

# Learning to Teach Science as Praxis

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## Abstract

The paper provides a theoretical rationale for learning to teach in/as praxis in terms of three salient concepts, learning to teach through being *with* others *in* a community, teaching as *habitus*, and building teaching expertise through expanding *Spielraum*. These concepts are explained and illustrated through examples of the use of coteaching to facilitate learning to teach in ways that demand changes in the roles traditionally adopted by school and university personnel and blur the traditional boundaries between initial teacher education and inservice programs for experienced teachers.

Despite much research in teaching and teacher education, the gap between the theories of teaching and teaching practice continues to haunt educators. Most dramatically, the gap is experienced every year anew by novice teachers who find out that what they have learned in their university classes does not seem to prepare them for the actions required of teaching in real time. Thus, we documented in our studies of preservice teachers how even the best prepared preservice teachers do not feel ready to teach (Roth and Boyd 1999, Roth et al. 1998, Roth et al. 1999). Despite their great success in their course work and micro-teaching experiences, these traditionally well-prepared students struggled when they were enacting science teaching as interns (over several months). The following statement about her teaching experience is typical in this respect.

[Nadine:] Well I think that it's just the here and now. It's easy to think of, "Well somebody does this to me then I follow this and this and this." But every situation is so different and every student is so different. I mean for me, as far as classroom control, it has just all been trial and error; that is, learning as I went along finding what works or what doesn't work.

At the time of her collaboration with Roth, Nadine was near completion of a two-year practice-oriented teacher professional development program that followed her bachelor's degree in child and youth care. Thus, despite a longer training and more intensive teacher preparation program (including micro-teaching and field experience) than most receive, when she taught mathematics and science for a four-month period, she was almost overwhelmed. Most crucially, she continuously experienced the difference between what was required of her in teaching and the "idealistic ways" of her university courses as a gap. What worked when she answered questions about teaching scenarios on paper and what it meant to enact appropriate teaching at each moment seemed to be worlds apart. Educational research and theorizing has not spent time enough to make thematic that which makes teaching in praxis so different from teaching in theory.

For one, there is a big (in fact ontological) difference between events and actions unfolding in real time, on the one hand, and their re-presentations as sets of formal prescriptions and theoretical statements, on the other. However, acting appropriately without having the luxury to reflect on one's next move is typical for practical action (Bourdieu 1980). That is, the temporality of teaching in praxis (under the constraints of real time unfolding events) is never captured when student teachers respond to case studies on paper. Second, there is an equally big (ontological) difference between events and actions, on the one hand, and their re-presentations in and as formal concepts and precepts. This difference between action and its re-presentation, which is a central thematic in the work of ethnomethodologists (e.g., Suchman 1987) has not entered the work of much (science) education research. This problem in theorizing teaching, and consequently, in theorizing learning to teach (science) are endemic of traditional approaches to knowing and learning.

Traditional (psychological) lore has it that human behavior is controlled by some central mechanism in the brain much like a digital computer is controlled by a central processing unit (e.g., Anderson 1985). Drawing on stored declarative knowledge and manipulating it according to fixed rules (procedural knowledge), intelligent behavior was thought to arise from the application of abstract re-presentations to concrete cases. This

idea of knowing in fact underlies most current teacher preparation programs at the university level. Accordingly, learning to teach seems to mean that future teachers have to learn the declarative and procedural knowledge in their university classes. Preservice teachers therefore get their dose of university courses to make them know subject matter knowledge, pedagogical subject matter knowledge, and general pedagogical knowledge (Shulman 1987). With respect to science teaching, the question university educators wrestle with are “How many science content courses should future elementary teachers take?” “Should future elementary teachers learn their science together with the science pedagogical knowledge (application?!)?”. Subsequently, during their brief stints in schools as part of a 6-week practicum, preservice teachers get their first chances at “implementing” what they “know” in practice. If educators were just listening to future teachers such as Nadine above, they would know that learning to teach does not work this way. Much of our recent work has been concerned with understanding the problematic relation between theory and praxis and therefore, between traditional teacher training and the experience of teaching (Lawless and Roth 1999, Roth et al. in press-a, in press-b, Roth et al. 2000, Roth and Tobin 1999, Tobin Seiler and Smith 1999).

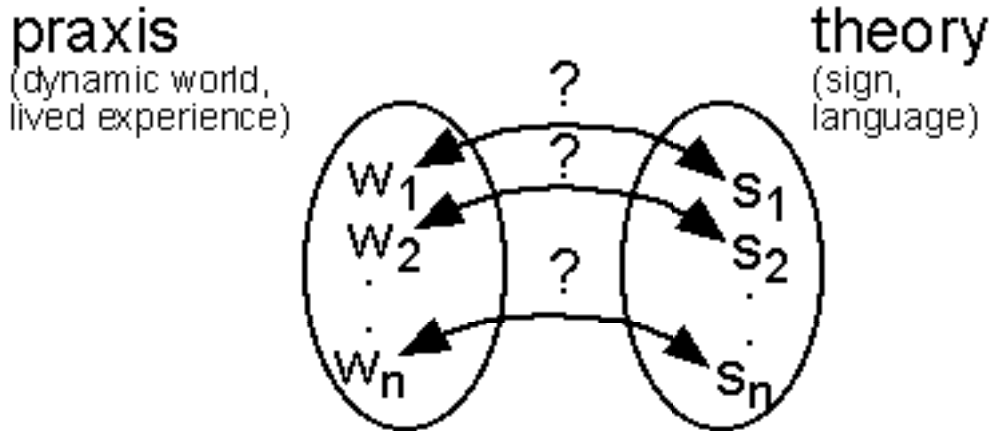
We maintain that the nature of the division between theory (technique) and praxis (actual teaching) can be characterized in terms of temporality and lived experience (rather than re-presentation). Rather than attempting to construe new “theories of teaching,” we therefore argue for a praxeology (Gr. *praxis*, action & *logos*, talk, speech) of teaching (Section 2). We propose *coteaching* as a venue for its development as well as a model for inservice and preservice teacher development, evaluation, and research (Section 3) and provide a description of *coteaching* as a mode of teacher preparation at the University of Pennsylvania.

