COTEACHING/COGENERATIVE DIALOGUING: LEARNING ENVIRONMENTS RESEARCH AS CLASSROOM PRAXIS

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ABSTRACT. Critical educators have leveled a methodological critique against traditional forms of classroom research because they both objectify teachers and students and lead to results that do not enhance praxis. Over the past decade, we have developed coteaching as a context for learning to teach and supervising teaching, on the one hand and, on the other, as a method for doing research on and evaluating teaching. Coteaching involves an equitable inquiry into teaching and learning processes in which all members (or representatives thereof) of a classroom community participate – including students, teachers, student teachers, researchers, and supervisors. In this article, we articulate coteaching in terms of activity theory and the associated first-person methodology for doing research on learning environments that is relevant to praxis because it constitutes an integral part of praxis. A detailed case study exemplifies coteaching and the associated research on learning environments.

Over the past two decades, learning environment research has become a firmly established form of research on teaching and learning (e.g. Fraser, 1998; Fraser & Walberg, 1991; Haertel, Walberg & Haertel, 1981). Although earlier re-

searchers mostly used questionnaires, more recent studies enact and recommend the use of a range of observational and interpretive methods (e.g. McRobbie, Roth & Lucas, 1997; Tobin & Fraser, 1998). Questionnaires and interpretive methods enhance each other in the sense that interviews are used to probe in greater depth what individual students and teachers have to say about their classrooms and the resources used to support their learning.

Each methodological approach makes use of a particular set of constructs, developed by researchers with or without prior interpretive research, that probe the way in which people understand their relationships to the contexts in which learning occurs. As theories of teaching and learning change, so do the constructs and, with them, the learning environment questionnaires, which frequently make use of combinations of old (proven) and new scales. Each construct and the methods used to research learning environments "reduce[s] the complexity of what happens in classrooms, and focus[es] on selected aspects of student and teacher actions and interactions" (Tobin & Fraser, 1998, p. 624). As these researchers point out, however, each theoretical frame with its associated set of constructs constitutes only one window into learning environments. Because observation and theory are tightly related, neither can be foundational in the comparison of competing theories (e.g. Kuhn, 1970). The choice of theory, and therefore the range of observable phenomena, will reflect the values of researchers and their educational praxis.[1]

In this article, we propose a different way of doing classroom research grounded in a theoretical framework that has as its basic value the primacy of human agency. This agency, or power-to-act, includes the capacity of individuals to participate in creating their lived-in world rather than merely being determined by it. We ascribe to a fundamental value that researchers can select the form of inquiry which they find appropriate to explore the puzzles that underpin their research on learning environments. Accordingly, in this article, we do not participate in the pervasive critique that adherents of this theoretical framework have launched against the use of questionnaires, surveys, and experimental research (e.g. Dreier, 1991; Markard, 1984; Holzkamp, 1991a; Tolman, 1994). Rather, we elaborate on our approach to research on learning environments which, among others, contributes to overcoming two persistent gaps in education, between educational theory and teaching praxis and between the praxis of research and the praxis of teaching.

Over the past decade, we have developed *coteaching* not only as a form of teaching but also as a way of learning to teach, doing research, supervising new teachers[2], and evaluating teaching in classrooms (e.g. Roth, 1998a; Roth & Boyd, 1999; Roth & Tobin, 2001). Coteaching is based on the fundamental idea that practices can be understood only from the perspective of the participating

subject (e.g. Markard, 1993), thereby requiring researchers to coparticipate in teaching in order to understand it. This first-person perspective provides us with a radically different view of classroom events and classroom environment; readers might want to explore this view for themselves.

In this article, we exemplify our theory-oriented work at two levels. First, we co-generate theory together with teachers and students, with whom we already shared the classroom experiences, for the purpose of improving the practices of teaching and learning. Because of the equitable relations between participants, this is 'open theory', a democratic process of generating understanding and explanation. Second, we simultaneously theorize the activity systems of teaching/learning and researching at a meta level, which allows us to account for the presence and interaction of researchers with the phenomena researched. Because of the particularities of human practices (e.g. meaningful and mediated subject-object relations), only first-person (subject-centered) perspectives allow us to recognize salient meanings and motivations that subjects (teachers, students) deliberately use to ground their actions.[3] Activity theory allows us to account for the mediated nature of human activities and therefore to counter those theoretical approaches which reduce humans to reactive and externally-determined beings. Our framework therefore explicitly accounts for the fact that human beings participate in the shaping of their (learning) environment rather than merely reacting to given conditions. We begin by articulating activity theory and use it to frame our *coteaching/cogenerative* dialoguing paradigm at a meta-level. We then provide a concrete case study of learning environments within the *coteaching/cogenerative dialoguing* paradigm.

1. ACTIVITY THEORY, TEACHING AND LEARNING ENVIRONMENTS RESEARCH

We practice *coteaching/cogenerative dialoguing* as a method to deal with the problems created by a separation of theory and research from teaching. Here, we articulate *coteaching/cogenerative dialoguing* practice in terms of practice-oriented and practice-relevant activity theory. Activity theory and the associated subject-centered (first-person) research approach are based on an assumption that it is inherently futile to attempt to understand human activity independent of contexts and that human practices can best be understood from the perspective of praxis (e.g. Holzkamp, 1991b; Leont'ev, 1978). Human beings and their environment, including researchers, are theorized as part of a fundamental unity. When we consider learning environments in terms of activity, we simultaneously theorize research and its object (e.g. the praxis of teaching and learning),

thereby removing the gap between theory and the praxis that research seeks to explain. Teaching, learning, and researching are regarded as constitutive parts of daily classroom praxis (e.g. Roth, 1998b, 2000).

1.1.   *Activity Theory*

Social science research generally focuses on what people do and, given certain external conditions, how they participate. In this way, human cognition, beliefs, attitudes and so forth are theorized independently of the external world, which itself is taken as the source of external stimuli that bring about responses. However, this approach to human knowing has been criticized because the contributions that human agents make to constructing and structuring their environments are not included in an integral way (e.g. Lave, 1988; Leont'ev, 1978). Activity theory is explicitly based on an assumption that humans are co-creators of their (learning) environment. They are agents of change with the power to act. Hence, activity theory regards learners as active creators of their learning environments rather than as passive reactants in a learning environment.

