ethics as a separate realm of moral reasoning and moral principles that are added as a separate layer onto the primordial, ethically unconcerned and neutral, layer of life. The resulting picture is that neither the socio-constructionist and constructivist approach, nor the most recent attempts to extend them through such notions as embodiment and experience, offer ontological foundations upon which to ground ethical and pragmatic discourse, let alone a new vision of society and schooling and to shape the direction of a critical praxis.

A third-way, a coherent alternative that does not jettison the profoundly cultural grounding of all human life, embraces plurality and contingency of identity and yet does not subscribe to spurious postmodernist relativism bordering on absence of any grounding, is proving hard to develop. I agree with Roth that at the core of this difficulty is the unresolved question of a very basic sort—about the *way humans are*, that is, about the foundational character of their life and Being. One needs to go all the way back to these

basic questions and build a solid grounding at this level of analysis if the next steps of integrating the ethical into our theories of human development and of offering viable implications for the field of reform are to be successful.

I see Roth's paper as an attempt to resolve exactly the issue of developing an alternative to the dominant discourses on Being that would allow to draw more immediate connections to the ethical dimension and thereupon enrich democratic processes in social spheres of life such as schooling. The position he offers is derived from the writings by Levinas, Derrida, Bakhtin, and Nancy—a welcome expansion on the theoretical scope of sociocultural approaches. According to the composite position worked out by Roth, our capability to think is due to our common existence with others in groups (societies), which means that we are indebted to others for the capacities to be conscious, to think, and to speak. At the core of the matter is that human beings became conscious because they have been with one another. This 'being-with' is recognized to be the condition for the very emergence of consciousness, Self, same, identity, Other, objects, and subjectivity (Derrida). It is the 'we that makes possible the very idea of an ego' (Derrida). Being simultaneously is singular and plural (Nancy 2000) and an absolute alterity of the Other forms the foundation of our humanity (Levinas).

Relying specifically on Levinas's writing for his next analytical step, Roth puts forward an understanding of ethics as the condition for Being. This ethics has a 'one-for-the-other' structure—as an ethics of care, for the Other and the Self. The 'one-for-the-other' principle is seen as "the foundation of theory, as it makes possible relationship, and the point outside of being, the point of disinterestedness, necessary for a truth that does not wish to be pure ideology" (Levinas 1988, p. 136). The one-for-the-other structure underlies solidarity, the fact that all members of a community are perfectly united in some dimension. This dimension is a responsibility for others generally and for their actions specifically. Responsibility and ethics appear then as integral to and constitutive of the nature of actions and agency as the power to act and, therefore, as *preceding* Being itself. This makes each individual both indebted to and responsible for the other, implying collective approaches to change efforts, leading to an ownership of change to those who simultaneously are agents of and subject to the effected change. Thus, a route from the absolute alterity and a collective being that makes the very Self and our awareness of ourselves as selves possible to the ineluctable collectivity of change, including in school reform, is worked out.

The relational ontology coupled with the centrality of alterity and associated ethics of care together with the ensuing responsibility for oneself and others, is an important and viable foundation on which to develop principles of democratic school reform, as Roth suggests. Yet this approach is still susceptible to the risk of falling back into the old ontological traps because Being based in alterity has to do primarily with relations and relatedness—both aspects of communication and intersubjectivity—but not with subjectivity that inheres in a *purposeful acting* in the world. Namely, there remains a danger that ethics is understood as having to do only with procedural aspects of democratic processes (and human development) such as only with the ways humans communicate with each other. Conceiving caring for the other (and others) to be the linchpin of ethics that cannot be separated from the realm of morality and even the Being itself is a progressive step forward compared to abstract notions of absolute ethics and morality. But more steps might be needed if a movement toward democracy and reform is to be not only procedurally impeccable but also *headed in the right direction*. It is the discussion of what 'the right direction' could mean and why this question must be answered (or at least asked) that needs to be addressed in the next step of analysis. Considerations of the *ends and goals* of democracy and reform, what the right direction in which to develop them might be, unlike the procedures through which dialogues about such issues are to be carried out, while irrelevant in a communicative paradigm (cf. critique of

Habermasian program of 'communicative reason'), are indispensable for a project interested in shaping the direction of a *critical praxis* such as reform in science education.

It is here that the voices of Bakhtin and Vygotsky, speaking in unison, become important and even indispensable.

Bakhtin and Vygotsky in dialogue

There are important, hard to ignore commonalities between Bakhtin's and Vygotsky's life and thought that make a dialogue between them possible. Born just one year apart, they were contemporaries of and participants in the same cultural-historical epoch, witnessing the same dramatic events that shook the world, and each answering in a unique way to the same challenges of their time. Although they never met in life, their voices were part of one conversation, one social drama that was unfolding during their lifetime. Their ideas have been explored for commonalities and contrasts in previous sociocultural writings (e.g., Cheyne and Tarulli 1999; Wertsch 1991), for the most part in an effort to advance cultural-historical theory based in the notions of dialogue and dialogicality of human consciousness. Dialogue and speech in general are indeed central to both scholars' thought. No less important, however, is that Bakhtin and Vygotsky worked within and made significant advances for a deeply relational understanding of human development and consciousness, in accordance with the cultural tradition they both continued and contributed to. At the same time, they both also worked out an agentive, activist stance toward human life and being. Below I elaborate on the commonalities and differences at this level and in application to the problem of ethics between the two systems of thought.

In terms of relationality of development, Bakhtin's thinking revolves around the importance of *dialogicality* with its central message that human beings are constituted through discourses imbued with intentions and voices of others. Dialogicality, as a form of a relational connection between people, is at the very core of human life according to Bakhtin. His intention throughout his career was to provide a value-governed system ('architectonic,' in his terms) to account for the actual experiencing of the world that is possible only because individual human beings are profoundly interconnected with others and essentially come to be only through such interconnections. In his words, "[l]ife by its very nature is dialogic. To live means to participate in dialogue… [a person] invests his entire self in discourse, and this discourse enters into the dialogic fabric of human life…" (Bakhtin 1984, p. 293). In his early writings, Bakhtin also stated his deep appreciation of the value of *otherness*. An unconditioned recognition of otherness served as a crucial aspect of answerability, representing interconnectedness in its expression through 'contraposition' of self and other. The notion of *co*-participation in the everyday lifeworld which is shared among human beings is constitutive of selfhood, requiring an engaged and embodied relation to the other because it is only through my relation to a concrete other that the architectonic value of my own embodied self can be established. In this sense, "the body is not something self-sufficient, it needs the other, needs his recognition and form-giving activity" (Bakhtin 1990, p. 51).

Vygotsky too is profoundly and unwaveringly relational in his thinking throughout his works. This is particularly evident in his writings on ontogeny and the roots of psychological functions including consciousness in infancy (e.g., Vygotsky 2004). In these works, he unequivocally posits that the initial situation in which the infant exists is a primordial *sharing situation*, a social symbiotic relationship or communion. Vygotsky characterized such a situation as *Uhr-we* ('pra-mi' in Russian), when the infant is indistinguishable from the care

giving adults and essentially belongs with them together, sharing the very being with them. The roots of consciousness and self are situated in the distributed field of co-being and only gradually become differentiated from the initial social unity with the adult. This initial situation of the infant is profoundly symbiotic, where individuals are merged at the level of being and consciousness, marking uniqueness of human ontogeny that is always first shared and then individuated (though never 'a-social,' see Stetsenko 1989 for details).

Although he never used the terms 'otherness' or 'alterity' and rarely discussed dialogicality in any great detail, Vygotsky clearly attributed much value to the role of others in development, for example, giving the following account of what is involved in the emergence of indicative gesture in infancy that, in its turn, serves as a precursor for attention and self-regulation. Vygotsky argued that when the infant reaches for an object that is too far away to be grasped, first it is the adult who interprets this incipient action and attributes meaning to it, turning it into a meaningful gesture that indicates an intent to reach an object. Though the infant herself initially has no conscious intent, her action serves to communicate the infant's need to the caretaker. It is in the adult's changing interaction with the infant that the latter's desire is taken into account and fulfilled. Thus, the infant is included in communicative social activity before she has the capacity to either express herself or use semiotic and communicative devices such as gestures appropriately and competently. Therefore, it can be argued that no competence initially exists solely in the infant; instead, this competence (just as any other dimension of individual psychological functioning) emerges first in the socially distributed field of *shared activity* with an adult. It is this shared activity that provides the foundation for the transformation of the infant's behaviors into intentional indicative gestures that helps to direct attention of the adult to the child's needs and later, into psychological function of self-regulation and attention.

The role of dialogicality in Bakhtin's works and sociality in Vygotsky's are well understood and integrated in today's interpretations of their works. The point to note so far is simply that the two scholars are clearly very close in their viewpoints at a very deep, metatheoretical level of analysis in that they both adhere to a relational ontology of a shared world as the source and fulcrum for human being and development. For both scholars, unavoidable and profound interconnectedness of human beings constitutes the deepest and most significant feature of all human life in all of its expressions. On this score, their positions are closely compatible and complementary, each strengthening the voice of the other. Here Vygotsky and Bakhtin themselves are in a dialogue, sharing one world and talking to each other. This is not in the least surprising given that both scholars are answerable (to use Bakhtin's term) to the same context and within the same cultural tradition. Namely, they both follow on with the long established tradition of Russian philosophy that revolved around the notions of unity, communality, and sociality of life and being. This tradition, starting from Vladimir Soloviev's philosophy of pan-unity, itself tracing its roots back to Plato's vision of ideal unity, was the source of inspiration for practically all intellectuals in Russia of the early 20th century (and even earlier), Vygotsky and Bakhtin apparently being no exception to this trend. As one contemporary researcher notes:

> If we try to single out the central trend of Russian philosophy that can be compared with those of "rationalism" in French philosophy or "empiricism" in English philosophy, this would be "totalism." Such diverse Russian thinkers as Chaadaev and Belinsky, Ivan Kireevsky and Herzen, Vladimir Soloviev and Vasily Rozanov all put forward the category of "integrity," "wholeness," "totality" (*tsel'nost'*, *tselostnost'*) or "total-unity" (*vseedinstvo*), which presupposes, first of all, the unity of knowledge and existence, of reason and faith, intellectual and social life (Epstein 1994).

But does this commonality at the level of relational ontology extend and apply to the ethical dimension of being as elaborated by Vygotsky and Bakhtin? This is where the answer is less straightforward, with this issue having been discussed much less (if at all) in the extant literature on the two scholars' writings. First, contemporary interpretations of Vygotsky are mute as to whether he paid any attention to the ethical dimension (for one rare exception, see Tappan 1998). Second, while this dimension arguably was at the forefront of Bakhtin's thinking, this part of his conception is less clearly articulated than the notion of dialogicality and its interpretations vary widely as to the core message intended by its author.