### **Re-presenting Teaching**

We begin by articulating the ontological gap that exists between teaching as lived experience and teaching when it is re-presented (as theory or even in teachers’ own narratives of their work).

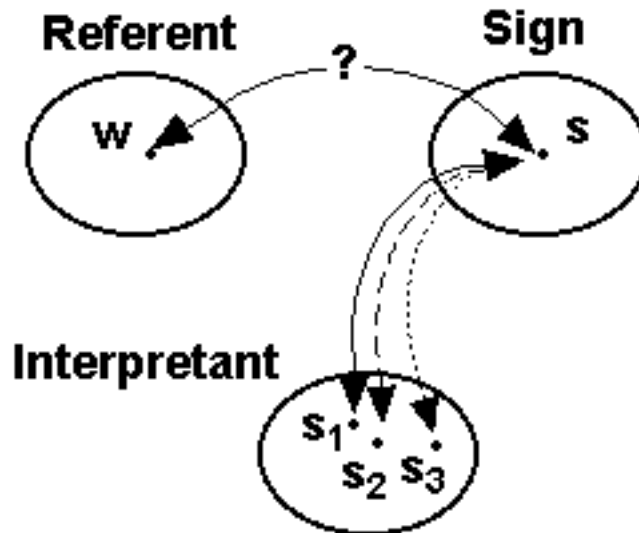
#### *The Theory-Practice Gap*

A common (epistemological) assumption is that there exists a perfect map between signs (theory) and the world (dynamic matter, praxis) as re-presented in Figure 1 (e.g. Lynch 1991). The question for theorists in the social as in the natural sciences is to find this map (“right” knowledge, theory). In this view, the gap between theory and practice of teaching can be thematized in terms of novice teachers’ inability to see how theory (signs  $s_j$ ) are related to entities in the dynamic world ( $w_i$ ) of teaching. During student teaching and during the initial years on the job, teachers are said to learn to make the connections between the descriptions of practice and practice as lived experience.



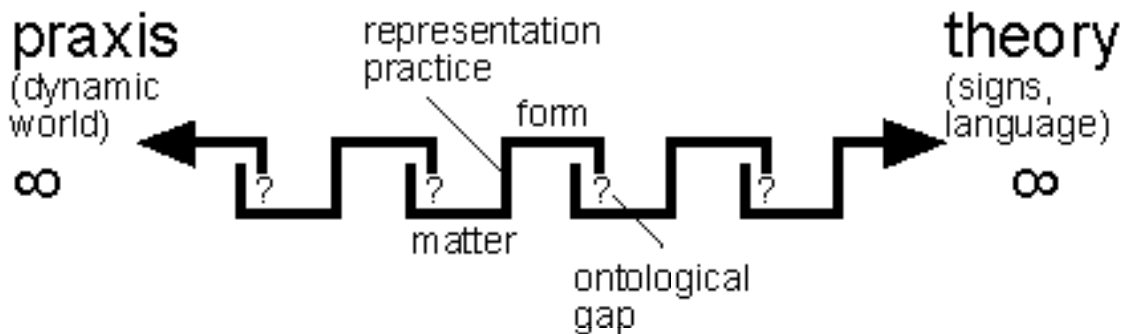
**Figure 1.** Isomorphism assumed by much of the research in natural and social sciences. The signs can be categories, or variables representing measures of categories. Any relation that obtains between, for example, variables  $s_1$  and  $s_2$  are thought to hold between things  $w_1$  and  $w_2$  in the world.

In the wake of constructivist theorizing, many social scientists have abandoned the idea that there exists one map and have come to agree that there are multiple, rhizomic (semiotic) webs of signs (theory) that can be used to describe the dynamic world. This new understanding is re-presented in Figure 2. With an increasing attention to (preservice) teachers' own accounts of the teaching experience, many university educators believed their constructions to be closer to the nature of teaching. Yet, the crucial relation between theory (including teacher narratives)—sign and interpretants—and the dynamic world of praxis—referent—still has not been clarified as Figure 2 indicates.



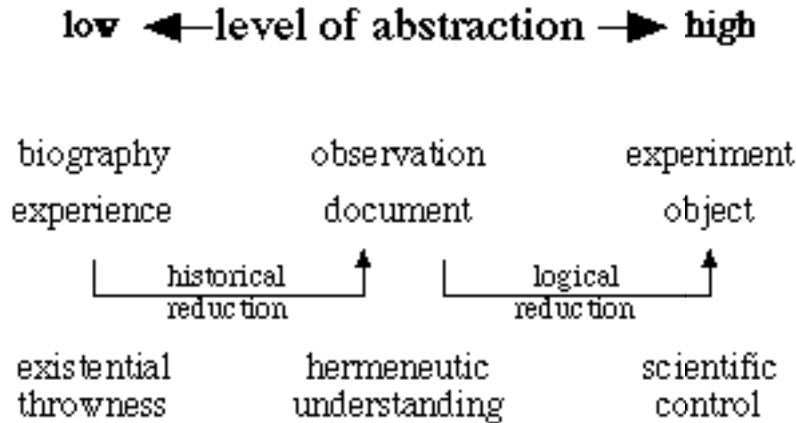
**Figure 2.** The relationship between a sign (theory) and its referent (praxis) is elaborated by another relationship of the original sign  $s$  with another sign ( $s_1, s_2$ , etc.), said to be its interpretant. Because there are potentially many interpretants, semioticians speak of an infinite process of interpretation, or infinite semiosis. A constructivist theory of teaching, for example, can have many different interpretations as it is related to specific teaching events.