In most theoretical approaches, the unit of analysis is the individual human subject that engages with an object. In contrast, activity theory articulates activity not only in terms of subject-object relations but also accounts for other entities (tools, community, rules, division of labor) and the mediating influence that they have on pairs of other entities (e.g. Engeström, 1987). In learning activities, these entities and the mediated relations in which they participate constitute the learning environment. That is, activity theory simultaneously and dialectically articulates the human subject, its learning environment, and the (mutually constitutive) relations between both (Figure 1). For example, in classroom research, the student is the *subject* of the activity and her primary *object* is (an aspect of) the world (Figure 1, top right). Teaching is motivated by the intent to assist the student in changing her relation to the world and thereby to provide the student with an increased potential to act in the world. This increased potential to act is the *outcome* of the activity. In this process, *tools,* including pedagogy and subject matter language, mediate the student's relation to the object (i.e. world). That is, the relation between the subject and its object is *mediated* rather than being of immediate nature. What makes activity theory non-reductionist is that subject, object, and tools also participate in other mediated relations. For example, the society (*community*) mediates the relationship between student (*subject*) and pedagogy (*tool*); that is, because tools have cultural-historical origins, the activity of teaching and the associated learning environments for students are connected to and mediated by factors from within and outside of the schools.
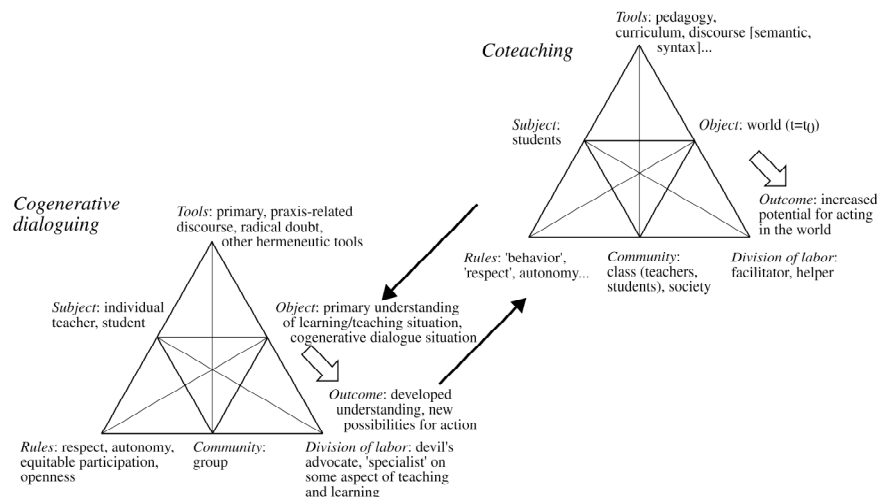
Coteaching

Tools: pedagogy, curriculum, discourse [semantic, syntax]...

Subject: students

Object: world (t=t_0)

Outcome: increased potential for acting in the world

Rules: 'behavior', 'respect', autonomy...

Community: class (teachers, students), society

Division of labor: facilitator, helper

Cogenerative dialoguing

Tools: primary, praxis-related discourse, radical doubt, other hermeneutic tools

Subject: individual teacher, student

Object: primary understanding of learning/teaching situation, cogenerative dialogue situation

Outcome: developed understanding, new possibilities for action

Rules: respect, autonomy, equitable participation, openness

Community: group

Division of labor: devil's advocate, 'specialist' on some aspect of teaching and learning

Figure 1. The activity system of coteaching consists of two mutually constitutive (reflexive) parts. From the perspective of an individual teacher, the object of coteaching is the same as teaching alone, but she now shares the responsibility with other teachers. Following a lesson, teachers and student representatives meet for a cogenerative dialogue session to increase their understanding of the events and, by means of critical analysis, to improve the learning environment.

Learning environments are constituted by the mediated nature of the student-world relation (i.e. the primary relation) and the other possible mediated relations that set the context of the primary relation. For example, the relationship between student and teacher is mediated by pedagogy (tools) and also by the rules of interactions between them. 'Learning to speak out' would be a dimension of the 'rules' that mediate the relation between students (subject) and teachers (community). 'Learning to learn ...' is a dimension of the mediation of the subject-community relation by pedagogy. 'Learning to communicate ...' is a dimension of the relationship between students and other members of the class, that is, mediation via the rules. Hence, this approach to learning simultaneously takes account not just of different nested and hierarchical levels of environmental units (e.g. Fraser, 1998), but also of the essentially mediated nature of all of these levels (Engeström, 1999).

Activity systems embody internal and external contradictions that interfere with and impede the motives of the activity. For example, in urban schools, we often detect a contradiction between the language which inner-city students cur-

rently master and the middle-class language used by their teachers; there is therefore a contradiction between the subject and the tools. Contradictions are not inherently bad. Rather, in activity theory, contradictions – dilemmas, disturbances, paradoxes, and antinomies – are the driving forces of change and development (Il'enkov, 1977). These contradictions become central to our approach because, once understood – not only in terms of lived experience but also in terms of their structural origin – they lead to the articulation of actions and change.

Activity theory allows us to frame the contradictions between being a teacher and being the object of research on teaching. In research on teaching, teachers and the learning environments of their classroom are the constituent *objects* of the research activity system. As objects (objectified subjects), they are made accessible to analysis in various forms of representation including questionnaires, scale scores, interview transcripts, and videotapes. (Teachers and other individuals often fear becoming the 'lab rats' or 'guinea pigs' of social research.) Simultaneously, teachers experience themselves as the objectified subjects in research and as subjective actors in the teaching activity system. There is a fundamental contradiction between these two activity systems, which teachers often perceive as conflict-laden relationships between two types of experience. There is the lived experience of being a *subject* and the simultaneous experience of being an *object* of research (i.e. *objectified* subject). That is, theory-building research and teaching are different activity systems not only because of the difference between their system-constituent objects, but also because of the contradictions in the experience of the participants in both activity systems. Because this form of research inherently remains external to the primary activity, teaching, we believe that it is a major obstacle to significant and lasting change.