That Bakhtin was centrally concerned with ethical issues can and needs to be understood, again, from within the sociopolitical context and cultural tradition that made his writings answerable and to which they were answerable (to apply Bakhtin's maxim to his own style of writing again). Namely, it was another hallmark of the whole tradition of Russian philosophy of the time that it did not differentiate between questions of ethics and those of rationality/truth. An ethical striving for concrete guidelines for human life, rather than abstract issues of epistemology, was the paramount and all-embracing central concern for philosophers and intellectuals of the time. Thus, it was common to address traditional philosophical questions such as the nature of knowing and reality as the pathway to answer existential, ethical questions and vice versa, to use ethical guidelines while exploring philosophical dilemmas—taking the two always in tandem and with the priority always reserved for the ethical. As one of the leading authorities of the time commented: "Philosophy, as an *academic* discipline, never took root in Russia, just as it did not exist in the ancient world. Our philosophers strived not so much to be intelligent as wise, not so much to be thinkers as sages… in a word, it is only life outside the study that seems to us of ultimate seriousness and completely worthy" (Pavel Florensky, quoted in Epstein 1996; emphasis added).

In an interpretation that has been in circulation in recent years, Bakhtin's original contribution to the field of ethics is associated with his critique of the Kantian transcendental aprioris and his elaboration of an alternative focus on the everyday, immediately given context—the 'eventness'—of life. According to this interpretation, the strength of Bakhtin's theory of the self and consciousness, tellingly termed the *prosaic* theory (e.g., Morson and Emerson 1990; cf. Hicks 1996, p. 9), is that it addresses ethical problems as they emerge in *everyday life*, in its sensuous *particularity*. It is because humans can think and act in a 'participative' fashion, in tune with the rhymes and textures of everyday life, that they are wholly answerable for their actions, in the sense of being conscious of and responsive to existential and ethical implications. Being-as-event must therefore be lived through, and not passively contemplated from afar. According to Bakhtin, each individual should understand the 'ought of his performed act [not as an] abstract law but the actual, concrete ought conditioned by his unique place in the *given context* of the ongoing event' (1993, p. 30; emphasis added). The emphasis in this and similar interpretations of Bakhtin's writing is wholly on the everyday, prosaic nature of life and experience that informs and makes the ethical possible as well as on *practical* ethics and rationality rooted in the specific actualities and conditions of the everyday life rather than some universalistic and apriori decontextualized 'indifferent Being not rooted in anything.'

It is indisputable that Bakhtin indeed reacted against absolute ethics by arguing for the importance of everyday and mundane experiences of life. However, one important aspect of his theorizing in need of more elaboration is that the grounding for the ethical and for the Being itself has to do with individuals *acting* in their world and not just experiencing or contemplating it. This theme cuts across Bakhtin's theorizing and finds many eloquent

expressions. For example, in one of his most striking observations, Bakhtin states that every thought of an individual is an individually answerable *act*. Our actions, according to Bakhtin, constitute no less than the lived world itself. As he formulates this striking conclusion, the terrain of daily life is constituted by the paramount reality in which 'we create, cognize, contemplate, live our lives and die—the world in which the acts of our activity are objectified and the world in which these acts actually proceed and are actually accomplished once and only once' (Bakhtin 1993, p. 2).

In these and similar descriptions, we are dealing with something more that a contemplative phenomenology of the immediate experience. Rather, it is a phenomenology of 'practical doing,' one that revolves around and is composed of incarnated activities. Everyday life, the lifeworld itself do not exist before or outside of the actual 'doings' by individuals and require 'actual communion' with the concrete actions that people perform. It is the concrete deed, always relational and cognizant of the others and their voices, that is the axiological center around which our existence revolves and of which it is composed. Accordingly, the ethical too is not a matter of a contemplative stance vis-a-vis being, albeit immersed in the experiential reality of the everyday world. Instead, it is a matter of *answerable deeds*, 'answerably performed acts' that constitute an architectonic reality of existence. This architectonic reality brings together the 'sense and the fact, the universal and the individual, the real and the ideal.'

Moreover, the answerable deed also brings the sphere of mundane and practical on the one hand and of the ethical and political, on the other, into a unity and thus transcends their opposition. What is at stake here is the unique phenomenological richness of each and every deed that, together, form a seamless stream of one's life as an active project of 'coming forward through doing', as 'postuplenie' (in Russian). In "*Towards a philosophy of the Act*" (1993), Bakhtin states that "[e]very thought of mine, along with its content, is an act or deed that I perform—my own individually answerable act or deed [postuplenie]. It is one of all those acts which make up my whole once-occurrent life as an uninterrupted performing of acts. For my entire life as a whole can be considered as a single complex act or deed that I perform…" Note the richness of Bakhtin's idiosyncratic term 'postuplenie.' Although literally meaning 'entering,' 'entry,' or 'joining,' and often translated in English versions of Bakhtin's works as 'deed' or 'act' due to etymological similarity to 'postupok' (literally meaning 'deed'), this term also derives from 'postup' which means 'step forward' (with a connotation of solemnity as in a measured tread) and also 'commit oneself to something' and even 'sacrifice' or 'surrender.' In Bakhtinian usage, this term captures much of these diverse connotations and conveys the sense of a process-like, continuous (uninterrupted) and dynamic (ever-changing and cumulative) unfolding and active pressing forward with one's life, as a stepping forward through deeds, as a *becoming-through-doing*. It also captures the unitary character of this process as one seamless, continuous flow understandable only in its totality, as not reducible to a chain of single discrete episodes. This totality of life is what makes each and every deed count as something that irreversibly and irrevocably, forever changes the whole life and the whole world.

The key to understanding Bakhtin's position on ethics is, I think, in this term. Both dialogicality and answerability are intricately connected with and perhaps even derived from it because each and every act or deed inevitably connects the person with other people, comes out of a life commitment and embodies this commitment, changing forever the whole dynamic of one's life and that of other people too, through each and every deed. In this sense, becoming-through-doing conveys acknowledgment of one's participation in the world, one's "non-alibi in it"—a sense that each and every act changes not only one's life (as it does) but also the world itself by leaving on it an *irreversible, and unique, seal*. Therefore, it is one's

responsibility (or answerability) to be aware of the impact that each and every act or deed carries for both the present and the future, for the totality of one's life and one's lifeworld, and in light of one's interconnectedness with others, for other people too.

Furthermore, within the unity of my 'once-occurrent answerable life' composed of deeds that *cannot be undone*, the ethical ('the ought') gains its validity and centrality. That is, the ethical becomes imperative within the view on the Being and Becoming as anchored in continuous stepping forward through our unique deeds. This is a two-fold relation. On the one hand, a person cannot act without knowing right from wrong, cannot be an actor without some goal and envisioned orientation, some commitment to a destination of one's 'postuplenie,' one's movement forward. As Marylin Frye states: "Just as walking requires something fairly sturdy and firm underfoot, so being an actor in the world requires a foundation of ordinary moral and intellectual confidence. Without that, we don't know how to be or how to act; we become strangely stupid… If you want to be good and you don't know good from bad, you can't move" (quoted in Houston 2002, p. 6). On the other hand, any and all acts/deeds entail and carry 'the right or the wrong' *in* them, because they inevitably change the world and life for better or for worse, for oneself and for others as well, even if this change is sometimes immediately unbeknownst to the actor herself. The ethical is therefore a distinctive inherent characteristic of individual activity of becoming-through-doing, and not an add-on to it. Ethical (and ideological) dimension is central in and integral to human being and becoming, including subjectivity and intersubjectivity (on the inherent link between the two, see Stetsenko 2005), if these are understood as forms of acts/deeds, and not as some kinds of addition that come about in special circumstances of a need to solve moral dilemmas. Ethical and purposeful dimensions are aspects of how we do things in the world, that is, they are integral to actions through which we come to be and continue to be in the world while always changing something in it.

The grounding of Being by Bakhtin in the activity of becoming-through-doing bears similarity to Vygotsky's position. The latter's understanding of how human subjectivity emerges within and out of shared actions with others (see the example above), to never completely break away from these actions, is indicative of the same meta-level understanding of Being as *an active project of becoming that stems from and is constituted by communal, shared forms of doing*. Vygotsky's acknowledgement of this position does not come through in his writings as a separate topic (an add-on layer to the overall body of his theory), just as the ethics never comes about as an add-on to the overarching activity of human being and becoming. Instead, it can be imputed from his reliance on the notion of collaborative transformative practice as the root and foundation of human development (for details, see Stetsenko 2005)—including initial roots of the human species itself in the tool-mediated collaborative activity—and learning. Importantly, this acknowledgment also comes through as an integral characteristic of his own activist position in his real life—due to his active participation in the socialist project of monumental societal transformation to which he devoted his whole life and his whole passion (for details on congruence between Vygotsky's activist stance in life and in his theorizing, see Stetsenko and Arievitch 2004). Importantly, both Bakhtin and Vygotsky took their inspiration from this societal transformation that they witnessed, participated in, and answered to (all the tragic faults and failures of this gigantic experiment notwithstanding), each in his own unique way, and that imparted their writings with an ineluctably ethical dimension.

It is this core position—of social activism embodied in theory and theory embodied in social activism (not unrelated to the tradition of Russian philosophy at large)—that colors the writings of both Bakhtin and Vygotsky and brings them into a dialogue. Namely, their taking an active position, an activist stance towards issues in their world and in their work

(the two being intimately related) imbues their writings with the ethical dimension. Indeed, a lack of a position is possible in philosophy only insofar as it interprets the world, but the task of changing the world makes one take a position while doing even seemingly a-practical work of theorizing the world, and therefore, turning this work and this theorizing into real answerable and responsible deeds imbued with meaning and ethics. In this, both authors follow the famous statement by Karl Marx on the tasks of philosophy in his thesis on Feuerbach: "The philosophers have only *interpreted* the world, in various ways; the point, however, is to *change* it."

While Vygotsky was an ardent Marxist, Bakhtin too adhered to similar tenets in his theory, following on with the larger Russian philosophical tradition expressed well by Nikolai Fedorov (19th century founder of Russian cosmism): "…philosophy must become the knowledge not only of what is but of what ought to be, that is, from the passive, speculative explanation of existence it must become an active project of what must be, the project of universal action" (quoted in Epstein 1996a, internet). In addition, that Bakhtin was not indifferent to Marxist philosophy, is apparent from his words that

> …a striving and action-performing consciousness can actually orient itself in the world of historical materialism. In the present context we shall not deal with … incongruities in method by way of which historical materialism accomplishes its departure from within the most abstract theoretical world and its entry into the living world of the actually performed answerable deed. What is important for us, however, is that it does accomplish this departure, and that is what constitutes its strength, the reason for its success. (1993, p. 20).

And, importantly, Bakhtin and Vygotsky both accomplish a similar departure too, as they stage their own entry into the living world of actually performed answerable deeds—and thus, history itself—both in their writing and in their lives.

Conclusion

The important point that I take from Michael Roth's paper is that responsibility and the ethical at large precede or, at least, inhere in human Being because each and every person can only *be* in a non-solitary way first, as a 'we' from which every person stems. This is the centrality of mutuality, relatedness, and interconnectedness of all of us with all others; on this view, our being is essentially always a *Co-Being* because we are never alone, in whatever we do and whoever we become. In this Co-Being, the relationships are first and foremost, that is, relationships precede individuals (while entailing them) and never disappear from the fabric of human life. And because all relationships are ineluctably fraught with ethics and ideology—conflict and power, responsibility and commitment—these dimensions turn out to be first too.