We recently suggested that the gap between any theory and practice is unavoidable, even if we accept teachers' narratives as one way of accounting for teaching (Lawless and Roth 1999). (Bourdieu [1980] suggests that practitioners' own accounts do not help us in understanding practice. Suchman [1987] and other ethnomethodologists amply showed how accounts of practice are constructed a posteriori, as rationalizations rather than constituting the nature of practice.) Thus, it lies in the nature of all re-presentation work that it breaks with the dynamic world and implies not just one gap, but a series of ontological gaps that lie between unlike things. This relation between world and its re-presentation is rendered in Figure 3. On one end, there is the dynamic world of which our biographical experience of being thrown into the world is but one aspect. This figure shows that there is not just a gap between theory and practice, but many (ontological) gaps. (The "ontological" nature of the gaps denotes that two neighboring entities are not just different, but different in type. If two such re-presentations are treated the same in practice, it is because of shared conventions and not because of a [non-existing] logic internal to the structure of the things or signs.) Once we accept that there are unavoidable gaps between any re-presentation and the entities it stands for, the fundamental question is no longer how to narrow the gap between theory (sign) and practice, but how to better deal with it.



**Figure 3.** Relationship between praxis (constituted by dynamic world and lived experience) and theory (re-presentation in the form of signs, language) Adapted from Latour (1999)

We then arrive at the following view of praxis and its relation to different forms of re-presentation. Practical action is absorbed, part of the experience of being-in-the-world and of existential thrownness (Figure 4). Practical action arises dynamically from the situation and does not make itself thematic. Practical action is therefore polythetic (many, potentially infinite, meanings) rather than monothetic (one meaning). To re-present practical action, the totality of existential thrownness has to be described using signs. In this, some aspect of reality becomes re-presented, made present again, but not as it was experienced but in the form of re-presentations (sign) of abstracted entities. When we account for lived experience, we automatically abstract from the experience. There are different levels of abstraction (Figure 4). We now recognize that any description, because it always leaves out, picks out some meaning relationships rather than all the other ones possible, tends towards the monothetic rather than the polithetic end of the meaning continuum. Even a teacher's own account, her own re-presentation will be different from the original experience. The ethnographer's account is still more abstract, in part because of the different position from which he sees the events in the classroom.



**Figure 4.** Forms of understanding and perspectives. At the origin lies the *existential thrownness* of being absorbed in praxis, the experience itself. The more we move to the right, the more ontological gaps we cross, and the greater the distancing abstraction. The teacher’s own reflections about praxis will lie to the left of the ethnographer’s documentation, which itself lies to the left of structural (statistic-based) theorizing. Thus, the teacher also has her biographical experience in terms of which the moment takes significance, whereas the ethnographer relies on the text/document alone. The ethnographer only has available some map of lived experience (through observation and interview), whereas the teacher has available the embodied experience and her map (descriptions).

### *Temporality*

Although re-presenting praxis is one of the modes of making present, it usually occurs when there are interruptions (breakdown) in the unfolding of everyday activity. In re-presenting a situation, deliberation catches sight directly of what is needed, but is not at hand. However, when the theoretician re-presents practice, it is for the purpose of creating re-presentations rather than moving along in the practice (e.g., of teaching) itself. In this case, the temporality that characterizes our lived experience in praxis is squeezed out and the situation now exists in the static structures of the re-presentations. It therefore comes as no surprise that re-presentation is associated with “understanding [that] is always a present that ‘has been’” (Heidegger 1977: 350 [321]). As a consequence, theorizing is always behind, always a re-presenting rather than capturing the decision making in the heat of the moment. “Temporality reveals itself as the meaning of authentic care” (Heidegger 1977: 326 [300]). Temporality is the crucial point in understanding practice, a point that has been completely omitted in traditional theories of practice. This temporality, which we address in our praxeology in the concept of *Spielraum* (see below), room to maneuver, which allows competent practitioners to do the right thing at the right time and without engaging in reflection and re-presentation.

It now becomes clear why teachers and preservice teachers often have difficulties with “ivory tower” theorizing. Arranging and rearranging those abstractions, actions frozen in the descriptions which are arranged into prescriptions for teaching do not and inherently cannot reconstitute the plenitude of teaching as a lived experience. Even if a preservice teacher knows by heart all prescriptions for good teaching, she would still not be able to enact good teaching herself. First, she would have to recognize (i.e., frame) the current situation in a particular way. Then she would have to search for the appropriate strategies to fit the particular situation. Finally, she would have to enact the strategies.

But we know from the cognitive sciences that such a process would likely take several seconds to complete. But such time is often not available (the “teachable” moment would be gone), nor do teachers have the leisure to engage in long searches for appropriate strategies.