1.2.   *Activity Theory and First-Person Research Methodology*

In our work, activity theory goes hand in hand with a practice of research method, developed by the critical psychologists of the Berlin school (e.g. Dreier, 1991; Holzkamp, 1983b; Markard, 1993). The central category in critical psychology is 'power-to-act' which, because it is directed toward action potential, co-thematizes individual, environment, and their mutual constitution in the same unit. Critical psychologists emphasize the irreducible uniqueness of the individual as a member of society, a fact that has to be accounted for in general models of human action. What must be central to any research effort in this spirit is the development, for each particular case, of a language and procedure that allows an understanding of the existing conditions in a *generalized* form not only by the

researcher, but more importantly by the subject herself. This development is directed not only toward understanding but also, and more important, toward creating new and *concrete* action possibilities, which lead to the removal of existing contradictions within the individual subject or the systemic relations (Holzkamp, 1983a). The development of new, concrete (rather than idealistic) action possibilities are therefore the motivation for doing research on learning environments. This replaces the identification of perceptions, for example, in the form of 'preferred' learning environments. Preferences often do not lead to useful actions because, as the popular adage goes, 'the (preferred) actions are *possible in theory* but *not in practice*'.

On a concrete level, we are held to ask how to articulate a specific praxis as part of the research process. Out of this process, it should be possible to capture the conditions that enable an extension of power-to-act, that is, the conditions which an individual affords to increase the opportunities for him/her to maneuver (Roth, Lawless & Masciotra, 2001). These conditions for the extension of action possibilities are therefore understood *out of* praxis itself under inclusion of the researcher and the inclusion of the particular researcher 'me'. Because meaning relations that give rise to action are always personal, research questions are framed from the perspective of the person (*subject*) rather than from a third-person perspective (questions *about* people). We assume that one can understand the conditions and in particular the room to maneuver only because we participate in praxis – or more strongly, we assume that understanding practice requires us to participate in changing it (e.g. Marx & Engels, 1970). This is so because the room to maneuver during practical action is a characteristic phenomenon of praxis, subject to particular constraints of time and the level of experience of the practitioner (Bourdieu, 1990). Conducted in this way, learning environment research becomes emancipatory to researchers and teachers because it brings about change in practice, and practice is *the* testing ground of theory. *Coteaching/cogenerative dialoguing* is our response to the gaps between research praxis and teaching praxis and between theory and practice.

2. THE COTEACHING/COGENERATIVE DIALOGUING FRAMEWORK

2.1. *Coteaching*

For nearly a decade, we have conducted research on coteaching. In coteaching, two or more individuals work at each other's elbows to enhance the learning experiences of students. These individuals usually include the regular classroom teacher paired with new teachers, visiting teachers, researchers, or (university,

school) supervisors. In the coteaching model, sitting on the sideline to 'get a good look' is not permitted. Rather, all individuals who want to see how it works are asked to immerse themselves in teaching (though they may do so by following around another teacher for some time). From an activity perspective, coteaching provides an ideal context for learning by providing a 'zone of proximal development' (e.g. Wertsch, 1984) in which the collective achieves more than any individual alone (e.g. Roth, 1998b; Roth, Masciotra & Boyd, 1999). This zone of proximal development arises from the dialectic relation between social and individual development and is defined as the "distance between the everyday actions of individuals and the historically new form of the societal activity that can be collectively generated" (Engeström, 1987, p. 174). Coteaching therefore enables (new) collective actions that span a zone of proximal development. These collective actions become, as part of ongoing praxis, part of the individual action repertoire and therefore enlarge the action potential of the individual teacher. The individual member makes a contribution to the development of the community, and thus indirectly to her own development and learning process. Learning is therefore an integral and inseparable aspect – and one of the characteristics – of the praxis of teaching and learning.

Coteaching as an activity system is depicted on the upper right in Figure 1. The central object of coteaching is the same as in traditional teaching; so are many of its tools and many rules that mediate the relations with students. However, there are relations and mediations that do not exist in the traditional situation because of the newly introduced division of labor at the classroom level that has a horizontal (democratic) rather than a hierarchical characteristic. It is evident from our figure that new relations between students and teachers are possible. These are often experienced by the individuals in our research as possibilities for better student-teacher personality matches, multiple opportunities for expressive means (tools), or teacher opportunities for attending to different aspects of the lesson (organization, telling content). This division of labor often 'changes the classroom dynamics' and leads to different student behaviors, which are concrete expressions in immediate experience of the changes that have occurred in the activity system. That is, coteaching leads to new mediational forms that entail modifications in the learning environment.

As coteaching researchers, we are involved in the everyday praxis of teaching and therefore directly experience the learning environment. We are no longer removed from teaching but a central part of it. A crucial question for us is how we get from the primary understanding of praxis, that is, in terms of immediate experience (understanding), to a generalized, structural understanding. In our work, this is achieved by engaging a dialectic interaction of understanding, experienced in practice, and explanation, achieved by means of critical analysis.

Understanding is a prerequisite for all theorizing; but only explanation-seeking critical analysis wrestles with the hidden presuppositions and common-sense ideology that surround us. These explanations enable *generalized* understanding and therefore give rise to new action possibilities and, ultimately, give rise to change.

2.2   *Cogenerative Dialoguing*

An integral part of our practice are discussions between all participants (or their representatives) involved in classroom praxis (Figure 1, left). That is, this includes students, new teachers, teachers, university supervisors, and researchers. Eldon and Levin (1991) refer to such talk about praxis as *cogenerative dialogue.* The intent of these sessions is to use current understandings to describe what has happened, identify problems, articulate problems in terms of contradictions (generalization), and frame options that provide us new and increased choices for enacting teaching and learning. That is, these sessions can be understood as a new learning environment that takes the classroom learning environment as its object of inquiry. To assist us in making these sessions productive and equitable, thereby explicitly modifying this learning environment, we have developed a heuristic that allows us to check whether they are consistent with some general aims (Table I). As Table I shows, rapport, inclusion of all stakeholders, respect for different forms of experience, or equitable participation are central tenets of these sessions regardless of a person's experience or knowledge along one dimension or another (e.g. being a methods professor or having 30 years of teaching experience). This heuristic is therefore a tool to monitor the practical functioning of this secondary learning environment.