My expansion on this position, while preserving the insight of initial mutuality and profound interrelatedness of our Co-Being, and following on with Bakhtin's and Vygotsky's position, is on two points. First, this initial 'we' from which we all stem (and never completely break away) has a history behind and in it; this 'we' embodies the past and endows each and every human being with this past, while continuing itself in each and every one of us, regardless of whether we know or want it. 'I am everything I ever was'—is a poetic metaphor that brings to the fore the continuity of Being. But that is not all. 'I am much of what my parents and grandparents were,'—the poet goes on to say, now portraying more than just my individual continuity. What is captured here is the blending of

each and everyone with humanity's past, its history, that is, everything and everyone there ever was (beyond immediate family too, although mediated most often through it). In this sense, we are responsible for (and answerable to) not only the immediate present but also the past and the future, if even not immediately ours. Dwight Boyd captures this broad understanding of responsibility when he writes: "However much I am, and experience myself to be a unique individual, I am in fact already part of a mob…That is, I am unavoidably part of something that is doing something to me, for me, through me, as me" (quoted in Houston 2002, p. 8).

The second point has to do with the *active character* of history and human Co-Being. On this view, responsibility indeed precedes being because we can *become* who we are and generally can *be* only through our actions in and on the world, as collaborative agents (or actors) who participate, through actions, in the social drama of collective life, that is, the history itself. The human history, or the drama of collective life, is ineluctably ethical in that it is always about who is right and who is wrong, what is good and what is bad, which way to go, and what choices to make. In this sense, our Co-Being is an activist project of, and a struggle for, entering this history, in order to continue it and make a difference in it. It is about our *co-authoring of history* (and not only our membership in some present-day collectivities, although that too, as argued in Vianna and Stetsenko 2006), through our answerable deeds which together form our struggle to find a way to contribute to history from within our uniquely given world and, more importantly, our uniquely undertaken commitment to changing this world in a particular direction. In other words, our Co-Being is an active—and even activist—project of becoming ourselves as profoundly interconnected with the others, yet distinguishable and unique human beings, and moreover, it is a project of becoming and being oneself *through making a difference in the world*.

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Developing and maintaining solidarity: A partnership between high school teachers and college faculty[7]

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Abstract This essay explores Roth's ideas about the importance of democratic processes and the development of solidarity in the implementation of education reform efforts by applying these ideas to a qualitative case study of a project in which a team of teachers and college faculty created a new integrated high school science course. The project was part of the Math and Science Partnership of Greater Philadelphia (MSPGP), which is one of many MSP projects throughout the United States aimed at supporting instructional improvement in K-12 math and science. This study suggests that reform efforts, regardless of the strength of initial democratic structures, may improve their level of democracy, given efforts to foster participatory structures. However, the process is not necessarily easy or straightforward, as institutionally assigned power differentials between group members are likely to impact the development of solidarity. Further, the conflicts and tensions that may arise in the interactions will likely impede some individuals' participation regardless of potential long-term benefits to their continued involvement in the project, such as the increases in everyone's action possibilities and the development of collective goals that Roth describes. Through a comparison of situations in which active participation persisted through times of conflict with those when it did not, this study suggests that it is important to foster conditions for solidarity–building interactions on the micro-level, in addition to working towards the longer-term outcomes that Roth describes. In order to fulfill this potential, the policies, and hence, processes and structures of funding opportunities such as grants should be altered to support authentic collaboration among key players in all stages of the design of reform projects. In addition, this essay extends Roth's ideas about the role of partial interests in collaborations. While at times the partial interests interfered with the development of common goals, as Roth's essay suggests, at other times the pursuit of such interests was a crucial step in stimulating participants' initial involvement in the project, insuring that individual perspectives were not muted in favor of consensus, and developing shared platforms. Overall, this study suggests that applying Roth's principles to science education reform efforts that are currently underway has the potential to create greater solidarity amongst relevant stakeholders and in the process, make reform efforts more democratic, ethical, and coherent with the goal of solidarity.

Keywords Education reform · Partnerships · Solidarity · Curriculum · Project design · Funding policy

Introduction

Roth's article, "Toward Solidarity as the Ground for Changing Science Education," presents a philosophical foundation for a more equitable and just science education research and reform process. Grounding his argument in the writings of Levinas, Roth describes how

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because we are indebted to each other for consciousness itself and responsible for the outcomes of each other's actions, we are "solidary" in that we are united along one or more dimensions. He suggests that acknowledging the inherent solidarity of all people should lead to a sense of mutual responsibility and the pursuit of goals that are collectively constructed, rather than partial interests. Roth uses examples to indicate that in science education reform efforts, it is often these partial interests that are sought, negotiated, and attained at the expense of common ones. His argument serves as call to action for others engaged in science education research, reform, and professional development efforts to collaboratively develop goals that increase everyone's action possibilities rather than attempt to implement "top-down" policies that can exacerbate inequities and constrain some participants' possibilities.

To illustrate his argument, Roth provides some data from a study of a research/reform effort promoting technology use in classrooms. He describes how although the researchers sought student and teacher involvement, the reform was not implemented in a democratic way.[8] As an example, Roth discusses the researchers' response to their own dissatisfaction with some of the teachers' infrequent use of the technology. When some of the students expressed an interest in more opportunities to use technology, the researchers told them to go to their teachers and ask for them. In this type of interaction, the students' goals of using more technology could be met, and the researchers' goals of pressuring the teachers to increase their technology use could be met, but the teachers were not brought into the discussion, so they did not have the chance for their perspectives to influence events. Roth describes how both the researchers and students were meeting their partial interests and coming to some kind of "agreement" rather than working together with the teachers to develop shared goals. In other words, the researchers and students were engaged in an alliance (you pressure your teachers, then I will supply you with technology) rather than a collaboration, in which all stakeholders would be involved in making decisions and solving problems.

Along similar lines, Roth critiques the use of financial incentives for involving participants in research/reform efforts, since such an approach is based on a negotiation of partial interests (teachers get money, researchers get their goals for the project met) rather than the development of shared goals. Roth's argument suggests that people will invest their time in a reform effort without financial incentive if they believe it will lead them to have more autonomy and independence in their work situation, as this contributes to what he refers to as "positive emotional valence." He writes:

> Being radically committed to democratic values, my involvement in these projects was grounded in an understanding that meaningful change usually occurs when those concerned are in control of the changes and in control of the tools required for implementing them. …those concerned need to be able to define goals, which they always will do such that the projected outcomes *increase* their control over the reigning conditions (rather than feigning commitment and then resist change, as the teachers in the vignette). This is so because the projected increases in personal control and room to maneuver have a positive *emotional valence* (a subjective measure for the chance of success [positive valence] or failure [negative valence]), which is the central feature that drives conscious goal formation and determines the selection of unconscious operations that realize the goal realizing actions (Roth 2007).

An implication of his argument is that reform efforts should emerge from the equal participation of all stakeholders in the process. In this way, all stakeholders will be

[8] Roth conceptualizes "democratic" as "the power of each and everyone to contribute to decision-making processes."

committed to the reform, which will be based on common goals rather than partial interests.

Roth's critiques and suggestions for change have potential for wide application. Yet efforts towards democratic changes in science education research/reform efforts face substantial challenges. The tendency for 'partnerships' to be based on negotiation of individuals' goals rather than on collaboration to create new, shared goals is prevalent in education research and in many other domains. Many structures, such as the processes for applying for grants, may encourage alliance types of partnerships. For example, those who work in academia are busy given the various expectations for their position and may struggle to meet application deadlines. Therefore, time is often not allocated to involving all potential stakeholders in developing shared goals before the proposal is written. In addition, grant applicants often need to describe specific outcomes for projects in order to be attractive to funders. However, describing specific outcomes in advance opposes a process of developing emergent goals based on the development of common platforms over the course of a project.

However, it is not just the "fault" of such structures; such an explanation is overly simplistic. There are numerous factors that contribute to projects leading to the negotiation of partial interests rather than collaboration to create shared ones. One issue is that it may be easier to get commitment from people by appealing to immediate interests, which are often partial, rather than the promise of long-term increases in action possibilities that are an outcome of collaborative reform efforts.

Roth provides clear guidelines for projects aimed at a more collaborative and consensus-building process, which include an emphasis on dialogue, how "each participant must consider legitimate the experiences of all other participants," and how everyone needs to have opportunities to develop an understanding of the issues at stake. He describes some studies that can serve as examples of research/reform efforts that are planned based on a sense of solidarity, with directions for change that are jointly constructed by all stakeholders in order to increase everyone's action possibilities. However, these examples are a very small percentage of science education research studies and many of them are small scale, such as one or two teachers working with several classrooms of students. Further, the examples are in some ways ideal circumstances, as they were planned, implemented and evaluated with the goal of creating a more democratic and equitable research process. Yet Roth's recommendations would be advisable in all types of situations, not necessarily just those that are small scale. His essay suggests the need for exploring the possibilities of implementing a collaborative model more extensively throughout the science education field.

What about projects that are already underway, and that are not initially conceived of as democratic? Is it possible to make relations between participants more equitable than they are even if the initial project was not developed collaboratively? Perhaps there could be some kind of continuum from democratic to traditional, rather than a dichotomy of reform efforts being either one or the other. At one end of the continuum could be a change that is completely imposed by above. For example, in a "top-down" reform, teachers may be held accountable to implementing a particular instructional approach, their actions might be monitored, and they might have limited opportunity to have an impact on the goals or the process. At the other end of the continuum would be the types of situations that Roth describes, with goals co-constructed with all stakeholders from the very beginning. If we think of a continuum rather than an "either/or" situation, reforms that are not initially conceived as democratic can still move in that direction, and it is possible to apply Roth's recommendations to a wider array of projects.

Therefore, one area for exploration that I address in this paper is the process by which projects might move toward the more democratic end of this continuum, and the factors that can either support or inhibit this process from occurring. I investigate these issues through a qualitative study of a project that involved college math and science faculty in the work of school districts.

Description of the project

The project was part of the Math and Science Partnership of Greater Philadelphia (MSPGP), which is one of many MSP projects throughout the country aimed at supporting instructional improvement in K-12 math and science. MSPGP's focus is on grades 6–12 in the greater Philadelphia area, with 46 school districts and 13 institutions (colleges and universities) as core partners. MSPGP uses a Core Connector model, in that it facilitates partnerships between teachers, administrators and faculty from higher educational institutions. One motivation for involving college faculty members in the work of schools is that they can share their expertise and resources. Through their involvement, it is hoped that teachers will further develop their content and pedagogical content knowledge, which will have positive effects on their self-efficacy, the quality of their instruction, and student achievement. While a project involving faculty members in secondary schools has some characteristics of a traditional reform, in that the initial idea did not emerge from collaboration with all stakeholders, the MSPGP staff built into their planning and took specific actions in order to make their programs more democratically oriented. Their strategy was intended to encourage the formation of both solidarity among the faculty and teacher participants and reciprocity in that the faculty members would engage in discussions of pedagogy that could potentially affect their own teaching.