### Understanding Praxis: Praxeology

It has become almost a truism that the essential aspects of accomplished practice resist formalization (e.g., Dreyfus and Dreyfus 1986, Suchman 1995). Formalizations do “not ‘impart’ the primary relation of being to the being spoken about, but being-with-one-another takes place in talking with one another and in heeding what is spoken about” (Heidegger 1977: 168 [157-8]). In the objectification that comes with re-presentation, things lose their place in the experienced whole and become released, that is, the things are pulled away, abstracted (Lat. *abstractus* p.part. of *abstrahere*, to draw away: *ab-*, away + *trahere*, to draw) from the experiential whole. But such abstraction is always making a thematic in a particular way such that the totality of what is objectively present is figured against everything else: re-presentation in its very nature constitutes a particular point of view. There is an ontological difference between praxis and lived experience, on the one hand, and theory, on the other. That is, the “logic” of practice is different than the logic inherent in representation and theory. We therefore prefer to talk about a praxeology, which ultimately leads us to draw on the etymological roots of the word (Gr. *praxis*, action, and *logos*, talk). Our praxeology is based on three central concepts: *Being-in/with*, *Spielraum*, and *habitus*.

#### *Being-In/With*

Understandings of knowing and learning grounded in (sociological) phenomenology presuppose *being-in-the-world* (as body among bodies) as the fundamental condition of all knowing (e.g., Bourdieu 1997, Ricœur 1992). Being in the world, we are not only with material bodies, but also social bodies among social bodies: Each being is a being-with an Other. Always and already thrown into a world shot through with meaning, our (social and material) bodies are formed by the (social and material) world that envelops them. Bodies are open to the world, and in this openness they are susceptible to be conditioned by the world, formed by the material and cultural conditions of existence in which it is placed from the very beginning (e.g., birth). Through our bodily inclusion in the world (e.g., classroom and school), we are therefore subjected to a process of socialization in which individuation, the formation of Self (e.g., as teacher), is itself a product. The social is grasped as lived experience, through day-to-day praxis, and the singularity of the “me” is worked out as I enact and emerge from each social relationship. “Me” and “I” therefore presuppose a condition of *being-with* (Heidegger 1977). Our bodies—gestures, attitudes, and facial expressions—are the primary means to provide contextuality and indexicality that are the fundamental conditions and stabilizing features of everyday interaction (communication). It is because the world comprises us, because it includes us as entities among entities, that we can comprehend this world. We acquire an understanding and a practical mastery of the us-including space by means of this material inclusion (which our rationalist theories do not allow us to perceive and which are therefore repressed). We also acquire an understanding by means of the social structures embodied in our

dispositional structures that follow from this material inclusion (Bourdieu 1997). *Being-in* and *being-with* is the core foundation for our solution to the problems in teacher development and teacher education: coteaching. It is this *being-in/with* that is central to apprenticeship and enculturation theories (e.g., Lave and Wenger 1991) and studies of the cultural reproduction of practices (e.g., Jordan, 1989). Relative to teaching, *being-in/with* is the central underpinning of the “co” in coteaching (Roth 1998a, 1998b, Roth and Boyd 1999, Roth et al. 1999). But before we come to coteaching, we need to develop two further concepts.

### *Spielraum*

Competent teachers always seem to do the right thing at the right time. They have a capacity to anticipate problematic situations. This capacity to anticipate, to make salient in the present certain aspects of the future is acquired in praxis, and in a familiarization with the field. This capacity arises from a familiarity of *being-in-the-classroom* even if we do not objectify it and are therefore like the fish, which do not objectify the water that supports them and structures their activities. The anticipation that characterizes competent teaching has nothing to do with the susceptibility to the mobilization of explicit knowledge drawn from memory. This anticipation only reveals itself in practical situations and under the contingencies of an ever-unfolding time. The range of action possibilities available to the agent at any one point constitutes a *Spielraum*, room to maneuver (Roth et al. in press-a). An extended *Spielraum* provides more possibilities for action without stopping to think (reflect) on what to do next. *Spielraum* arises from a practical sense, which locates the next move in the unfolding situation. For the experienced practitioner in a familiar situation, unlike for Nadine in the above quote, there is therefore no question what to do next; what comes next is part of the possibilities of the situation. It is this *Spielraum* that differs across individuals and in effect can be used as a distinguishing characteristic between an inexperienced and an experienced science teacher (Roth et al. 1999). The pressing matters to be completed (Gr. *pragmata!*) are constituted in the relation between the anticipations and expectations on the one hand and the probabilistic structure constitutive of the social world on the other hand (Bourdieu 1997). That is, the objective probabilities that constitute the extended *Spielraum* exist only for the master teacher, who has already developed a sense of the game. This sense is developed in praxis. *Pragmata*, the pressing matters that orient anticipation and the generation of practical action are never produced in the form of explicit forecasts of what is going to happen, or in terms of explicit rules of behavior.

### *Habitus*

*Being-in-the-world* amounts to a non-thematic but caring absorption in everyday activity (Dreyfus, 1991). The world is comprehensible, immediately endowed with meaning because we have been exposed to its regularities from the beginning (see above). We therefore acquire dispositions or systems of dispositions: *habitus* (e.g., Bourdieu 1980, 1997, Bourdieu and Wacquant 1992). *Habitus* generates, without reflection, the patterned ways we interact with the world, that is, our practices that *embody* both actions and perceptions. There exists a mutually constitutive and therefore reflexive relationship between the structures of the world and the structures of *habitus*. Being exposed to and formed by the world, *habitus* embodies the structures of the world.