Our description so far has shown that all individuals participate in teaching and learning; in our original research on coteaching, no 'fly-on-the-wall' observers were allowed to participate. Such a first-person methodology harbors dangers in that existing understandings could be reified and thereby become ideology. That is, when we use only immediate descriptions of the context, we are likely to remain stuck and reproduce ways of perceiving and acting in a particular context. So, while we need our immediate experience in terms of the immediate concepts that correspond to them, we also need to engage in a critical analysis to come to an understanding that makes salient the fundamental structures of the condition in which we are finding ourselves while coteaching. This critical analysis requires our personal understanding of praxis but also a 'radical doubt' (Bourdieu, 1992) or 'suspicion of ideology' (Markard, 1984) to over-

TABLE I

Heuristics for Productive Cogenerative Dialogue Sessions

1. Respect (between participants)
2. Rapport (between participants)
3. Inclusion of stakeholders (student teachers, students, school personnel, high school students, university personnel)
4. Ways to participate
1. Coordinating discussion
2. Listening attentively
3. Initiating dialogue/ideas
4. Posing critical questions
5. Providing evidence
6. Expressing an opinion (agree/disagree)
7. Speaking freely
8. Clarifying and elaborating on ideas
9. Suggesting alternatives for actions
10. Evaluating ideas and practices
5. Opportunities to participate
1. Contributing to an equitable playing field
2. Listening attentively
3. Making space to participate
4. Showing willingness to participate
5. Making invitations to participate
6. Refusing all forms of oppression
6. Discussion topics
1. Learning to teach
2. Teaching and learning
3. Curriculum
4. Teaching kids like us
5. Coteaching
6. Transformative potential of activities/curriculum
7. Links to particulars
8. Quality of the learning environment

come the possibility that we remain ideologically stuck in our current understanding.

On the level of immediate understanding, we can come to understand conflicts as they appear at first sight. But immediate understanding does not automatically increase one's action potential. This action potential lies at a very personal level, always a question of "What is my room to maneuver?" and "How

can I enhance the options I have?" Arriving at explanations, and implicitly to new understandings, puts me in a new improved situation characterized by an increased room to maneuver. All participants operate out of their own initial frames using their primary discourses to describe aspects of their praxis. In so doing, they communicate at a level at which frames can be analysed and altered, and new frames can be generated. Freire (1972) suggested the need for dialogic relations within a community, providing its members with opportunities "to name the world in order to transform it" (p. 136). Cogenerative dialoguing therefore leads to locally relevant theory (e.g. Roth, Lawless & Tobin, 2000).

3. RESEARCH CONTEXT

Our research on coteaching was conducted in two schools on the Canadian West Coast (six cotaught science units) and in two urban schools in Philadelphia. The present case study was taken from our work at City High School (pseudonym). City High School (CHS) is a placement school for students at the University of Pennsylvania enrolled in a graduate-degree leading to teacher certification (i.e. new teachers).

   We are now in our third year of conducting ethnographic research on the changes in teaching and learning to teach. As part of the research, we changed our roles from outside observers to active participants in teacher preparation and teaching in the public schools (to be more described below). Our current research model is coteaching, a form of 'participatory action research' (e.g. Eldon & Levin, 1991), particularly close to those forms of research that pair research and activism (e.g. Cole, 1991) and therefore enact partiality (e.g. Nissen, 1998).

   Tobin is a professor in teacher education at the University of Pennsylvania (Penn) and has been coteaching on a regular basis at City High School with resident teachers and the Penn interns. He is a participant who engages in research to transform the different lifeworlds that he shares with students, teachers, student teachers, and colleagues. As a result of his work, the conditions of learning change in the school and at the university. At the time of the study, Zimmermann was enrolled in the teacher education program at Penn. She and a peer cotaught with Simpson, a resident cooperating teacher with previous coteaching experience. Roth was a visiting researcher with several years of prior coteaching experience who cotaught with Tobin in different classes at CHS.

   City High School is attended by more than 2000 students mainly from African American, poverty-stricken or working-class families. The school is organized into small learning communities, schools within the school, each containing about 200 students and organized around a different core idea (e.g. health,

sports, or science and technology). The curriculum is often enacted at a minimal attainment level, students rarely engage appropriately in activities, equipment, supplies and textbooks are in short supply, and there appears to be a lack of motivation on the part of either teachers or students to pursue deep learning goals (Tobin, Seiler & Walls, 1999). Conversations with teachers reveal that they often place the blame for this state of affairs with the students and the situations in which they live. Teachers also note a lack of commitment from the school district and a system that permits urban schools to be funded at a level far below that of suburban schools. In a striking contrast, the students place the blame for the inadequate curriculum squarely with teachers and administrators who maintain a curriculum perceived by many students to be a complete waste of their time.

As part of our research, we draw on a variety of qualitative research methods appropriate in school contexts, including ethnography, discourse analysis, and micro-analytic approaches to studying situated cognition. In addition to the usual observational, methodological, and theoretical fieldnotes, we videotape lessons and cogenerative dialogue sessions, interview students and (new) teachers, audiotape interviews conducted by high school student research assistants among their peers, and collect the teaching-related discussions that new teachers held using an online internet forum.

To construct meaning, we enact a dialectic process consisting of two movements: understanding and explanation. Immediate understanding of the praxis situation is primary and constitutes the necessary prerequisite of any other form of understanding (e.g. theory) (Ricœur, 1991). However, this primary understanding has to be expanded through a second, explanation-seeking (critical) hermeneutic analysis lest we are to remain ideologically stuck. It is only through structural explanations that we can remove the structural contradictions that are of a societal nature (Holzkamp, 1991b). This movement from primary to theoretical understanding begins during our cogenerative dialogue sessions and is often continued during face-to-face meetings or email exchanges among some of the individuals (e.g. Tobin-Zimmermann, Tobin-Zimmermann-Roth, or Zimmermann-Simpson).

Our format of presenting the second part of this study reflects the process by means of which we construct knowledge. At first, we provide an excerpt from a lesson that we cotaught. Subsequently, we provide excerpts from a cogenerative dialogue session in which we generate first understandings, commented upon in terms of a second level of analysis conducted at a later point in time. We then articulate our learning in the form of a metalogue that reproduces the form of cogenerative dialogue.

4. LEARNING ENVIRONMENT RESEARCH IN AN URBAN SCIENCE CLASS: PRACTICE OF METHOD

In our work, *coteaching/cogenerative dialoguing* arose in response to problems in the praxis of teaching (e.g. we began coteaching because our participating elementary teachers wanted to innovate but felt that they did not have sufficient science background to teach novel engineering curricula). Because we engage in a practice of method, we provide a concrete example from our research.

