Available online at www.sciencedirect.com
ScienceDirect
Teaching and Teacher Education 24 (2008) 967–981
TEACHING AND TEACHER EDUCATION
www.elsevier.com/locate/tate

Coteaching as a model for preservice secondary science teacher education

Kathryn Scantlebury[a,*], Jennifer Gallo-Fox[a], Beth Wassell[b]

[a]Department of Chemistry & Biochemistry, University of Delaware, Newark, DE 19716, USA
[b]Department of Teacher Education, Rowan University, Glassboro, NJ, USA

Received 27 July 2006; received in revised form 30 September 2007; accepted 25 October 2007

Abstract

This paper focuses on a 3-year, longitudinal study of the implementation of coteaching, as an innovative approach for preparing high school science teachers enrolled in an undergraduate science teacher education programme located in the United States. The coteaching|co-generative dialogue|co-respect|co-responsibility dialectic is introduced as a way to conceptualise coteaching practice and support successful implementation. We also discuss means to introduce coteaching into the preservice programs and report on findings from an evaluative study of the implementation process. Coteaching has the potential to re-conceptualise teacher preparation and professional development models for science teachers.

Keywords: Preservice teacher education; Field experience programs; Science teachers; Teacher collaboration; Dialogs (language)

1. Introduction

Student teaching is the capstone experience for most teacher preparation programs in the United States. As such, teacher educators acknowledge the influence of the student teaching experience on one's development (Feiman-Nemser & Buchmann, 1987). However, student teaching can also be problematic because of different power status between cooperating and student teachers, the idiosyncratic nature of student teaching, contextual issues, a focus on classroom management during the teaching experience, and limited opportunities for student teachers to link theory and practice (Guyton & McIntyre, 1990; Smith, 2005; Wideen, Mayer-Smith, & Moon, 1998). Moreover, few studies in secondary education focus on the nuances of the teaching experience within specific content areas (e.g. science) or on the role of cooperating teachers and teacher educators in preparing teachers (Clift & Brady, 2005).

Research has focused on the isolation new teachers face in the classroom, yet few practicum models or professional development programs seek to address the inherent isolation in teaching (McIntyre, Byrd, & Foxx, 1996). Recent reforms have promoted the establishment of learning communities at the classroom level for inservice teachers (Roth & Tobin, 2002), and other United States reform efforts[1] have highlighted the importance of

*Corresponding author. Tel.: +1 302 831 4546; fax: +1 302 831 6335.
E-mail address: kscantle@udel.edu (K. Scantlebury).

[1]For example, Interstate New Teacher Assessment and Support Consortium (INTASC) (Council of Chief State School Officers (CCSSO) (2007) and National Science Education Standards (NSES), National Research Council (1996).

0742-051X/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.tate.2007.10.008

being a community member as an element of professionalism (Davis, Petish, & Smithey, 2006). However, there is little effort to forge learning communities among individuals before and during the student teaching experience (Clift & Brady, 2005). When introduced into a teacher preparation programme and conceptualised as a dialectic,[2] coteaching and co-generative dialogues are strategies that can promote learning communities based on collective teaching, respect, and responsibility within classrooms and departments.

In order to address these issues, the coordinator of a secondary science, undergraduate teacher education programme located in the United States introduced coteaching and co-generative dialogues into dialectic science education courses and as a model for the student teaching practicum. Coteaching offered an alternate method for preparing teachers that emphasised situated learning within a construct of collective responsibility, reflection, and mutual respect (Tobin & Roth, 2006). The structure of coteaching and co-generative dialogues promoted the establishment of a professional learning community comprised of cooperating teachers, interns,[3] and university supervisors and researchers.

This paper focuses on a study of a 3-year implementation of coteaching and co-generative dialogues as innovative dialectical approaches for preparing science teachers in the United States during the academic years spanning Fall 2003 through Spring 2006. In this paper, we first review coteaching and then present the coteaching|co-generative dialogues|co-respect|co-responsibility dialectic. Second, we describe the model and its introduction into the teaching methods course and student teaching. Finally, the paper concludes with the study's findings and presents future directions for the programme and research on the coteaching|co-generative dialogues|co-respect|co-responsibility.

2. Developing capital: considering teaching from a socio-cultural perspective

Typically in student teaching, preservice teachers learn from an experienced teacher through praxis (Guyton & McIntyre, 1990). As student teaching is framed by the social and cultural settings of schools, we used a structure|agency framework as an analytical tool to examine how individuals' practices are constantly shaped and reshaped by schema and human and material resources (Sewell, 1992). Interns, cooperating teachers, students, university supervisors and researchers, and school administrators are human resources, while material resources include science equipment, the physical environment, and the artefacts generated during teaching practice (e.g. board notes, worksheets). An actor's power or agency is constantly empowered or constrained by structures and her/his ability to appropriate both human and material resources.