But, because the *habitus* generates our actions and perceptions, I, the human agent, structure the world itself. *Habitus* therefore constitutes a system of structured dispositions in which the past is constituted in the present. Because *habitus* was formed by the regularities of the world, it is enabled to anticipate these regularities in its conduct. This assures a *practical* comprehension of the world entirely different from the intentional and conscious decoding acts normally attributed to the idea of comprehension. *Habitus* therefore temporizes itself in praxis through a practical mobilization of the past in the very moment it anticipates the future.

*Habitus* cannot be described in the abstract. Central to the notion of *habitus* is that it only reveals itself in reference to the particular, that is, in definite situations. Thus, what has to be done cannot be specified a priori and in the abstract (e.g., in the form of advice to Nadine for classroom control) but emerges from the contingencies and temporalities of each situation. For example, even though it is highly desirable for teachers to plan thoroughly for enacting a curriculum in classes like those in which Nadine is teaching it must be remembered that the most appropriate course of events will unfold *in* the enactment and cannot be pre-specified. Similarly, it is not possible to sit on the side watching a teacher and his/her class and specify a correct course of action to adopt. Thus, *habitus* produces given discursive and material (perceptual, classification) practices only in relation to the specifics of a setting (*being-in!*). To acquire *habitus*, one has to *coparticipate in* situations with those who already have acquired *habitus* prior to ourselves. The formation of any *habitus* therefore requires being-*in* and being-*with*.

*Habitus* is not static and closed but an open system of disposition that is under continuous experience-dependent transformation embodying its own history and experiential trajectory. These experiences either reinforce or modify existing structures of *habitus* such that it will sustain more viable practices. To avert the criticism that we are developing a behaviorist theory, we want to add two points about *habitus*. First, being exposed to the social and material world is not the sole form of shaping *habitus*. *Habitus* “can also be transformed via socio-analysis, i.e., via an awakening of consciousness and a form of ‘self-work’ that enables the individual to get a handle on his or her dispositions” (Bourdieu and Wacquant 1992: 133). Thus, reflection (either in or on action [e.g., Schön 1987]) is an additional, though not primary mode by which *habitus* is formed and transformed. Second, the notion of *habitus* does not rule out strategic choice and conscious deliberation as modalities of action. First, the sequences of actions generated by *habitus* may always be accompanied by interests, strategic calculation of costs and benefits, and by other concerns prevalent in the situation. Second, in times of serious breakdown, when the normal routine forms of interacting with the world are brutally disrupted, rational choice indeed takes over—at least in those agents who are in the position to be rational.

### **Becoming-in-the-Classroom through CoTeaching**

Becoming a teacher means to develop the *Spielraum* and *habitus* that characterize competent teaching. This, according to Bourdieu, can only happen in the experience; if we *coparticipate* (being-with) *in* the classroom (being-in), we participate in the patterned activities, practices, which in themselves make sense: we “are the ways we do things.”

We understand ourselves in the way we objectify our experiences of being-in/with an Other. These experiences constitute the ground that reflexively elaborates (objectified) discourse about teaching. As teachers, we never just do things in a stable world, but interact with students who are also agents themselves. Thus, students and teachers construct their Self-Other continuously and emergently in situation. “Teacher” and “student” arise out of the dynamic of each situation, and personality can only be attributed to individual bodies in a retroactive manner. To be a teacher does not mean just to expose a stable self into the classroom, but to engage in a continuous construction of “teacher” arising from the interactions in and with the (social, material) classroom (e.g., Giddens 1991).

In response to the problems experienced by preservice teachers and based on our experience of teachers learning from teachers as they coparticipate in praxis, we have developed coteaching. Coteaching is a mode of teaching grounded in *being-in/with* as the fundamental condition of existence (Roth 1998a, 1998b). In coteaching, several practitioners share (*being-with*) the responsibility of teaching this class (*being-in*). They plan lessons together and work side by side in the classroom. This does not preclude that one individual take a greater and more central role in some situations (e.g., during planning or questioning).

Coteaching works because *habitus* generates (discursive and material) practices only *in the relation to* particulars; as with other practices (e.g., Bourdieu and Wacquant 1992) there is no better way to experience it other than in the praxis of doing the real thing together with another practitioner. The benefits of coteaching fundamentally arise from the experience of *being-together-with* that leads to a silent pedagogy where people learn and harmonize their practices with more experienced practitioners, without having to make their learning thematic. By working with another person, particularly with an experienced Other, new teachers come to enact appropriate teaching as a way of being in the world.

It is the objective homogenizing of group or class habitus that results from the homogeneity of conditions of existence that enables practices to be objectively harmonized, without any strategic calculation or conscious referent to a norm, and mutually adjusted in the absence of any direct interaction or, a fortiori, explicit coordination. (Bourdieu 1980: 98)

Being-together-with, which underlies non-thematic learning and coordination of practices, allows *coteachers in* the classroom to experience events under the same conditions of temporality, openness of activity toward the future, and constraints to have to enact without the leisure of theoretical (atemporal) reflection. Practitioners experience the synchrony between themselves and with the class. Under certain conditions, two experienced practitioners can enact lessons, improvising and exchanging roles during questioning, with a feel for the implicit intent of the other, without objectifying the events and communicating about it (Roth 1998b, Roth and Tobin 1999).