4.1. *Coteaching*

The Grade 10 biology class started with students constructing answers to the daily question designed to get them started and to refresh their minds about what they had learned previously. While Zimmermann was preparing the materials for the upcoming student investigation, Simpson talked to students about a newspaper article on the cloning of cells that had appeared that very morning in the newspaper. Tobin picked up and expanded the topic. Zimmermann then commenced the lesson. As the lead teacher, she had planned a student investigation for the first part of the lesson designed to assist students in learning about the scientific method, control of variables, independent and dependent variables, etc. Throughout this part of the lesson, the four teachers interacted with individual groups of students, sometimes while standing at each other's elbows, and at other times while working on their own with individual student groups. For the second part of the lesson, she had planned another activity, in which students were to apply what they had learned by constructing mobiles based on a scientific method of inquiry.

The first part of the lesson lasted longer than originally planned because we allowed more time to adjust to students' needs as they became apparent during the lesson. Accordingly, Zimmermann and Simpson replaced the second planned activity with an activity on genetics that first reviewed the monohybrid cross and then extended to the teaching of a dihybrid cross. Midway during that part of the lesson, Zimmermann handed over the lead to Simpson. Although the lesson was now in a whole-class forum, the different teachers still provided each other with space to enter into the ongoing conversation.

4.1.1. *Episode 1*

The following episode comes from the opening part of the lesson when students investigated different variables that influenced the fall of a peanut jelly sandwich to test the hypothesis 'peanut jelly sandwiches land on the jelly side'. The camera records the events at two different places, namely, the front and back of the classroom.

Back of Classroom

Zimmermann: OK, that would be another independent variable. How about height?

Natasia   I am not. If height is a variable, then I can't change the amount of jelly. But I can do it with a lot of jelly up in the air (holds hand high up).

Zimmermann: You are really doing two::: independent variables, and what we are going to do is, we are doing it simpler. We are going to do two separate experiments, each with one independent variable.

Natasia: No, this is not what I meant. See [Moves towards Zimmermann about six feet from her.]

Roth: How often did you drop it?

Natasia: Like this [Holds her hand above her head] one time.

Roth: How sure are you that this one time it … ?

Natasia: I am not. I was just testing. [Turns to Zimmermann] I am making these two charts, and then testing the height three times.

Zimmermann: OK. Perfect. Two different experiments. So you need to specify which one you are going to control, and then vary the height.

Natasia: You are using your left hand and then your right.

Zimmermann: But that is not what you are changing, you are changing

Front of Classroom

Tobin: [Stands next to the teacher's desk. Two students to the right of him are still sitting in their seats.]

Tobin: [Approaches one of the two students, still in her seat, almost looking as if bored or not knowing what to do.]

Tobin: [Touches her arm] Are you ready to start?

Student: Heh?

Tobin: Are you ready to start?

Student: Yeah, I am just [gets moving].

Tobin: You needed a pep talk, did you?

Tobin: [Walks on to the next student in her seat.]

height. You are not changing the hand. You are changing the height [Moves away from the two groups of students].	*Zimmermann*: [Moves next to Tobin to the second student still in her seat.]

In this episode, we observe several elements characteristic of coteaching. Roth, who was a newcomer in *this* classroom community despite his experience, followed Zimmermann around to learn about appropriate ways of interacting with *these* students. However, being in a coteaching learning mode allowed him to interact with the students. Thus, when it became evident that Natasia had done only one trial of tossing the jelly sandwich from a certain height, Roth posed a question that brought this to her attention as she walked toward Zimmermann. As a physicist, he had not been satisfied with obtaining only one data point in a case for which the outcome measure was a dichotomous variable. That is, Roth utilized a moment of transition to ask a question that Natasia answered appropriately.

Roth – who in a traditional sense would have been designated as a 'researcher' watching the class and taking notes, subsequently used to write field-notes and reports – adopts a different role. He was a participant and, as the lesson progressed, he interacted with students in increasing ways, assisting them in learning about experimenting and subsequently about genetics (i.e. he mediated their relation to the world; see Figure 1). That is, rather than presuming that standing back gives him a privileged perspective, he participated in order to get the practice perspective.

While Zimmermann and Roth interacted with two groups of students doing their investigations in the back of the classroom, two other students were still sitting in their seats. Tobin, although he was Zimmermann's supervisor, did not sit back and observe in order to be able later to admonish her about having failed to see these students uninvolved, but rather approached the students to involve them himself. That is, his role was not to judge the activity in the classroom from the outside, but to participate actively. As a coteacher, his primary duty (within our shared understanding of coteaching) was to contribute to making this the best learning environment possible. He would later contribute his own perspectives on the events, such as lack of student involvement in the present situation, during the cogenerative dialogue session. As it turned out later, the two students had been a concern of Zimmermann for some time, because they seem to have difficulties in following the lessons.

4.1.2.   *Episode 2*

In the following episode, we are in the middle of the review of Mendelian genetics that replaced the planned second investigation. Zimmermann had noted pairs of letters on the transparency and asked students to name (scientifically) various gene combinations that she noted as 'BB', 'Bb', and 'bb'. Zimmermann asked students to demonstrate how the gene combinations of parents combined, and called on Keesha.

Zimmermann: Excellent, little 'b', little 'b', so we got homozygous recessive (makes a note on the acetate). And what is the last condition?
Students: (calling out) Heterozygous. Little 'b', big 'b' …
Zimmermann: Heterozygous, awesome. Homozygous recessive means that there are two recessive genes. Keesha, come around.
Simpson: A good way of remembering this … someone just said phenotype, genotype, and you gave the correct answer. An easy way of remembering this is…. Just think of the first letter. A 'p' for physical expression, for physical appearance. A 'g' for the genes. So if you ever get confused, genes, genotype, physical expression, phenotype
Zimmermann: (Keesha has arrived at the overhead projector) All right, Keesha is going to put this on the overhead for us.

Keesha sat in the back of the room so that it took some time to get to the front; there was the potential for unused time for the transition. However, the regular teacher, Simpson, used the opportunity to teach by turning the transition into a 'teachable moment'. Here, he contributed a mnemonic that would allow students to remember the meaning of scientific terms, 'phenotypes' and 'genotypes', in terms of their familiar language. Simpson provided the students, who previously had been hesitant in answering Zimmermann's question about different expressions (phenotype, genotype), with a mnemonic that would allow them to map the scientific terminology to words that are from the students' everyday language and therefore more familiar and easier. Simpson thereby built a bridge between two forms of language, one that students bring to class and the other that is appropriate in the context of formal science.