Culture consists of structures, framed as schema and resources, in a dialectical arrangement with agency (Sewell, 1999), and enacted in social settings or spaces called fields (Bourdieu, 1986). Within fields, participants have cultural, social, and symbolic capital. A teacher's capital impacts her/his agency. Cultural capital includes elements such as an individual's language skills and the ability to use resources that exist in the field. A field may be the whole classroom or students in a laboratory setting, that is, wherever culture is enacted. Symbolic capital provides a participant with the ability to command respect from others. In student teaching, cooperating teachers attain symbolic capital through their experience and pedagogical knowledge. Social capital reflects participants' social networks, that is, their acquaintances, peers and friends. Coteaching depends upon the social capital built between the co-teachers and students. Participants may consciously or unconsciously appropriate resources. When participants consciously access resources, they can be used to reproduce or change the culture of the field. Individual and collective responsibility and co-respect are critical for a successful coteaching experience (Scantlebury, 2005).

3. International perspectives on coteaching

Prior studies on coteaching have discussed the rationale for the model and initial outcomes of its implementation in various preservice teacher education programs (Roth & Tobin, 2002, 2005; Roth, Tobin, Carambo, & Dalland, 2004; Tobin & Roth, 2006; Tobin, Zurbano, Ford, & Carambo, 2003). Coteaching enables key stakeholders in teaching, such as interns, cooperating teachers and university personnel, to link theory and practice through the

[2] Tobin and Roth (2006) interpret dialectic as recursive, representative of the complexity of theoretically understanding social interactions and the use of the symbol "|" to represent a dialectic.

[3] We refer to student teachers as interns to acknowledge the different status and responsibilities expected in coteaching as compared to the more 'traditional' approach of one student teacher assigned to work with a cooperating teacher.

critical analysis of teaching practices (Roth & Tobin, 2002). Faculty have utilised the model in university methods courses focused on engaging preservice teachers with inquiry (Eick & Dias, 2005). Other studies have explored how preservice teachers acquire and optimise pedagogical knowledge when coteaching with their peers in a methods course (Eick, 2004; Eick & Ware, 2005).

Moreover, in some arrangements coteaching provides teachers additional human resources to teach content specific material. For example, inservice teachers have used coteaching as the model between special education and classroom teachers (Gleason, Fennemore, & Scantlebury, 2006; Kluth & Straut, 2003). Murphy and Beggs (2005) introduced coteaching into Irish primary schools by pairing primary preservice teachers, majoring in science, with teachers who had little or no experience teaching science through inquiry. Their studies noted the improved teaching practice scores of the preservice teachers involved with coteaching as well as improved attitudes towards science from primary school children in the cotaught classes (Murphy & Beggs, 2005; Murphy, Beggs, Carlisle, & Greenwood, 2004).

At the high school level, Tobin and his colleagues placed multiple student teachers in various coteaching arrangements with cooperating teachers and each other (Roth & Tobin, 2002, 2005; Tobin & Roth, 2006). They studied how coteaching expanded the teaching resources for students, interns and teachers (Roth et al., 2004), the use of co-generative dialogues to review teaching practices and develop knowledge (Roth & Tobin, 2001; Tobin & Roth, 2006), and the introduction of culturally relevant curriculum in urban settings (Tobin, Roth, & Zimmermann, 2001).

Co-generative dialogues are formal discussions among participants based on shared experiences and focused around improving teaching and learning. Initially introduced into urban schools (LaVan & Beers, 2005), co-generative dialogues are now used in various education settings when the participants collectively co-generate strategies for improving practice (Tobin & Roth, 2006). A major tenant of co-generative dialogues is that no one participant's voice is privileged over another. By listening to each other, participants are able to gain insight into various perspectives and ways of interpreting the teaching and learning experience. Thus, within the context of a co-generative dialogue focused on issues related to teaching and learning, a student's perspectives were as important and as valued as a teacher's (LaVan & Beers, 2005; Tobin & Roth, 2006). The importance of valuing all voices and respecting one another as colleagues is also central to coteaching and co-generative dialogues within this study's setting. All stakeholders are introduced to these ideas before coteaching begins. In addition, it is an element of practice and an approach towards working together that is generally reflected throughout the work of co-teachers.

4. Methodology and data sources

We conducted an ethnographic study of the implementation of coteaching, a new model of student teaching for the University of Delaware's Undergraduate Secondary Science Teacher Education Programme. The paper describes a model of coteaching implemented as an alternative approach for student teaching. It presents the ways that the model unfolded in practice and describes the four essential elements of coteaching which were found to be critical dialectics for successful coteaching practice (coteaching, co-generative dialogues, co-respect, and co-responsibility). In our study of the implementation of coteaching as a model for student teaching, we asked:

(1) What were the model's characteristics that afforded or hindered coteaching?
(2) Are these characteristics aligned? If so, what are their relationships in practice?
(3) How can teacher educators support the successful implementation of the coteaching model?