In order to appropriate *habitus* without the tinkering required in trial and error, the teaching of a practice (*métier*, craft, trade) requires a pedagogy that is different from that of teaching propositional knowledge. It has been suggested that often the most vital modes of thinking and action cannot be made thematic, and therefore cannot be taught by

talking about them (e.g., Bourdieu 1980, Dreyfus and Dreyfus 1986, Schön 1987). Rather, to learn these modes of thinking and acting, practitioners have to coparticipate in doing the real job, which allows them to learn enacting teaching in similar ways even if teaching situations are too complex to be broken down in a small and manageable number of variables. Such a view of practice is a viable one not only for the learning of material practices such as those required of butchers and midwives (Lave and Wenger 1991). Rather, such pedagogy is also appropriate for the conceptual and methodological practices of doing research in academia more generally (e.g., Bourdieu 1997, Roth and McGinn 1998); and they are especially appropriate for teaching (Roth 1998b).

In our ongoing studies (of which we have conducted seven so far), all teachers who experienced coteaching emphasized the tremendous amount of learning they experienced. Even experienced teachers typically make comments such as “I don’t think three university courses could have given me what [coteaching] gave me in these two months.” (Tammy) or “This experience has changed my thinking about this unit [although] I wrote it, tested it, and had done workshops with teachers on it for the past three years.” (Gitte) (Roth, 1998a). Teaching interns in our research especially drew benefit from working at the elbows of a more experienced practitioner:

[Nadine:] Yeah, that was helpful for me to, to listen to your [Roth’s] questions and hear your questions *then and there*, as it happened, and then to think about how it related to the demonstration and where you [Roth] were trying to go with that question.

### CoTeaching Science: The Penn Experience

At Penn we assigned prospective high school teachers in pairs to the small learning communities<sup>1</sup> in two high schools. The underlying reasons for this approach were twofold. First, we wanted to create a community of learners in which 6-8 student teachers (two each in English, social studies, mathematics, and science) learned to teach with the assistance of 5-6 practicing teachers and approximately 200 high school students (i.e., being *in* a community). Although in most cases two or three student teachers were assigned to one cooperating teacher (i.e., a “coop”) there were instances when only one student teacher was assigned to a coop. The resources to support learning to teach within a SLC included a coop, other practicing teachers, other student teachers (some of whom are assigned to a common coop), a SLC coordinator, the methods instructor, and high school students. Also we considered the context in which teaching would occur as an important resource to support learning to teach.

Second, we wanted prospective teachers to learn by teaching with others (i.e., being *with* others). We did not begin with an assumption that one resource would be more salient than another in enhancing learning to teach. For example, we rejected models that assumed that the coop was the critical variable in facilitating learning to teach or that the coop had to be an exemplary teacher. Instead we regarded coops, high school students, methods instructors, and supervisors from Penn as resources to provide ongoing support

<sup>1</sup> A small learning community (SLC) is a school within a school. An SLC usually consists of about 200 students and a teacher for each subject (i.e., about 5 teachers).

for learning to teach. The support assumes many forms, including the presence of Others to facilitate coteaching and colearning; these Others are constitutive of the social world that shapes a new teacher's becoming-in the classroom. In addition, our approach regards conversations about praxis as a critical ingredient in learning to teach that involves others who participate in the practices *with/in* a community. This assumption necessitates all participants assuming roles (often new roles) as teacher educators and for those who customarily are teacher educators (such as supervisors) to adapt their roles to allow their perspectives to be *Other from with/in* rather than *Other from out/side*. In addition, we expect administrators from the school and SLC, parents, and people from the wider community to be *with/in* resources to support learning to teach. Accordingly, learning to teach is situated *with/in* a community and learning arises from and is constituted by coparticipation in the ongoing activities of that community. Coparticipation and the associated learning includes not just the coteachers but also the participation of students and Others that belong to the community (i.e., stakeholders). We did not define coteaching in specific terms, leaving it instead for the participants within a SLC to work out the details to fit the circumstances and opportunities that emerged.

Because we did not define the roles of participants (especially coop, student teacher, and supervisor) there was an initial tendency to participate and enact teaching according to a *habitus* built elsewhere from a participant's experience of teaching, learning and teacher education. Also, we encouraged supervisors to coteach rather than to effect evaluations from viewing teaching from the side or back of the classroom. The role of the supervisor was not so much to judge from the side as to facilitate conversations between (co)participants from *with/in*.

When university supervisors visited a class we encouraged student teachers and their coops to teach, to participate as a teacher, to become a teacher *in* the class *with* another teacher and in so doing, to build new *habitus* and an associated *Spielraum*. Given our open approach to role definition it is not surprising that coteaching evolved differently in different sites. In some instances coteaching was regarded as teaching with another prospective teacher rather than coparticipating in a community of teachers (Skyla<sup>2</sup> and I have been coteaching every day in chemistry. This is working out well as we are working in 15-minute segments so the students don't get tired of us. Also, in planning it is great to have someone to bounce ideas off of. Two heads are better than one. It is also nice to be able to assess each day). In other instances the coop teacher participated by coteaching with the prospective teachers (We break up our class into smaller groups many times and we each take charge of a group so that it is like having three classes within one. Each of us then becomes the lead teacher for our group so I feel that during these times my coop and I are at the same "level". I like this arrangement very much because I don't feel intimidated by the class size and it gives me a chance to be in charge and be responsible for the students. Sometimes we will all be together for one class and during these times we usually go around the room to help individual students and take turns explaining/going over what we're learning). Finally, there were very traditional arrangements in which the coop teacher placed greater value in learning first by observing and then allowing the student teacher to participate as an assistant, gradually assuming more control until s/he could teach alone. In such circumstances student teachers often felt disadvantaged with respect to their peers. Indeed throughout

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<sup>2</sup> Pseudonyms are used for all participants and the name of the school.

the student teacher group there was a strong preference to be assigned to coop teachers in pairs.