This episode is typical for coteaching in that any teacher will (request to) step in and contribute to enhance the lesson. Rather than sitting in the back of the classroom, watching the lesson and constructing an evaluation, Simpson moved in and taught. Rather than admonishing her later for a long transition, he set an example of how periods of transition can be turned into moments of learning. If salient, such situations were brought up in the subsequent cogenera-

tive dialoguing sessions. However, even if such situations are not brought up, they nevertheless can lead to learning because of the 'silent pedagogy' that working on another's elbow (here coteaching) enables (Bourdieu, 1992).

4.2.   *Cogenerative Dialoguing*

After the lesson, the four teachers (Zimmermann, Simpson, Tobin and Roth) and two students (Natasia and Shawan) met for a cogenerative dialoguing session. In this session, the most important issue to be raised and covered was how to deal with students who have learning problems. That is, although Tobin had initially stated his observation of students sleeping or not being involved, Zimmermann had re-interpreted the events in terms of the learning problems of the uninvolved students. This became very clear when Roth asked Zimmermann about the critical issue arising from the lesson that they had shared:

Zimmermann: Even in that small a class, with the levels being so different, I feel like there are always two students left behind, who I am not giving enough attention to, and these are the students who need more attention. But because the other students are so much more boisterous and outgoing, I am always drawn to them. You know, "What are you doing?" "What is the independent variable?" And then I turn around and see that there are two students who are still sitting at the table, not doing the work. So, that's just a class of 15, or there were only 11 today. So, when there is a class of 30, 33, and the gaps are even bigger, like how do I get my attention around to all of them? That is difficult.

Here, Roth had asked Zimmermann to articulate an issue. He thereby took on a mediating role (i.e. a division of labor in the activity system [Figure 1, left]), facilitating Zimmermann to talk about the lesson from her perspective and therefore to articulate it and evaluate it from her perspective. This is a starting point for one person, but has the potential to be picked up by others and become a topic for the group. This was a real problem that was picked up later again, and in fact is provided with some solutions including the suggestions by the students. Roth pursued the issue further by asking Zimmermann whether and how she started dealing with the problem that she had identified. But Simpson was the first to answer:

Simpson: You mean, addressing the weak students? I mean you have the aids coming in. And we also have the grouping so that we can do group activities …

Zimmermann: One thing that I have found, and it has worked very well in the next-period class, because I have the weirdest division between students who work very very fast and students who work very slow. And what I did, I buddied them up. And I was worried about that at first, because I was worried about the poor students. You know, they have to be buddied with somebody else, you know ... But they enjoyed it. And I spoke with the students, who are sort of the tutors, and I said "Don't go around bragging, 'Oh you need help, I need to help you'. Take your time, don't do the work for them." And they like it, because they feel like they are teachers, and the other students just actually look forward to the help. So a student walked in the other day and said, "Oh no, what do I do?" you know, "My buddy is not here." And when she comes in the next day, she goes "Oh thank you. Thank God, she is here." So that worked well. I was worried that it would place a stigma, and certain things, but they enjoyed it.

Although Roth directed a question to Zimmermann, Simpson entered the conversation and asked for clarification. Zimmermann then addressed the question by offering an example from her own experience. Here, she provided a specific example of what she had done to deal with the problem of students being behind. The fact that this technique had worked out provided her with the confirmation of a workable aspect of practice.

Roth, together with Zimmermann and Simpson, elaborated on the issue of using the buddy and tutor system by contextualizing it in terms of the learning that occurs as part of teaching. All three were in agreement that teaching subject matter actually assists them in better understanding the very subject matter. Thus, the potential problem Roth had raised – a fear that those who teach, tutor, or help others are held back – was resolved. In a more encompassing picture, teaching was reframed as a way of learning:

Tobin: Lots of variability. Ms Z finds this a challenge. We all find it a challenge. How do we deal with that challenge?

Natasia: Have the people who catch on fast work together with those who don't catch on fast.

Tobin: And you don't think that the people that ...

Natasia: No, I mean like mix them together, like half, like me, Jeanine, and a couple of other students in one group. Because some don't catch on

as fast as others … And let the ones who catch on faster help the ones that don't catch on as fast.

Tobin: What do you (to Shawan) think about that?

Shawan: When I am in a class like where she is the only person who catches on like this (snaps fingers), like there is not everyone as fast.

Zimmermann: She is like super fast but not everyone else.

Natasia interrupted Tobin to contribute to the conversation. This is unusual for students and in fact her contribution, in most circumstances, would be constructed as undermining the power of teachers and university visitors (Roth, 1993; Lemke, 1990). Natasia suggested group work as a solution to a problem raised by Tobin, but then Shawan provided an example in which this solution might not work. Natasia's suggestion was consistent with the literature in education that supports the use of heterogeneous grouping practices. But Shawan raised a potential problem with this model if there was an insufficient number of students in the class to assume the leadership needed to have sufficient expertise in each group.

In the following situation, Natasia and Shawan further developed affordances and constraints of learning in groups, and having one or more of them participate as a peer teacher:

Roth: What about if you had her [Natasia] taking on one group and then each, Ms Z and him taking on another group of four and another group of four? So in this way, you divide the class into 13, 14, three groups?

Shawan: So a teacher takes on ...?

Roth: Natasia one group, and each of them one other group.

Shawan: That's good, but some of the kids might get a little disruptive.

Natasia: Some kids will do that anyway.

Shawan: So when she … she is explaining the lesson to 'em and everything, but they go "aaaah", they won't listen to her, they go, "she's just like me, I won't listen to her." And then they are tuning her out.

Tobin: And you think that they are just being disrespectful?

Shawan: Yeah. Or, as many people **…** get the teacher for whatever she taught to help them better understanding. And Ms Z's case, she would teach the kids that don't catch on that fast. And then tell the kids, they should listen to what they are saying, because when Natasia is finishing, you know ... 'cause she's gonna ask them, you know, what they learned from what the teacher was saying. That's the way, to

me, they would get dumped on, so they got to listen to her now, cause she's gonna ask us.

Zimmermann: But on research reports, you catch on and so you could help other students (to Shawan). Every student has something that is her favorite.