In examining interviews of both faculty and teacher participants in the MSPGP program, it is apparent that there was some variation in how participants perceived various facets of solidarity within the project, such as mutual respect for each other's perspectives or a sense that the project will increase their abilities to realize their goals. For example, one teacher involved in the project describes, "Working with faculty helped me to see the big picture … I enjoyed working with him, as he was a colleague interested in teaching." Another teacher states, "I did not think the faculty respected our knowledge." What accounts for the variation? What lessons can be learned from this partnership in order to inform future reform efforts so that the interactions are more like those among colleagues who respect each other and work towards common goals? Applying Roth's ideas to understanding when solidarity developed, when it failed to develop, and why, could provide insights that could benefit other projects working towards a more ethical approach that increases all stakeholders' action possibilities. In this paper, one of my goals is to explore these issues by focusing on one of the MSPGP projects in which a school, Linden High, worked with faculty to revise its curriculum by creating an integrated science course.

In some ways, solidarity as Roth describes it can be thought of as an outcome of democratically oriented reform (in addition to solidarity being a precondition of human existence). Aspects of this outcome include the development of common platforms, participants' sense of responsibility to each other, and participants' commitment to the project. Yet along the way, it is possible that interactions that may initially seem like they are detracting from solidarity end up contributing to it in some way. For example,

partial interests may come into the dialogues, as these inform participants' experiences and perspectives. As participants seek to have their partial interests represented within whatever common platforms that develop, conflicts are likely to arise. Certainly in the interest of not sacrificing individual perspectives to one dominant viewpoint, they should not be suppressed; what is important is that rather than pursuing these individual interests, common interests develop over the course of the project. Yet such conflicts may temporarily disrupt participants' feelings of solidarity, and could even undermine the shared platforms that had been previously accepted. What would help such interactions lead to the solidarity that Roth describes over time? In the interest of addressing this issue, I explore the relationship between Roth's ideas on solidarity and the sociologist Randall Collins' (2004) conception of solidarity, which focuses on micro-level interactions, as it applies to evaluating and improving science education reform.

Solidarity in the MSPGP project

Depending on how a project in which college faculty work with school districts is implemented, there are some potential barriers to the development of solidarity. Some of the assumptions behind this reform could be interpreted as follows: Teachers lack the content knowledge required to do their jobs, and faculty somehow can give this knowledge to teachers. It is possible that in working with teachers, the faculty would disregard teachers' current knowledge and experience, and decide what types of knowledge are important for them based on their own values rather than on values that are shared. If this occurs, the goals are not collaboratively constructed, and teachers would have little say in the professional development in which they are participants. The teachers would not view the reform as increasing their action possibilities, and would not gain a positive emotional valence (Roth 2007) through their participation. Such a process would be inequitable and undermine the formation of solidarity among participants. Another way in which this type of reform process could not support solidarity among all participants is that it only involves teachers, faculty and administrators, rather than including other stakeholders such as students. For the purposes of this paper, however, I focus on the potential for solidarity between faculty and teachers, as this in itself is an important goal.

It is important to note that inequality is not always in the directions that are most obvious. Although the faculty members are more advanced in their subjects, teachers may feel more expert about teaching in high schools. Therefore, in some situations, teachers could make the faculty members feel isolated and ineffectual, rather than the reverse. Though this section focused more on the possibility of teachers feeling alienated from the process, I do not want to imply that college faculty members have power and the teachers do not. Instead, the potential for inequalities varies depending on the situation.

While there are some ways that solidarity could be difficult to achieve in an endeavor involving faculty in schools, in other ways this change could contribute to solidarity by promoting the idea that teachers at all levels, from K-16, are responsible for a student's science education. Rather than a situation in which college faculty can "blame" high school teachers for their students' lack of skills, faculty members through their participation in K-12 instructional improvement efforts acknowledge the collective responsibility for students' science education at various phases in their educational careers. Just as Roth describes how we are responsible for each other in that our utterances shape the meaning of the utterances of prior speakers, so do the teaching practices of college faculty members

shape the meaning of the practices of high school teachers. Similarly, through participation in such a reform, teachers acknowledge that they are not only responsible for their students' education for the school year, but also for students' continued abilities to participate in science-related communities. They are responsible not only for what goes on in their classrooms, but also for the earlier and later phases of students' education.

Certainly there are some limitations to involvement of faculty in instructional improvement in secondary school science. One issue is that not all students continue with the study of science in college, so an emphasis on the continuation of students' science education excludes many students' pathways. Even with this limitation, the idea of teachers at different points working together to shape students' science education experiences, to discuss how the subject matter should be learned and taught, to explore similarities and differences in their ideas about science education and goals for students, and to collaborate on instructional improvement, could both build solidarity between faculty and teachers and lead to positive outcomes for all participants. It is possible that the positive emotional valence that Roth describes would develop for everyone, as they begin to integrate others' perspectives in formulating their own action plans for educational improvement.

It is therefore important to attend carefully to how such a reform is implemented, and to assess whether the interactions between participants lead to solidarity rather than the negative emotional valence that can come from inequities between participants. Solidarity among the faculty and teacher stakeholders is important not only for the ethical reasons that Roth describes, but also for the very practical reason that the process of involving college faculty in the work of schools, will be considerably more effective if teachers welcome their participation and feel empowered by the process.

Efforts to foster solidarity in faculty/teacher interactions

The involvement of faculty in MSPGP was intended both to support teachers' content knowledge and to promote instructional reform, such as increasing teachers' use of student-centered, inquiry-based approaches. The researchers and staff of MSPGP were very much aware of the potential barriers to solidarity between teachers and faculty in such a reform, and intended to make the *process* by which faculty work with teachers characterized by equitable relations. In their planning meetings, the following issues frequently emerged in the conversations: (1) it is important that teachers feel respected in their work; (2) it is important that faculty learn from the teachers, as well as teachers learn from the faculty; (3) it is important that faculty have some background in secondary school education reform before starting their work in schools. These issues directly informed the preparation of new faculty working with the program. For example, faculty members were not just immediately paired with schools; the first step was for them to attend workshops on innovations in high school pedagogy and be observers in teachers' meetings and in classrooms.

In addition, rather than having faculty adopt the role of telling teachers what they need to know and how they should teach, MSPGP has worked to structure formats for involvement that increase the possibility for collaboration. For example, rather than having the faculty members plan and teach the week-long summer institutes for secondary school teacher professional development, there was a concerted effort to have faculty/teacher pairs plan and teach the institutes together. Other formats for involvement that were participatory and potentially solidarity-building included disciplinary symposia in which teachers

and faculty discussed topics of mutual interest, and designing a high school course collaboratively with faculty members and teachers. This latter format for involvement is the focus of this paper.

Comparing conceptions of solidarity

In this section I compare Roth and Collins' conceptions of solidarity in preparation for evaluating the development of solidarity in the Linden High project. There are some overlaps between the ways Roth and Collins discuss solidarity, yet there are also quite a few differences. While solidarity as Roth describes it relates to ethics and responsibility, the solidarity that Collins describes focuses on interactions and may be marginally related to ethical content depending on the situation. The relationship between the two may be helpful to unpack, as in evaluating reforms, it might be easy to focus on one and assume that the other follows. For example, if participants appear to be having positive interactions, it may be assumed that solidarity in the way that Roth talks about it could emerge, but it may not be so. Conversely, conflict and awkward social interactions may appear to undermine solidarity in the sense Roth describes, but in the end may not if it is an effective way of discussing different perspectives and leads to some type of resolution or shared platform that reflects a common interest. For the purposes of clarity, for the remainder of this essay I italicize Roth's conception of solidarity. To further clarify, there will be times when I refer to Collins' conception as "interactional solidarity."

Solidarity as Roth describes it is an outcome of people acting based on a sense of responsibility and the recognition that we are "one for the other." It is associated with more equitable relations between all members of a community. He describes:

> This one-for-the-other structure underlies *solidarity*, the fact that all members of a community are perfectly united in some dimension. This dimension, as I show here, is responsibility for others generally and for their actions specifically. Responsibility and ethics are integral to and constitutive of the nature of actions, and therefore agency, the power to act.

Rather than a fleeting sense of belonging to a group, it implies a long-term commitment to others within a larger community and to ethical relations. It can therefore be thought of as existing over an extended time scale.

While Roth's conception of *solidarity* emerges from a focus on ethics and responsibility, "the collective agency toward common (rather than partial) interests," the sociologist Randall Collins does not specify any ethical imperative underlying solidarity. He draws on the work of Durkheim, describing how solidarity emerges from the collective effervescence within successful interaction rituals (IRs) characterized by bodily co-presence, a build-up of mutual focus, coordination of voices and body language, clear boundaries regarding who are the participants in the ritual, and the development of a common rhythm and mood. As an example, he discusses how in religious rituals, participants' movements and voices can become increasingly coordinated and contribute to feelings of solidarity among the group. An outcome of this solidarity is high levels of emotional energy (EE) for the participants and investment of EE in the circulating images and sounds.

While Roth seems to view *solidarity* as an underlying condition of human existence as we are all responsible for each other, Collins portrays it as a primary and immediate goal for individuals as they choose in which activities to engage or with which groups to

associate. Participants feel drawn to symbols that circulated in prior successful IRs, will invoke them in the future, and will seek groups in which these symbols are used. For example, as people exit political rallies during which the speaker was effective in soliciting synchronous cheers from the crowd, these individuals may have a greater desire to talk about politics, place bumper stickers on their cars, hang signs in their windows, and join political groups.

Unlike Roth's *solidarity*, Collins' concept of solidarity views the relevant unit as the interaction or the situation, which are short-term events. However, there is a more extended time scale aspect to Collins' ideas in that these situations accumulate in "interaction ritual chains" which form the basis of group membership and identity. Series of successful, solidarity producing interactions will result in emotional energy invested in the symbols of the group and a sense of belonging. As such, an outcome of an interaction ritual chain may be a sense of *solidarity* as Roth describes, in feeling responsible for others within a community. Roth does invoke Collins' description of solidarity, suggesting that the commitment to the goals of equality and democracy can serve as sacred symbols uniting a group. Successful interaction rituals, providing micro-level solidarity, can produce commitment to *solidarity*. He writes, "Once stakeholders in science education get the idea that they are "in it together" and that reform only exists when everyone changes, this idea also may serve as a focal artifact that produces the sense of solidarity."