Bert had been teaching at City High School as a science teacher for more than 30 years. He is an experienced coop and although student teachers are very fond of him there are constant criticisms about aspects of his competence as a science teacher. Most of the critical comments reflect a perception that he is not an exemplary teacher and therefore that he may not be an ideal cooperating teacher. Critical comments about his teaching included: a lax approach to discipline, limitations in his background knowledge of some of the disciplines of science (e.g., chemistry), and a tendency to teach off the cuff. However, Bert was willing to accommodate the goals of student teachers and organized his classes to allow them to teach for the entire year. In the two years prior to our adoption of a coteaching policy in the teacher education program, Bert had been the coop for pairs of student teachers with whom he had cotaught (i.e., he pioneered some of our early work on coteaching). Even though these student teachers occasionally were critical of aspects of Bert's science teaching it was apparent that their teaching blossomed in comparison to that of their peers. The contexts created in Bert's SLC seemed ideal for learning to teach. This year is no different. Stephanie and Swee Chiew, two student teachers, both seeking biology certification, are assigned to the Health SLC with Bert as coop.

From the very beginning Bert handed over the responsibility for planning to Stephanie and Swee Chiew. Because of her prior experience as a teacher in a private school Stephanie seized the initiative and, before long, her mark on the class was apparent. She planned thoroughly and was innovative in her efforts to create an environment in which students would be interested in science and challenged. Bert facilitated Stephanie's teaching by being enthusiastic about her ideas and Swee Chiew provided support in enacting them. Stephanie and Swee Chiew were willing to enact teaching in ways that it was consistent with the theoretical precepts discussed in their methods courses. Because Bert was always willing to try something that made sense to him, the classroom environment was transformed during the fall semester. For example, they broke each 90-minute class period into relatively short 15-20 minute activities and, in an endeavor to maintain student focus and engagement, they set aside the initial activity each day for the problem of the day. This allowed students to review what they knew from previous lessons and settle down as they entered the classroom. Also, Stephanie and Swee Chiew responded to a schoolwide emphasis on reading and literacy with a daily 15-minute activity that focused on the creation of a vocabulary wall. Here, essential scientific terms were mounted to enable students to focus on how to read and write them and ensure that they knew their meanings and could use them appropriately in sentences.

As a team, Stephanie, Swee Chiew, and Bert regularly reviewed their experiences of coteaching and possible ways to organize the curriculum to enhance the learning of their students. Their conversations were reflections on what happened in the previous lessons and focused on their shared experiences that had arisen from *being-in* this classroom *with* the partners. The conversations included plans on what, when, and how to teach the next classes, the problems that were to be addressed, and the roles each of them would assume. Tobin's role as supervisor was to coteach rather than observe passively, which

allowed him to experience the events from *being-in/with*, giving him a better position to subsequently facilitate conversations between the three of them that directly focused on their roles and goals. These included curricular ideas that would connect their activities to district standards, how to manage particular learners who were experiencing difficulties in learning or who were disrupting others from learning, and how to extend the classroom discourse to be more science-like.

As problems arose they were identified and resolved through discussion. For example, there was a concern that Swee Chiew was not pulling her weight as a teacher. Stephanie was doing a disproportionate amount of the teaching and Swee Chiew was prepared to stand back. In his role as supervisor Tobin made this issue explicit in one on one discussions with Stephanie and Bert. When Tobin sought Swee Chiew's perspective she explained aggressively that she was learning a great deal and, for the time being, was more comfortable in a backup role. However, the discussions between pairs facilitated the issue being raised by Swee Chiew in a meeting of the three teachers. A plan was then devised to ensure that each of them assumed the primary responsibility for one class and backup responsibility for others.

The roles of student teacher, coop, and supervisor have adapted to incorporate coparticipation *with others in a community*. There is increased recognition of the goal of building *habitus* and *Spielraum* and less of an emphasis on learning techniques from an exemplary coop and applying methods suggested university instructors. All three teachers learned from one another even though Stephanie consistently demonstrated leadership throughout the semester and Bert and Swee Chiew showed in their teaching that they learned from her. Similarly, Stephanie was a highly motivated learner and changes in the way she taught were apparent throughout the semester. The enacted curriculum showed evidence of Stephanie having learned from listening astutely to advice from Bert, Swee Chiew, Tobin, and her methods instructor. Also, consistent with Roth's experiences with coteaching, all participants showed evidence of having learned from one another (especially from Stephanie). By teaching at the elbows of Bert and Swee Chiew, and at times Tobin, there was evidence too that Stephanie's interactions with students changed and Bert's teaching was noticeable in Stephanie's approach to managing students.

The manner in which student teaching was organized reflected the personnel and factors associated with the SLC. In one instance a coop in his third year as a teacher regarded himself as an authority and assigned his three student teachers to teach the classes in pairs. The following excerpt from an interview with one of the student teachers captures some aspects of the respective roles of student teacher and coop in this arrangement.