Zimmermann pulled the discussion together in the sense that she made a suggestion of how this could be organized across different activities and content areas for which the different abilities and competencies of different students come to bear. She used a specific example in which Shawan had excelled to exemplify for the student what she meant, and that Shawan could take a role in assisting other students. So, although Natasia had been in the foreground as the central student in the genetics class, Zimmermann pointed out that Shawan had excelled in another domain, where her own role would change from someone being helped to a helper. Both students agreed with this assessment, not only in its content, but grounded in their lived experience of having helped other students as part of the class activities.

4.3.   *Metalogue*

Roth: I was reflecting on the cogenerative dialogue sessions. In our collective effort, we, students and teachers, enact practices that are consistent with the practices included in learning environment instruments you have used in the past, including such dimensions as 'personal relevance', 'critical voice', and 'shared control'.[4] For example, in this one lesson, we find that students are provided with opportunities to learn about the world outside the class. There was an activity in which they investigated the claim that peanut butter sandwiches always seem to come to land on the jelly side; also, Simpson and you brought up an issue relating to the current curriculum that had appeared in the news that very day.

Tobin: This activity was a splendid example of how Zimmermann, in particular, is able to connect not only with mainstream goals for science education, such as pursuing inquiry, but also she is able to enact the curriculum in ways that are culturally relevant for her African American students (Boykin, 1986). For example, of nine psychological dispositions that Boykin attributes to African Americans, Zimmermann incorporates at least six of them (e.g. verve, affect, communalism, expressive individualism, oral tradition, and social time

perspective) into this one lesson. Zimmermann enacts a curriculum that allows her African American students to get involved and thereby to accomplish what might be described as mainstream goals. I regard the incorporation of those African American dispositions as critical components of the learning environment because it is what possibly makes the lessons so inviting to the students (all of whom are African American).

Roth: We can see that students not only have a critical voice, but that Zimmermann changed her practice with the input from students and later assessed these changes as being of a very positive nature to the learning environment. Overall, it struck me how well the student participants articulated pertinent issues even though they represented the broad spectrum of students. Some of them were failing or had poor attendance records, and yet they made incisive and justified critiques, understanding comments, and proposed viable alternatives for ways of changing the learning environment.

Tobin: *Cogenerative dialoguing* sets a context for change in the learning environment, if not within a week, certainly within the next month or couple of months. The conversations were very rich, detailed and persuasive. I can see this as a way of building credibility with students too. If you show a willingness to listen and act to improve their learning, I can see this being a major factor in establishing rapport with students and gaining their respect too.

Zimmermann: I appreciated having all of the participants present during the praxis discussions. On a few occasions, a subject was introduced that had been troubling me, yet I was too embarrassed to discuss with Simpson one-on-one. Having the students, supervisor, and coteachers available actually relieved the pressure because the issue could be addressed from various viewpoints, not just mine. The students also enjoyed the dialogue immensely. They would often request to participate in the meetings and were more inclined to approach us with their opinions about lessons after they had shared in a praxis discussion session.

Roth: What is most important to me is the radical openness that all parties bring to the cogenerative dialogue. It seems as if nothing is sacred and all participants contribute enormously to maximize learning in both environments (classroom, cogenerative dialogue). Even traditional hierarchical relationships between students and teachers have been abandoned. Thus, neither Natasia nor Shawan were afraid to voice preferences that were not consistent with those declared by

their teacher. But they did not only voice alternative preferences but also articulated rationales for them.

Zimmermann: I never felt that one voice dominated the discussion. It seemed that the students appreciated their roles as consultants and the teachers were very interested in what they had to offer. I think our experience with coteaching allowed this dialogue to be as comfortable as it was. Simpson never acted as 'master' and never treated me as a lowly apprentice. Rather, there was an even exchange of knowledge. Because of this arrangement, we were willing not only to learn from one another but from the students as well.

5. RESEARCH, PRAXIS, AND DEMOCRATIC REFORM

In this article, we propose learning environment research as a form of praxis in which teaching and research are different aspects of one overarching activity system intended to assist students to learn. Coteaching, constituted from a teacher perspective by its components of teaching and learning to teach (cogenerative dialogue), is a recursive process in which the same individuals engage in two different but functionally dependent types of activities – which we theorized in terms of activity theory. As part of the research praxis of coteaching, cogenerative dialogue is based on the following central tenets. Common experience is the foundation for participation, and all concerned (or their representatives) must participate; everybody needs to be active, contributing to the dialogue; all participants are equal at the outset; and participants' experience must be treated as legitimate, even if it might not be shared. In fact, the research can assist participants to develop the range of actions available to them, requiring that they understand the constructs (Holzkamp, 1984). If we attempt, for example, to derive an individual teacher's understanding of the learning environment by drawing on abstract constructs (e.g. the constructivist foundations of 'cooperative learning'), then he might feel disempowered because he might not recognize his own situation and action possibilities in such constructs. Furthermore, constructs that generalize 'common' attributes rather than derive from and emphasize common historical origins always fail to capture what is concretely shared between people and things (Il'enkov, 1982).

The *a priori* selection of categories that might have salience to the learning environments experienced by different types of participant is unlikely to be fruitful. We have participated in research in which this issue has been recognized and learning environment categories are selected at some point during the study when the research has been in progress for sufficient time to have a grip

on what is salient. We envision discussions of a cogenerative type yielding categories that then can be explored within a classroom using a variety of methods. What might be different in what we are proposing is the inclusion of students and teachers as equals at the table at which a decision is made as to what is salient. As these discussions progress, we foresee situations emerging in which there is recognition that different people at the table are better able to contribute to one another's learning in different ways and in different domains of learning. We think this is what makes the cogenerative dialogue form such an exciting contribution to our work. The domains in which the students could be helpful in teaching us were not necessarily predictable *a priori*.

The researcher as coteacher loses power and privilege in many senses. One privilege that is lost in the cogenerative discussions is to focus the discussions in particular ways. For example, a researcher as coteacher might find the discussion focused on his teaching practices and ways in which he might change to be a more effective teacher. And in discussions of values and practices, it might be the researcher's beliefs that are marginalized and the merging consensus within a group could be for very specific changes to occur prior to and during the next lesson. We cannot assume that the privilege of a researcher, often enshrined in *a priori* questionnaires that measure perceptions of learning environments, can withstand discussions of the type that we have described in this article.