While the solidarity that Collins describes can emerge around symbols that have an ethical content, it can also emerge around symbols that do not. It is possible that partial interests can serve as a compelling mutual focus and unite a group, whether it is a professional class, an ethnic group, or a peer group. In such a case, there would be solidarity in Collins' sense, but not *solidarity* in Roth's sense. For example, teachers can experience a sense of solidarity when talking about "problem students" and students may experience a sense of solidarity making fun of teachers, yet the mutual foci of such discussions serve to divide rather than unite, and there would be no accompanying efforts to involve all stakeholders to improve the classroom community. In the case of research/reform efforts, if stakeholders experience solidarity with others similarly positioned, and not with everyone involved, solidarity may develop, but not *solidarity*, and the reform is unlikely to be implemented in a democratic way. One important question for evaluating a research/reform effort is to ask where the boundaries are drawn in the solidarity-building interaction rituals that take place. Do they include all relevant stakeholders or are some positioned as outsiders?

There may be some paradoxes that can develop in thinking about the two types of solidarity. Solidarity in Roth's sense is not only an extended timescale concept, but also seems to be extended in space, in that it encompasses all humans. While Roth discusses *solidarity* in relation to particular projects with limited numbers of participants, the ethical foundation implies *solidarity* among all. In contrast, Collins conception of solidarity is tied to a clear sense of boundaries to outsiders, as without such boundaries there is no ritual, no sense of who is caught up in the common rhythm and mood and who is not, and no group. Though certainly there are some groups in which a larger sense of *solidarity* between all humans and a sense of mutual responsibility serve as important symbols, solidarity is just as likely to exist among groups that do not embrace these ideas. Collins (2004) writes, "Durkheim provides a model of how solidarity and shared symbolism are produced by interaction in small groups; thus it is an easy extension (although admittedly Durkheim did not make it, and might well have been hostile to it) to see these groups as local, ephemeral, or mutually conflicting, rather than integrated into one large society. 'Collective conscience' can exist in little pockets rather than as one huge sky covering everybody in the society" (p. 14).

Further, even in a successful IR, a sense of solidarity and the accompanying EE may develop for some participants and not others. For example, an IR among five colleagues that references a recent sports game may be entraining for the four who have seen the game, yet not be successful for the one who missed it. Levels of EE can vary among participants when IRs are centered around power differences, such as when lower-ranked soldiers show deference as they salute higher ranked soldiers. Rituals with strong power effects can result in emotional energy invested in the relevant symbols for those in greater power, yet a loss of EE for those in lesser positions of power.

While in Collins' view the drive for solidarity in interaction may be universal, solidarity itself is local and dependent, emerging in interpersonal interaction at times, yet not at others. Collins writes, "the 'society' that is held together is no abstract unity of a social system, but is just those groups of people assembled in particular places who feel solidarity with each other through the effects of ritual participation and ritually charged symbolism" (p. 41). In contrast, Roth's *solidarity* seems to be a more universal concept, integrally tied to ethics of human relationships. While people may not always act out of a sense of *solidarity*, such as when they pursue partial interests at the expense of common ones, it is still a basic condition of human existence.

Yet the interpersonal solidarity-producing interactions that Collins describes can foster awareness of and sustain *solidarity*. It is possible, as Roth points out, that the ideas of equality and responsibility to a larger community can serve as foci for successful IRs. In addition, if solidarity develops between participants who are differently positioned, they may feel themselves part of a larger community and be more inclined to pursue common goals rather than partial interests. Cogenerative dialogue that generates solidarity on the micro level has the potential to generate "pockets of solidarity" from which collaborations can emerge. To get to the *solidarity* that Roth describes, in the sense of people being united in common goals, micro-level solidarity in interactions is one important path. One question is how can those engaging in research/reform efforts foster conditions that can generate localized solidarity-producing interactions, with the boundaries encompassing all stakeholders? Another question is what conditions can foster common goals emerging out of the experience? It certainly is possible that solidarity-producing interactions could fail to be sustained, or fail to lead to the sense of *solidarity* and the accompanying democratic reform that Roth describes.

Another point of difference between Roth and Collins' approaches is how they address the issue of emotions. Roth describes a "positive emotional valence," which is the outcome of increased control of action possibilities. Collins discusses how emotional energy is a direct outcome of the interactions themselves. These interactions may or may not lead to increased action possibilities, yet there is a temporary emotional payoff merely through participation. Loyalty to the group, and decreased individual action possibilities can certainly be an outcome, as people might give up individual control in exchange for solidarity through interactions. Roth seems to be more focused on emotional outcomes in a longer time-scale, while Collins refers more to the emotional payoff in the present interaction. Yet Collins does also address longer time scales through discussing how individuals seek interactions in the future that produced an emotional payoff in the past.

In determining the development of *solidarity* over the course of the project, it is certainly important to attend to the long-term outcomes, such as shared platforms and whether what transpires increases action possibilities. Yet there also seems to be a need to understand the relationship of the micro-level solidarity to these longer-term goals, as these longer term outcomes are composed of these shorter-term interactions.

Designing a new science course

Roth criticizes many reform efforts because they are implemented in a top-down manner. He writes:

> In such top-down situations, the control over the conditions and changes therein lay with those situated higher up in the institutional hierarchies… At this point in time, the organization and change of schools, however, is structured hierarchically. Thus, change is often implemented from the outside, for example, through the regulation of science education content and teaching methods from regional or state (province) governing bodies. Teachers and even more so students have little or no say with respect to the science curriculum.

In contrast to a top-down process, he writes that it is possible to instead have a goal of *solidarity*, the collective agency toward common interests.

While many reform efforts are structured hierarchically as Roth describes, there are some situations that are neither completely "top-down" nor completely collaborative. The integrated science course that is the focus of this paper falls in this category, as there was not an open discussion among all stakeholders about having a new course, and students were not directly involved. The initiative for the new course came from the science department head. He describes the motivation for this change:

> The origin of the project began as—It became evident when the science standards were released…that it's virtually impossible for a school district to address the PSSA's [Pennsylvania System of School Assessment] standards under a traditional set up of biology, chemistry, physics. The other thing that I find more important is that…We start to look at what we're doing in schools, and we have a tendency for students to see sciences as separate entities…I wanted these kids to see more of a connectedness. In other words, to be able to read something and if they would pick up the *New York Times* or *Time Magazine*, and become scientifically literate. And look at an article, it's rarely an article that's going to be strictly about biology. It's going to involve the different sciences, which means a kid has to have a broad understanding of how these sciences are connected.

However, the department head wanted the process of creating the course to be conducted in a participatory fashion. If we think of the goal of *solidarity* as being on a continuum rather than a dichotomy, in some ways this project could serve as an example of a move toward greater *solidarity* in reform efforts. Rather than positioning himself as the only decision-maker, and imposing a new integrated course on the teachers or setting up a course developed by external experts in the field, the department head, in partnership with MSPGP, formed a development team of four of the high school teachers and three disciplinary faculty members. In addition, all meetings were facilitated by a MSPGP staff member, who conceived of her position as supporting and facilitating the process. She maintained a role of providing clarification overviews of the evolving work for the purpose of supporting the dialogues, rather than setting the direction for the project. Occasionally a second or third MSPGP staff member would join meetings where their expertise would be particularly useful for the discussion.

In this situation, teachers would not be forced into a particular curriculum or set of practices to implement; instead, they would be part of the design team and therefore have considerable impact on the content and teaching methods. All members of the team voluntarily participated in the project. Faculty received a semester-long course release for

their overall participation in MSPGP projects, and the teachers were given coverage for their classrooms so that they could attend all the planning meetings and work sessions.

The plan was that the entire process would be collaborative, from the initial conception of the topic through the design of the units, lessons, and assessments. The intention was for all participants to have equal voice. The department head describes the process:

> I found the collaboration among the people very, very interesting. …From the beginning it was a complete collaboration among everybody. So there were 10 people, I had 10% of the say. And it was interesting because it went smoothly. I was very happy with it, and very happy with the way it came out.

The course was developed over the course of eight months, with meetings held every two weeks. Initially, the meetings focused on deciding the main themes and goals of the course, with many discussions about the best way to teach sciences in an integrated manner and in ways that were relevant to students' lives. While at first the discussions centered on the greenhouse effect as the theme for the course, the group ended up deciding to focus on energy. The participants describe this as a decision that was made collectively, indicating that common goals had emerged from the discussions rather than one participant's ideas being privileged. The department head describes:

> In fact, the original idea when the MSPGP staff and I first spoke, the idea we would maybe do it around like a greenhouse effect. It didn't make any difference—this or that. It was great. We did it by committee, and we said, "Well, let's do the energy one." And we dealt with it and that was it. I wasn't concerned with that.

In the sessions following, the participants constructed concept maps, broke into groups to identify the sub-topics, and brainstormed units and activities. The course was completed at the end of the school year and taught the following year.

Approaching the principles for democratic reform

Interactional solidarity mitigating the struggles for consensus

In his essay, Roth provides a set of principles designed to make workplaces more democratic. In this section I will evaluate the Linden High project using these principles, and explore the factors that contributed to both successes and problems regarding the development of *solidarity* between faculty and teacher participants. By applying these principles to this reform effort, I intend to uncover some issues that would be helpful for others attempting to implement reforms that are less hierarchical and more participatory.

Roth writes, "Dialogue fundamentally is a process of exchange; points and arguments move back and forth between all participants." In a similar manner, the Linden meetings were structured to encourage back and forth discussion. Both the initial discussions about the topic and the later sessions in which lessons were developed were characterized by dialogues, which included arguments and points made by the participants. However, both teachers and faculty described the process as having a "slow start" or as being initially a "struggle." While this may seem to be a somewhat negative comment, it does indicate that decisions were not made in advance by the department head. Every step had to be arrived at through consensus achieved in the process of dialogue. Perhaps "slowness" is a necessary characteristic of a process that is not "top-down" and that seeks to integrate a variety of perspectives. One of the teachers discusses how she also felt a struggle to have her perspective represented:

> Many of our sessions were quite a struggle. When the course was first proposed, it was going to address environmental issues like global warming, and then it evolved to Energy as an over riding concept.

There is the question of how to retain the interest and engagement of participants if the sessions are experienced as difficult. It is possible that some would withdraw in frustration, either physically or through reducing the amount of their verbal contributions. Roth provides part of the answer in his discussion about the positive emotional valence that comes with the increased action possibilities. This idea seems to suggest that participants will stay involved in the dialogues if they know that they will lead to increased control over the conditions of their workplaces. In this case, the teachers in particular would have the incentive to remain actively involved, as they would be teaching this course in the future. Yet there is still the question of whether participants can keep that long-term increase in action possibilities in mind. In this particular case, in comparing teacher engagement in the beginning stages of the course development, it seems that the micro-level solidarity, and the levels of emotional energy in the interactions, were also relevant factors impacting engagement.

For example, on one of the days early in the project the participants divided into groups of three or four participants to speak about various goals for the course. In the two groups that I observed, one of them had teachers and faculty speaking animatedly. The participants leaned toward each other and had synchronized body movements. The scientific ideas served as an effective mutual focus, and there was smooth turn-taking between participants, which serves as evidence of the solidarity (Collins 2004). This micro-interactional entrainment corresponded with at least a temporary type of *solidarity* in the sense that there were relatively equal amounts of time given to all participants speaking and that shared platforms evolved that addressed the diverse experiences and perspectives. This indicates that inequalities were not salient. Further, there was considerable uptake of each other's ideas. Rather than "talking over each other," the faculty and teachers listened to each other and incorporated the ideas in subsequent statements. The expertise of both parties, such as the faculty member's subject content knowledge and the teachers' knowledge of the subject and the high school environment came into the discussion. Even after the session was officially over and lunchtime had begun, the participants continued to talk, indicating that they had experienced high levels of emotional energy through participation.