My coop seems to think that we will take over his classes and that he can sit in the back unless "a fight breaks out" (his words) and then he'll save the day. To date, he is either ON (full charge of class; we act as TAs) or OFF (he's either physically not present or mentally not participating). When we offer ideas, he tells us to run with them, and wants it to take the whole period, even if it is a simple demonstration. He usually doesn't even want to know exactly what we are doing beforehand, and I need to press him to even look over my plan and worksheets. Unfortunately, when we ask for the coop's input on how we can better control the class, he undermines us by telling the class that they will be punished for not having listened to us. Once he gave a pop-quiz and canceled a lab "because of they didn't listen to us" when in truth he didn't even have the lab

ready and the quiz didn't even cover the material we had tried to go over - so those kids who listened weren't rewarded.

The above comments are a segue into a discussion of the roles of participants. Adapting roles as teacher educators of student teachers, coops, high school students and supervisors cannot occur through prescription, nor does it happen overnight. All people involved have to change their habits and their *habitus*. This will take time. Coteaching is not a panacea that automatically yields solutions to the enduring problems of teacher education. Rather, it is a different way of doing and conceptualizing teacher education. As such, time and reflective discussions among insiders (i.e., *with/in* communities) are essential to align the roles of participants and to effect coparticipation oriented toward learning to teach.

Because new roles have to be negotiated there may be times when the participants are uncomfortable in making changes. For example, Tobin focused his role as a supervisor on the building of community in each of the sites in which student teachers were placed. Instead of adhering to the traditional supervisor role of scheduling visits to observe teaching he visited most classes of the student teachers each day for periods of 15-20 minutes. During his visits he interacted with the coop and student teachers and, as the lesson was taught, he coparticipated as a teacher. He perceived his principal role to be as a mediator of the roles of the coop, student teachers, students and other faculty in the SLC. Through his presence he was able to make suggestions on how to structure the resources so as to maximize the opportunities for teachers to learn from one another and maximize the learning opportunities for the high school students. His position as Director of Teacher Education allowed him to change his roles without the worry of what others might think. However, he felt uncertain at times and constantly examined his participation in terms of his beliefs about teaching as praxeology and learning to teach. The pressure to adopt more conventional roles as *an expert on the side* was pervasive and evident in the expectations of coops, student teachers, other practicing teachers and school administrators (and colleagues and administrators within the university).

Our widespread adoption of learning to teach based on coteaching has shown that there are different ways of organizing coops and student teachers (at different places along the continua of teacher performance). Despite differences, the coteaching teams facilitate the learning of high school science students and, in so doing, learn from one another. However, to maximize the effectiveness of coteaching it is clear that all participants need to actively raise questions about roles (especially university supervisors, coops, student teachers, and high school students) as resources to support learning to teach. One cannot overemphasize the significance of conversations about roles and the reasons for some roles being more salient than others. We find salience in the concepts of being *with Others in* a community, *habitus* and *Spielraum*. It is not only important to explain to each person what they might do to facilitate learning to teach but also why particular ways of participating are more likely to be beneficial than others. It is in the explication of why particular roles might be productive that theorizing can be beneficial. Although it is accepted that there are multiple ways of participating appropriately with the goal of learning to teach it also is a truism that there are multiple ways of participating that will not be productive. Accordingly it is desirable that discussions among participants *with/in* a community focus on the rationale for the most salient roles

and associated modes of coparticipation. It is out of these discussions that we see evolving a viable discourse, a praxeology (praxis + *logos*, talk) in the true sense of the word. Our teams, coops, student teachers, supervisors and so on develop praxis-relevant understandings rather than theory (which does not account for the particulars of a setting that constitutes the suitability of each practical move).

### Coda

We have suggested coteaching not only as a mode of learning for preservice and inservice teachers, but also as a different way of conceptualizing the supervision and evaluation of teaching (Roth and Tobin 1999). Supervisors and evaluators, in the traditional model, are looking from the outside onto the lived experience. Although they are *in* the classroom, they are not in the classroom in the same way as the teacher. They therefore look *at* teaching from a vantage point that differs from the teacher's. They therefore do not share teaching in the mode of being-with nor do they share the teacher's being-in: The "in" is different for the teacher than it is for the ethnographer, supervisor, or teacher evaluator. As Figure 4 shows, these supervisors, coaches, and evaluators do not share in the existential thrownness that is characteristic of teaching practice. On the other hand, the coteacher, being-in/with, shares the original experience. We therefore propose to change the positioning of supervisors and evaluators. Rather than looking at teaching from the outside, we suggest that they should engage in coteaching and experience teaching, from the *inside* and *with* the partners. In this way, they would come to share the fundamental condition of being-in/with the teacher. Then, because "supervisors" and "evaluators" are also absorbed in the process of teaching, they get an inside perspective of the particulars of *this* classroom in which they find themselves. During those moments that allow them to step back because the coteaching partner has taken over the lead, coteaching allows for reflection on the actions of the other. Out of this experience of *being-in/with*, an experience that can be objectified *a posteriori* and away from the unfolding events, the participants may then collectively elaborate an evaluation. Thus, Ken who at first provided his student teachers with advice on what and how to teach could develop a sense of what it meant to teach in the here-and-now of *this* class only by working side-by-side with a student teacher or the regular classroom teacher. Furthermore, all of our studies showed that the coteaching experience provides a rich ground for developing a professional discourse, a praxeology (understood as talk about practice), that is associated with an ever increasing understanding of practice out of practice. Praxeology, as we elaborated in some detail elsewhere, is grounded in a hermeneutic phenomenology designed to develop understanding through rigorous explanation seeking inquiry but always remaining in, and being enveloped by, the situated understanding of day-to-day praxis (e.g., Roth and Tobin 1999). Thus, coteaching provides a fertile ground for dealing with the gap between theory and practice in that it objectifies practice *out of* practice but is always attached to practice.

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