Despite (and perhaps because of) losing privilege, the generalizations lead to local theorizing and lasting change in teaching practices. This is so because the mediations of individual possibilities by the generalized possibilities that exist in the society are made central. Our *praxis/cogenerative dialoguing* model therefore constitutes a way of walking the walk of 'learning environments research' and teaching. Here, all stakeholders who participated in a lesson (or representatives) participate in conversations that are democratically structured. At issue is not the agenda of a more powerful agent, but the improvement of the situation in which all individuals are, differently located, participants.

Participation is a necessary but insufficient condition for the success of learning environment research as an aspect of praxis. The degree and nature of participation in all phases (while undertaking participatory action research) is necessary, though knowledgeability is likely to be heterogeneous and distributed. Participation must be 'full' in terms of being legitimate or a form of 'co-determination' if it is to be empowering. Participants create new understandings of the learning environment in their own terms through a learning process that plays out as a dialectic between lived experience and critical analysis. Different individuals are not merely consulted in each phase of knowledge production; rather, they participate as co-producers of knowledge.

Our model of the cogenerative dialoguing does not require *every* individual (such as every student) to participate in discussions about the classroom learning environment. The size of meetings if every individual were to participate would be prohibitive; rather, the stakeholders have to be legitimately represented. For example, different studies in the Scandinavian work context showed that the participation of the entire organization is not required to improve the work environment, but that it is sufficient to have representatives of workers, unions, and management participate (e.g. Ehn, 1992; Eldon & Levin, 1991; Onstenk, 1999). Initially, participants might have little expertise in empowering forms of participation; that is, they have little expertise in making cogenerative dialogue itself a productive learning environment. Here, our heuristics in Table I provide a framework to begin and fine-tune interactions.

Traditional models of the individual and her environment are based on the presupposition that individual beings and environment can be theorized independently, and any interactions between the two are treated as add-ons. Learning environment research within such a perspective reifies the division between the human subject, its context, and the notion that the (material, social) environment determines human actions. The 'learning environment' is thereby theorized as a box in which the individual finds itself, and in respect to which it re-acts.

From an ontological perspective, it makes no sense that we separate 'I' from 'we' or 'we' from 'it'. However, historically there has been a tradition of people undertaking research from the side and in a relatively non-participatory manner. They have identified some interesting trends, outcomes and implications. We assume that they will continue to do this. In our own early research, we used to bracket the observed situation from the research, although we knew that the presence of researchers and the participants' knowledge that they are being researched affected in non-negligible ways the research itself. Activity theory forces us to account for the researcher in the overall picture; that is, research from a perspective that accounts for all mediated relations that constitute the context for an activity system necessitate that we account for our own interactions with the participants. In this way, we account for our own subjectivity and partiality that are often obscured in other paradigms. As our Figure 1 shows, we explicitly articulate our simultaneous involvement in teaching and research on teaching and therefore incorporate the effect of research on its object. We regard this approach to research on learning environments as contributing fresh insights into teaching, learning and the improvement of learning environments. The approach addresses a problem that much of the research on learning environments is built around a single theoretical framework and its associated methodology. We do think that many researchers in our field of learning environment research do what they do out of habit. It is time for the conversation about methods and

the associated conceptualizations to be undertaken in a serious manner. Our suggestions here might be one viable way to proceed.

6. CREDO

"A school is a lousy place to learn anything in." (Becker, 1972, p. 85)

We began this article with the statement that theory choice is based on values. One of our central values is the practical relevance of our work to the daily work of teachers and students. We chose activity theory because it is interventionist in its methodological approach. Seeing humans as creators of their activity learning environments, it aims at reconstructing these environments in practice "so that people are not just objects or subordinate parts but *regain their role as creators"* (Kuutti, 1999, p. 373, our emphases). We therefore endeavor to enact an activity-theoretic practice (of method) to build and sustain learning environments conducive to growth (e.g. Newman & Holzman, 1996). Contrary to Becker, we believe that schools can be exciting places to learn for students, (new) teachers, and researchers alike. Through our research activities, we are committed and personally invested to making a positive difference to the learning environments of schools in which we conduct our research.

Historically, as a result of a division of labor, educational researchers (and theorists) were able to separate from daily praxis and retreat into the confines of the 'ivory tower'. In the society at large, there are many prejudices about the idealistic nature of theory, ivory tower thinking, and the irrelevance of university-based research to everyday life. Gramsci (1971) rejected the idealism of intellectuals, who thought that practices and worldviews could be changed through rational analysis and critique. He did not want intellectuals to work for their own sake but to enter into a practical relation to society that contributes to a change in the cultural context. We feel that we are practically involved in the everyday affairs of education in the way Gramsci conceived of 'organic' intellectuals.

Our methodology breaks with past traditions, taking us (researchers) into the front lines of the daily work of schools and, thereby, assisting in bringing about change. Our choices to undertake research in this way are based on our values and commitments. With Gramsci, we believe in the unity of understanding and changing of praxis and its political dimension. Whereas previous historical developments brought about a divide between educational theory and educational praxis, and a physical move of the former out of school, *coteaching/cogenerative* dialoguing returns university-based researchers to their historical origins to become significant partners in educational praxis. That is, we ask

ourselves about the extent to which our work in schools has emancipatory practical value to those whose lifeworld we share. If the practitioners (the supposed beneficiaries) were to view our research and theory as idealistic resulting in impractical outcomes, we would deem our effort to have failed.

AUTHOR NOTE

NOTES

[1] We distinguish 'praxis' from 'practice(s)'. Praxis refers to the moment of doing (teaching, researching, etc.), whereas practice(s) are descriptions of patterns of praxis. Praxis therefore pertains to the biographical experience of doing something, as it first presents itself, whereas the description of patterned actions, practice(s), are already abstractions, once-removed *re*-presentations of praxis.

[2] We use the term new teachers in preference to student teacher or prospective teacher. We feel that the term 'student teacher' is a classification that is inconsistent with our paradigm, coteaching, which is premised on the idea that we learn to teach by teaching. Coteaching allows for *legitimate* peripheral participation, whereas 'student teachers' are often regarded as a disruptive aspect in school contexts.

[3] In this article, 'subject' connotes subjective rather than the 'human subjects' of (quasi)-experimental research. We are interested in learning environments as they are constituted and experienced by each individual at the subjective level.

[4] Constructivist learning environment scale (e.g. Tobin & Fraser, 1998)

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