In contrast, in one of the other groups, the two faculty members were doing most of the talking. While the teacher did at times attempt to speak, his comments were not often taken up by the other participants. Solidarity seemed to develop between the two faculty members, who completed each other's sentences, had coordinated movements, and demonstrated enthusiasm in their body language and statements. However, the teacher did not seem entrained in the rhythm of the conversation. Over time, the teacher stopped talking altogether. Though his active participation in the discussion could have increased his long-term action possibilities, in the sense of his having an impact on the emerging course, the lack of solidarity in the immediate interactions dampened his participation. This would serve as an example where a lack of solidarity at the micro-level between all participants contributes to a lack of *solidarity;* since the teacher withdrew, his ideas were not considered, relations were unequal, and *solidarity* failed to develop.

Why did the interactional solidarity (and *solidarity*) seem to develop in one case and not the other? This is a hard question to answer definitively, but one issue may be that in the second group, there was only one teacher, which may have contributed to inequalities in the interactions, while in the first group, there were even numbers of teachers and faculty.

Also, there might have not been a good match-up between participants in terms of the emotional energy they brought to the interactions, their confidence, and their levels of cultural capital. Poor match-ups can contribute to failed interactions (Collins 2004). In any case, perhaps it would have been beneficial for the leaders to intervene in some way if the failure of the interaction of the second group was observed.

This is just one of many examples that indicate that attention to solidarity on the micro-level can have implications for the development of *solidarity*. If not everyone is caught up in the interaction and gains emotional energy from their participation, it is unlikely that everyone can be equal participants. Therefore an important feature for such dialogues is not only ensuring not only that all participants have an awareness of the increased action possibilities, but also that the interactions are set up in ways to be conducive to the development of micro-level solidarity.

Partial vs. common interests

In describing the principles, Roth also writes about importance of coming to shared platforms on which all can agree. He discusses how such platforms should lead to the realization of common rather than partial interests:

> *The dialogue continuously must seek to produce agreements that are platforms for future investigations and practical action*. Akin to *catalytic authenticity* (Guba and Lincoln 1989), the extent to which change-related action is stimulated and made possible, this principle intends to foster the negotiation of platforms from which the realization of common rather than partial interests can be envisaged. If each stakeholder group pursues its own, partial interests, there are possible, often-likely, and sometimes irresolvable conflicts between these interests (Holzkamp 1979). Arrive at agreement and common platforms means that all stakeholder groups can buy into the negotiated action plans and their concrete realization in the daily school praxis.

In applying this principle to the Linden High project, the actual discussions seemed a bit messier with regards to whether common interests rather than partial interests were being sought by participants. Roth points out that the common platforms that emerge from dialogue will end up reflecting everyone's interests, as they increase the action possibilities for all participants. The Linden High dialogues suggest that in the initial stages of dialogues, the common platforms may not yet be apparent, and therefore people's contributions are likely to reflect their own experiences, which may reflect partial interests in addition to common ones. One issue is that it is not easy to define a "partial" as opposed to a "common" interest, as they are often overlapping; sometimes it is difficult for a person to disentangle what is right and good for the community from what is right and good for him or herself. For the purposes of the following discussion, I will define an expressed partial interest as a statement that reflects the personal and/or professional interests of the individual who is making the particular contribution.

In the discussions about the theme for the course, participants often raised issues that were salient to them as professionals. One of the faculty members frequently discussed the importance of introducing advanced chemistry and physics content and including numerous opportunities to integrate math and science. His desire to have this material in the course related to his interests as a college professor, as he felt that this knowledge was lacking in his college students and believed it would be more rewarding to teach students if they encountered this material in a high school course. Though his advocating for

particular content is not a direct "personal" interest, as it is unlikely that any of the students in Linden High will attend one of his classes in the future, his concern for this issue still emerges from a partial interest. The relationship of his arguments about the type of content that should be taught in their course to his partial interests is evident in interviews when he talks about the incentive for his involvement. The following quote is one of many examples:

> One of my purposes was if they were doing more of these kinds of things at the high school level, when they get to me they would be better prepared for the kinds of things that we're going to have them do. And it would make their life a lot easier. I think we would see more retention of students after that first couple of semesters of science.

Similarly, one of the teachers who frequently stated a concern about the necessity of content being concrete and having direct relevance to her students did so partly out of conceptions about what constitutes good education, but also partly because it is more rewarding to teach students who are engaged. As another example, one of the teachers made numerous comments advocating for more biology content included in the course, as she felt that initially it focused too much on physical science. Of course it is in the common interest for students to learn biology, but her statements can also be seen as related to having her discipline sufficiently represented, which would make the course easier and more interesting for her to teach.

In some ways, partial interests can be thought of as not necessarily "selfish," but instead related to "solidarities" formed within different communities. The college professor experiences solidarity with others in his discipline, and the teacher with her students. Therefore, having these "partial interests" as part of the discussions helps insure the representation of other communities within the newly formed community of the course development team.

On a more general note, in interviews of faculty working with MSPGP, a common theme is that their initial involvement emerged from their interest in teaching students who had more experience with advanced content and scientific inquiry. Therefore, they wanted to get involved with improving instruction in high schools. In some ways this partial interest was extremely beneficial, as it served as the incentive for devoting their time to projects in schools. As the faculty members continued with the project, many of them worked with teachers to develop common goals, and they pursued these goals in addition to their own initial interests. Therefore, there was a kind of symbiotic relationship between the partial and common interests, as it was the partial interests that spurred involvement.

Are partial interests and common interests necessarily opposed to each other? While the goal of dialogue is to generate collective strategies, it does seem that if all voices are to be heard, perspectives such as these are desirable features of the discussion. Often in the Linden High discussions, rather than leading to stratification and undermining *solidarity*, the partial interests were valuable resources that helped lead to the common platforms that all participants were able to welcome. While there were some arguments, the teachers' and faculty members' desire to make sure their own areas of expertise were represented helped to determining a common topic—energy—that could meet everyone's needs. The choice of energy seemed to be a good one in being able to accomplish the varied goals of participants, integrate the different disciplines, contain applications for mathematics, have direct relevance for students, allow for considerable opportunities for inquiry, and address many of the other issues raised by both the teacher and faculty participants.

Similarly, the different types of expertise of high school and college teachers made it easier to reach common goals, when understanding of what is expected from students in college, combined with the knowledge of the high school environment, informed decision-making. The department head describes the role of different participants' contributions in coming to common agreements:

> I really enjoyed it. I found it very interesting when you talk to higher ed people, the depth of knowledge is greater than mine. And yet, it was interesting because when you start to talk about ninth grade kids, their only experience with a ninth grade kid might be one of their children. So, they really don't know how to approach a ninth grader. Its 'here's what we want to teach,' but 'here's how you do it from a high school perspective.' Here's the information we want to give them, but how do we bring it to them, to that level where they can get it. And that's why the two were so great, because we had knowledge on one hand from the higher ed people. And then the high school people said, "Well, here's how we can present it to the students." So it was a very smooth way to do things.

The differences in opinions and ideas that sometimes were sources of tension and led to struggle, many times were also a source of value. One of the faculty members describes:

> And we just kind of worked—we worked side by side, and we kind of went back and forth with ideas. Most of the questions that I had for them were, "You know, is this appropriate for this grade level?" Because that's one of the things that I don't always know. "Is this something a ninth grader can really do?" I only know that from, like, looking at, possibly, what my two sons were like at that level. So …it was, kind of, a give and a take. We were more working with them as partners.

In examining patterns regarding when the potential conflicts between partial interests ended up leading to a consensus, overall it seemed easier to develop common platforms when "larger" issues were being discussed. One way of thinking of the platforms as they emerged in the course development is as concentric circles. The largest circle was the idea of a challenging, inquiry based, integrated-science course that would be relevant to students. All of the participants readily embraced that idea. The next was the course topic, which also eventually led to an agreement among all participants, even with some struggle. In these situations, the various perspectives that the participants brought, their professional knowledge, and even their partial interests as they were expressed in the discussion, contributed to a progression of thought and common platforms. Roth argues, "All participants know that the agreed upon plans and actions, because they are oriented toward *common* interests, inherently do not suppress the interests of mutual others, be these individuals or (stakeholder) groups." These larger platforms seemed to represent all participants' interests. But the common visions did not replace the partial interests; rather, they existed alongside them. Rather than one or the other, participants' moves can be in the service of both.

However, as the circles became smaller and details were being discussed, consensus was sometimes harder to reach and shared platforms did not always emerge. One of the teachers describes:

> I think we all seem to agree about the big picture, but how to get to that big picture, what specific activities we want to do, I think everyone came in with their own because we were all from different curriculum areas, we all came in with our own bias. And I think that that was one of the larger areas of conflict. Some teachers felt

> like it was being slanted initially in the physics direction and the biology teachers… sort of resented the fact that none of the biology material was being covered. And we had to find a way to balance that need, because we all went agreeing initially that this is going to be a cross-curricular thing, that it's an integrated science course so we need to integrate the science…So that was an issue that a number of teachers were concerned that their curriculum specialty was being shorted, I guess is a good way to put it.

This comment indicates that even when the larger platform of an integrated course was agreed upon, it was hard to maintain consensus in the lesson planning. However, in this case they were able to appeal to the shared platform of an integrated course in order to move forward, and the end product had representation from all of the content areas.

In some other cases, conflicts arose that did not always get resolved. One main source of conflict was the level of science content that students should encounter in this course. A teacher discusses this issue: "Let's see, the biggest issue I think…the fact that the higher ed and the high school teachers had different thoughts going in about the students' skills." One of the faculty members describes his position that the content should be more advanced than most people think high school students can handle:

> Never assume what a student can or cannot learn…I think if you give it enough stimulus, I could get a ninth grader to come in and do the (college level) research.

This issue was very difficult to resolve, as appealing to the common platforms of an integrated course that focused on energy did not help to resolve it. In the end, some of the teachers and faculty felt that their perspectives were not fully represented in the activities. One of the faculty members described how he felt that there were important scientific ideas that were left out. One of the teachers describes:

> At times I felt that we were working at cross-purposes. One of the college professors was very concerned about units and would argue quite a bit about using Joules vs. Calories. This is an intro course for freshmen. Most of whom are 14 years old and will never be in a college chemistry classroom. If they need to learn about different units, they can do so easily if they are that level of student. Does the unit of energy matter in the overall scheme of a course that is trying to engage 14 year olds?

Perhaps some of the conflicts would be taken care of if the faculty were also participants in the teachers' high school classrooms, so they had some direct experience with the students. A situation in which the teachers and faculty members shared responsibility for teaching would have been even more desirable. Roth writes:

> *Experience in the classroom under discussion is the foundation for participation; coteaching and co/learning are forms in which outsiders may gain experience*. Research on collaboration and workplace improvement showed that participants in change efforts need to understand each other, which often means that a common discourse has to be established that includes the mutual viewpoints. Crucial is that participants reflect on shared objects, situations, and experiences, where shared initially means that all have participated in the event but may have different experiences. In such situations, there is a great likelihood that all parties are in possession of the same level of information, a condition for the fairness in the evaluation of the issues at hand (Guba and Lincoln 1989).

In this case, it was not feasible for the faculty members to be in the classrooms on a regular basis, as their involvement with MSPGP was in addition to an already busy work schedule at their colleges. Rather than working together in high school classrooms, the shared experiences consisted of hands on work with the materials for the course experiments. Therefore, when they discussed what students could or could not do, the conversation remained rooted in participants' individual experiences. It should be noted it is possible that faculty views on the level of content that students should encounter would be reinforced, rather than altered, by working alongside teachers in their classrooms. However, in doing so, at least there would have been some shared classroom events that could have entered the discussions.

The issue of the level of how much science content to include comes up continuously in the transcripts, and *solidarity* in these situations was difficult to reach. However, interactional solidarity was still possible, and seemed to be a "cushioning factor" that could prevent the conversations from breaking down entirely.

Interactional solidarity mitigating conflict

In this section, I discuss some of the specific interactions, illustrative of other similar incidents, in order to discuss the relationships between conflicts and the two types of solidarity. In this first vignette, the whole team was discussing whether to include certain ideas in chemistry in a lesson that they were writing:

> Faculty member: if they can understand something about the Faraday effect which is deeper than little electrons going from one place to another
> Department head: that's the problem. They have very little background
> Faculty member: OK. But there is nothing wrong with saying here is what the molecule looks like. And give them the Chemistry of what is going on. If they get it, fine. They have all seen a potato, and wiring up potato and getting electricity. If they have questions fine, and if not, they will when they get to chem.. some will see that.
> Department head: well look lets develop it and see where it fits in
> Faculty member: I am trying to say lets not be afraid to go deep
> Department head: OK. Well.. what is it exactly that we want students to get.
> MSPGP staff: that's right, lets come up with the concept. At the heart of the first one see that heat produces light. What will we do with the (inaud) is that light is used to produce starches and sugar.
> Department head: wait .. is it not that we want them to get out of it.. Here's the way I see it. The whole idea is that the plant turns it into an energy source. The plants need these starches and sugars to live.
> Teacher: I think that energy flow in ecosystems is the main concept. I think we can get rid of the yeast activity. We have a photosynthesis activity…there is already too much on a molecular level. You need to make it bigger for ninth graders.

While most of the talk was between the faculty member and the department head, one of the teachers also began as an active participant in the discussion. In this excerpt, the teacher's comment indicated that she did not think it was beneficial to emphasize content at the molecular level, as it was important to make it "bigger" for the students. However, as this dialogue progressed, she withdrew from the conversation and started talking to one of her colleagues. The faculty member and department head continued to discuss whether to include the advanced science content in the lesson.

Solidarity in Collins' sense was not reached in this particular interactional event. There was some "talking over each other," and the withdrawal of one teacher from the conversation. In addition, the other teachers did not contribute to the main discussion at all. It is possible that between the two teachers who began talking amongst themselves there was a "pocket of solidarity" but it did not encompass the whole group. In addition, *solidarity* seemed to be obstructed, as the dialogue ended without any resolution or shared platform.

Interestingly, it was not a simple case of one participant feeling empowered and another feeling ignored. Based on interviews, it seems both the faculty members and the teachers had a negative response to these types of interactions. The failure to achieve micro-level solidarity and the accompanying failure of *solidarity* between teacher and faculty participants is not just a result of hierarchies; while it could be argued that faculty are positioned as content experts, and therefore have some more authority, in this case it was a bit muddied. The faculty member did not get to see his recommendations included, and in the end the teachers taught the unit as they preferred. In this case, the process was neither "top down" nor was it democratic and *solidarity* producing.

There were a variety of ways in which participants either addressed and/or avoided these types of conflicts. One strategy was avoiding situations in which the issue of "how much content to include" was likely to emerge. In some of the work sessions, groups would form that involved two faculty members working with each other, or two teachers working with each other. While this may be just a coincidence or a byproduct of the mix of the disciplinary knowledge of the team, it may also indicate people's tendency to seek solidarity-producing interactions, which are more likely when sources of conflict are reduced. However, dividing in groups in this way may have been detrimental to building the *solidarity* required for a democratic reform process. In order for this *solidarity* to develop, it seems that it would be important for the issues to be raised and dealt with, rather than avoided. In addition, if we conceptualize interactional solidarity as a pathway to *solidarity*, it is also important for differently positioned participants to have opportunities for successful interaction rituals with each other.

Another conflict-avoiding strategy that occurred infrequently was for teachers and faculty to add parts to lessons that were written by other team members, such an extra "fact sheet," or a table to provide students with more structure in the laboratories. One of the conditions that often led to this outcome was when someone had an opinion or idea that was not overtly supported by the other members of the team. These incidents raise the issue that in a democratic process, even if everyone seemingly has equal voice, some participants may not get to see their ideas, perspectives and goals reflected in the product if they have a minority opinion that runs contrary to the ideas of most of the other members of a team. Perhaps a relevant question is whether it is more important for everyone to have equal voice, which entails a focus on input and process, or to have an end project that increases everyone's action possibilities, which entails a focus on outcome. While these could cohere at times, at others they may not; a focus on equal voice could lead to suppressing a minority opinion, and a focus on the end project could end up reflecting the ideas of one individual who others agree has more foresight and is able to "solve the problem," or could end up with a mix of options for how to proceed rather than a true consensus.

Equal participation may therefore not lead to commitment to the project and a positive emotional valence among all if people do not feel their contributions were equal in the results. This variety in perceptions of "equal contributions" is evident in interviews with some of the participants after the project was over. For example, one of the faculty members describes:

> I think this project was the best one I worked on and I felt like I contributed a great deal to it. It was different from other projects in that there was a clear goal, a known deadline, and the amount of work that needed to be done couldn't be realistically accomplished by the high school teachers. We had to work together or there wouldn't be a class ready for the students in the fall.

In addition, one of the teachers described how he felt he had a substantial influence on the process and was pleased with how it turned out in the end. However, one of the teachers expressed a concern that environmental issues were not adequately included, "I was disappointed that there was not a more environmental approach to the course …I feel strongly that this is a disservice to our students." While she was a frequent contributor, somehow the outcome did not reflect this emphasis as much as she felt it should. Another of the faculty members described how while he liked the product, he felt his contribution was not as great as it should have been. This variety in satisfaction with one's own role in the process has implications for the emotional valence that Roth describes.

In the cases where rather than coming to an agreement though dialogue, the science course ended up with some optional parts, a question is whether or not these types of "add-ons" undermine *solidarity* and should be avoided in these types of products. Roth writes that in a collaborative process, people need to raise issues directly and in dialogue, rather than take action independently. However, could one acceptable (and ethical) outcome be an agreement that independent action is the best course because the issues are too difficult to resolve? It is possible that although such strategies avoid dialogue, they increase everyone's action possibilities by insuring different voices are represented in the final product? For example, creating fact sheets facilitates the introduction of advanced chemistry content for those to wish to do so. Or, is this proliferation of options an undesirable outcome that dialogue could have helped deter?

While sometimes participants used strategies to avoid conflict in working out the details of lesson creation, there were also other times in which the issues were worked through. There were conversations in which the issue of depth of content came up, yet both faculty members and teachers maintained their participation in the process, questioned each other, and found some type of resolution. I use the following example, representative of other incidents in order to explore possible reasons why this was effective sometimes, yet not at other times. In this vignette, one of the faculty members and two teachers were constructing a diagram of energy flow. There are several points that recall the conflict over the level of science content that should be taught, yet unlike the above transcript where the faculty member persisted and the teacher withdrew, all three participants stay engaged and they work out the issues by creating a demo that they think will both interest the students and convey the material.

> Faculty member: But before that.. you have hydrogens and carbons coming in, but take out CH_2O.
> Teacher 1: It just confuses them.
> Faculty member: do we want to make these the same numbers? The brilliant ones say there are 3 carbons here and only one there.
> Teacher 2: if they are brilliant they are in honors
> Teacher 1: brilliant is not the problem.
> Teacher 1: didn't we want producers consumers, carnivores, omnivores.. in this. And do you want to have the O_2 going back?
> Teacher 2: here is another thing.. do you want to see coal coming off of this? This will give a connection to the fossil fuels.

Faculty member: this comes back to electrons. If these guys mention electrons, right here, do we define what an electron is?
Teacher 2: what do we tell them is energizing the plant to produce food?
Teacher 1: this is too much.
Faculty member: here if we have molecules at a certain level of energy—but the sun raises the level…
Teacher 1: can we do model building where we take H_2 molecules and make a sugar, so that we end up seeing there is more stress and strain in these molecules, and there is therefore more energy there. Instead of having you do this, the sun does this. Is it useful? I don't know if it's useful.
Faculty member: I don't know if we have energy here.
(laughter)
Faculty member: you have more of these. Need to put energy into it. Like your room.
Kate: I think "organized" is a better way. You take low energy molecules, organize to high energy.
Faculty member: To do that, you need to do something. Can't just stare at them.
Teacher 2: would you do a demo? I would give them balls and stick…
Teacher 1: to me I think this is an overwhelming amount of stuff,. I think there are big leaps here… Once that energy is stored in sugar, we need to discuss respiration
Faculty member: So that is where the food log comes in.
Teacher 1: Respiration is a component of this
Faculty: are we relating this to our own respiration?
Teacher 1: No. We are not
Faculty member: we don't want to?
Teacher 1: No we are not. My experience is that when kids learn respiration—they can't make the connection between Cellular respiration and breathing.
…
Faculty: you know what they can handle, and what to get across as long as we set up … but they need to make a connection between the staining of the iodine
Teacher: so you give kids a leaf.

In this interaction are numerous points of conflict, then resolution. The participants question each other and insure that their points are heard, yet also acknowledge each other's contributions and expertise, such as when the faculty member says, "you know what they can handle, and what to get across … but they need to make a connection between the staining of the iodine." All are taking responsibility for what happens, though Teacher 1 and the faculty member are more active than Teacher 2.

One difference between this dialogue and some of the others is there was shared laughter and coordination of vocalizations and movements, indicating that at least on the micro level, solidarity did emerge at times. This event and others suggest that interactional solidarity can have a role for the formation of *solidarity*, in addition to the relationship that Roth describes of ideas such as equality serving as focal artifacts. Interactional solidarity can also serve as the "glue" so that when the conflicts emerge, the participants remain engaged and committed. They may perceive some benefit to continuing to participate actively, as they are gaining emotional energy through the interaction ritual, and building a shared sense of the situation at the same time.

The next question is how to set up the conditions so that dialogue characterized by conflict can still be somewhat solidarity producing. One feature of the second vignette that seemed to support solidarity was that this group was assigned to develop the lesson, which

meant that some type of product had to emerge, and they had to do it together. In the other situation, there was active facilitation by the department head. This may have contributed to the perception that it expedient for some participants (in this case the teachers) to withdraw, and for some participants (in this case the faculty) to persist in making a point. The scenario may have been interpreted by both faculty and teachers as appealing to a higher authority to resolve a conflict (in this case the department head) rather than actually having to work out an agreement.

Certainly the department head's intention was for all participants to have equal voice. But it is important to recognize that "equal voice" may be difficult to reach when power inequalities are inherent in relationships. It may be that participants expected the department head to come up with a solution, and therefore wanted to convince him or avoid the discussion altogether as it was not worth the investment. This incident suggests the need for constant attention to how participants may "read" a particular situation given current realities of power relations, if the goal is to have everyone's voice be equal. In the first transcript, active facilitation was detrimental to the process, whereas the lack of facilitation in the second transcript meant that the participants had to work it out amongst themselves, and had some investment both in making the interaction work and in coming up with some solutions. The differences in opinion were apparent from the beginning, but they were spoken aloud and the work of creating the lesson continued.

Roth notes, "possibilities for participation are an insufficient condition: everybody is responsible for taking the opportunities for contributing to the discourse." Applying this principle to the faculty/teacher collaborations, the question is not just whether the format is structured to allow both teacher and faculty participation, but do the participants feel invested in the process and empowered to act. To insure that this is happening requires considerably more work on the part of organizers than just setting a project in motion, as it important to conduct ongoing assessment as to whether the opportunities are being taken up, and collaboratively plan for changes when they are not. In this case, setting up conditions for interactional solidarity might lead to persistence through the struggles that are likely to accompany dialogue between differently positioned participants.

Conclusions

Based on this study of the creation of a new course at Linden High, it seems that even projects that are already underway and that may not have begun as democratic can become more so, given efforts by those who are guiding the process of change. In this case, the department head's decision to have the course created by a team of teachers and faculty members with the intention for everyone to have an equal voice was an important step toward a more ethical process that is consistent with the development of *solidarity*. In this paper, using Roth's principles to better understand the process was helpful in illuminating both the successes of the project as well as the areas that could have been changed. While in this case the analysis was conducted after the project ended, it seems that applying Roth's principles to science education reform efforts that are currently underway has the potential to make the process of change more democratic, ethical, and coherent with the idea of *solidarity*. In addition, these principles hold the promise of making reforms more effective, by securing the input, commitment, talents and resources of those who are most affected by the changes and can insure their success.

In addition to providing insight into this project, this case study also raises some questions and issues regarding the application of Roth's principles related to the

"messiness" that characterizes collaboration between differently positioned stakeholders with varied motivations for participation. In these conclusions, I discuss the following issues: (1) the importance of considering power differentials in a collaborative process; (2) the importance of considering different time scales; (3) the role of partial interests in a democratic process. In doing so, I also raise some questions for further investigation.

Power differentials

Although the project was initiated by the department head, overall the course development process was characterized by dialogue and decision-making that utilized the expertise and perspectives of all participants. However, even such a process could not eliminate the reality of the power relations that shaped participants' professional lives. In the one example where the faculty member advocated including advanced chemistry concepts, and the teacher withdrew from the conversation, the roles that participants played in the interaction seemed influenced by the perception that the goal was to "convince" the department head. Certainly his role of starting the project in the first place would reinforce this idea. Therefore, when the situation was perceived as one in which the goal was to appeal to him, rather than to reach consensus, it interfered with the democratic process.

Even if the department head had not initiated the reform, power differentials would have still been relevant. Workplaces, and schools in particular, have hierarchies, and there is therefore likely to be a tension between the idea of equal voice within dialogues and the everyday navigation of these hierarchies. Power differentials can therefore undermine collaborative processes in spite of the intentions of those involved. Similarly, in Olitsky and Weathers (2003), we discuss how a research process that was intended to be ethical and provide student and teacher participants with equal voice did not always succeed in this regard, as interactions could reinforce larger societal inequities. It seems that despite intentions for change, there is no space that can be completely free from power relations. The persistence of power differentials further emphasizes the importance of Roth's argument that stakeholders must actually take up the opportunities for participation, rather than just have these opportunities available to them.

Although power relations inherent in school structures can derail the process of "equal voice" it does not necessarily have to do so. In the Linden High vignette described above, the department head was in the front of the room acting as a facilitator, which likely reinforced existing power relations. Yet at other times, these power relations were not as salient, such as when participants were working in smaller groups. In trying to work toward a democratic process, it is therefore important to acknowledge that power differentials exist and cannot be eliminated entirely. A more realistic goal would be to strategize regarding setting up conditions for interactions in which these differentials are less salient. Perhaps one possible change, in addition to promoting small group work, would be to rotate the facilitation role among participants.

Time scales

Another issue that this study suggests is the need to take multiple time scales into account when thinking both about the development of *solidarity* and the impact of a reform process on a particular participant's emotions. Roth describes a main incentive for participating in democratic reform efforts as a *projected* increase in action possibilities and "control over

the reigning situation." (italics mine). The results of this study suggest that although this projected increase in control has a role in fostering participation and commitment, long-term outcomes may not be a sufficient motivation to sustain participation within unsuccessful interaction rituals where participants may experience a loss of emotional energy (Collins 2004) in the short-term. For example, there were times when participants withdrew from conversations that could have increased their future control of the situation because of a failure to achieve solidarity (in the sense that Collins describes) in the immediate interactions. There were also times when people exercised control over the situation by avoiding interactions in which they would need to discuss difficult issues with differently positioned participants. This is a strategy that makes sense for avoiding a loss of emotional energy in the short term. However, this strategy may not help bring about the positive emotional valence from a more active role in shaping the outcome of the course which may entail open discussion of difficult issues. Similarly, there may also have been a reduced risk of a loss of emotional energy by adding fact sheets or other "extras" to a completed product, rather than engaging in the difficult interactional work of explaining an unpopular viewpoint to others.

It could be argued that perhaps the problem was that people's long-term action possibilities were threatened in some of these situations. For example, the teacher who withdrew from the small group conversation early in the process may have felt a negative emotional valence (Roth 2007) from a perception that his voice did not matter in addition to a loss in emotional energy (Collins 2004) that came from a failed interaction ritual. However, even when progress toward common goals was being made, such as when the topic for the course was being discussed, some participants felt frustrated and were inclined to withdraw from participation. In other words, in the messy interactions that constitute collaboration between people with very different ideas and perspectives, it may be hard to keep in mind the idea of the formation of common goals and increases in everyone's room to maneuver.

Some questions that emerged for me: Does achieving *solidarity* in reform efforts require participants to make some type of rational calculation of the steps they should take that would lead to later increases in room to maneuver? Does this calculation somehow overcome a tendency to seek emotional energy through immediate interactions in cases where these interactions are likely to be difficult? What if people cannot see that the "struggle" of dialogue will help in the end in terms of achieving their goals? It seems like evaluating progress toward *solidarity* needs to be conducted at several levels. In addition to applying Roth's principles, such as examining whether relations are characterized by respect for others' viewpoints and by equal voice among stakeholders, it may also be important to foster situations where interactions on the micro-level could be conducive to the building of solidarity (Collins 2004) between differently positioned participants. If this occurs, engagement will be more likely to persist through the difficult times.

Partial interests

Another question that emerged in applying Roth's ideas to the Linden High project is how to conceptualize the role of partial interests in a collaborative process. While Roth suggests that the pursuit of partial interests may detract from the formation of common interests, in this particular study, the role of partial interests was unclear. Sometimes the pursuit of partial interests, in the form of professional interests, was a crucial step in stimulating participants' initial involvement in the project, in insuring that individual perspectives were not muted in favor of consensus, and in developing shared platforms. Coherence

between the expression of partial interests and the development of common goals occurred more frequently when the focus was a large issue, such as deciding on the format and theme of the course. Yet at other times, particularly when the details of lessons were being worked out, conflicts arose due to pursuit of these interests and it was difficult for participants to agree.

Some questions that arose for me: Could there be some times when there is a contradiction between partial and common interests, yet other situations in which they support each other? If so, what should be the role of these partial interests in a democratic process? What if there is a situation in which there is no solution that increases everyone's action possibilities? In these cases, are the compromises and negotiations, which Roth describes as detracting from a democratic process, the only possible solution? Can a particular goal that is agreed upon by all present be considered a "common interest" simply because all of the stakeholders' partial interests are adequately addressed, or at least because no one's possibilities are constrained? Perhaps a distinction needs to be made between a "partial interest" that detracts from *solidarity* and shared goals, and a "valued perspective" that can help in developing common goals. Yet these are often closely intertwined, as our perspectives often emerge from partial interests. Overall, in developing Roth's ideas further, it might be helpful to investigate the complexity regarding the role of partial interests in a democratic process. In addition, it might be helpful to further develop guidelines regarding how to proceed when the divergence in stakeholders' interests is such that it is extremely hard to increase the action possibilities of everyone involved.

Future efforts

One issue that merits further exploration is the relationship between the long-term outcomes of *solidarity* that Roth discusses and the immediate sense of solidarity that Collins describes as emerging from successful interaction rituals. While this paper has addressed this relationship somewhat, more questions than answers emerged. Based both on transcripts and interviews in this study, at times participants seemed to feel like they were "in it together." Yet at other times, some participants felt that they were working at "cross-purposes," as one teacher describes, even as they were engaged in a dialogue intended to lead to joint decision-making. A sense of being "in it together," as with any other focal artifact, seemed to be fleeting, waxing or waning depending on the emergent interactions. The study suggests that a sense of *solidarity* and a commitment to equality is more stable as a focal artifact when the group interactions themselves sustain a localized sense of solidarity. It seems to be easier to have a sense of membership within a small group of people in the same physical space than allegiance to an idea, so perhaps reform efforts would work best when facilitators plan for ways to make them coincide.

Roth writes, "I believe that the problems we experience today have to be changed by dialoguing and by working together, both of which presuppose our original debt to the Other, acknowledged and recognized in the praxis of collective responsibility." An important route toward this end is to better understand how to maintain this sense of collective responsibility through collaborative processes that may be difficult, and may sometimes lead to a loss of emotional energy for participants. This study suggests that there are some steps that can be taken to foster successful interactions among differently positioned stakeholders. These steps can include insuring that there is a balance of representation within small groups or setting up tasks that must be accomplished collaboratively. In addition, it would be beneficial if the structures related to applying for

grants were changed to cohere with the need for negotiation and the true partnering that builds toward solidarity. For example, funding could be provided to promote collaboration in the initial planning stages of projects, rather than for outcomes that are specified prior to gathering stakeholders together. Overall, further research on how to support collaborative efforts and foster successful interactions among participants would be helpful to those planning for a more democratic education reform process.

References

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