The study followed three cohorts of secondary science preservice teachers from the fall semester of their senior year through student teaching and into their first year as classroom teachers. During the first year, 2003–2004 six interns were placed at Biden High School for the spring semester of student teaching with seven cooperating teachers. In the spring semester of 2004–2005, nine interns worked with nine cooperating teachers at Biden. Six interns were placed at other schools.[4]

We interviewed the interns three times: during their fall methods course, within the first few weeks of

[4]The increased number of interns necessitated the placement of some interns at new coteaching sites. The interns' science major and the availability of experience cooperating teachers' willingness to embrace an alternative student teaching model became the primary selection criteria for placing the remaining interns.

student teaching, and after completing the programme. Methods instructors, university supervisors, and cooperating teachers were interviewed yearly. Interviews were conducted using a combination of semi-structured and open-ended interviewing techniques. They were structured as free-flowing conversations with the goal of addressing the different topics identified in the interview protocols. The protocols had general questions, but the participants typically directed the interview conversations.

Video data were collected regularly throughout the year from the methods course, practicum experience and the weekly seminar. In addition, at least ten hours of video data were collected of each intern's coteaching, solo teaching and coplanning experiences. Finally, interns' weekly lesson plans, journal entries and researcher field notes served as additional data resources.

After the interns completed their student teaching experience, we transcribed the interviews and reviewed the video data to produce coded segments and vignettes. Interview data were also coded. During this process, researchers initiated axial coding and used a constant comparison method. As coding continued, relationships between codes were noted and themes began to emerge. HyperResearch Software© was utilised to label and track codes and to generate reports of coded data for further analysis. Consistent with our methodology, we assembled patterns of coherence and contradictions that emerged from the data (Sewell, 1999). Research findings were triangulated across time, data sources, and participants. Additionally, classroom observation and field note data were utilised for analysing both supporting and contradictory cases. We conducted member checks with the research participants as an on-going, multi-level process: we checked for facts and theoretical understanding throughout data collection; research participants member checked their interviews; and finally theoretical models were member checked with groups of participants. Additionally, three interns participated in the data analysis, thus providing an emic or insider perspective on the data constructions and interpretation. Through an iterative process, we used the on-going data analysis and collection to improve the model's implementation and to share the research with participants.

5. Implementing coteaching

In this section, we discuss the introduction of coteaching and co-generative dialogues to the stakeholders involved in the science teacher education programme.

5.1. Introducing coteaching and co-generative dialogues to the secondary science teacher education programme

During the fall semester methods course the instructors, university science education faculty and a current high school science teacher modelled coteaching and co-generative dialogues for the interns by using these pedagogical approaches. Throughout the semester, the methods instructors highlighted unfolding events as examples of good or poor coteaching. They discussed how they shared the teaching space through conscious and unconscious gestures and practices, such as stepping into the spaces within the conversations to provide an example, ask a question, or share an anecdote (Milne, Scantlebury, Blonstein, & Gleason, 2006).

The methods instructors introduced co-generative dialogues by engaging the interns in dialogues focused around improving the methods course. Some of the interns' suggestions included expanded use of the course's electronic blackboard, restructuring of class discussions, and a different strategy for introducing required readings. Three co-generative dialogues were held during the semester. This allowed for the implementation of suggestions from first two co-generative dialogues. The final dialogue was a course evaluation.

In the first year of implementing the coteaching model, all interns were placed at Biden High School[5] (Scantlebury, 2005). In the second and third year of implementation, with increasing numbers of science interns, we involved teachers at other schools. Before its introduction into other settings, potential cooperating teachers attended presentations on coteaching and co-generative dialogues that included a question and answer panel session with the cooperating teachers and interns from Biden High.

5.2. Coteaching|co-generative dialogues during student teaching

During the methods course the previous semester, all interns had observed the teachers that they would be working with during coteaching, however they had not always visited the specific classes that

[5]For a detailed description of the establishment and arrangements with the school site see Scantlebury (2005).

they would be teaching. In some circumstances, interns visited their classes and talked with co-teachers in January before commencing student teaching. This enabled a quicker move to more central instructional roles once they began working in full-time in the classrooms. Once coteaching, interns became involved in the classroom teaching on the first day of student teaching. All interns cotaught from the first day, assuming various roles in the classroom—tutoring groups of students, working with individuals, leading discussions or asking and answering questions. However, the extent of that involvement depended upon their preparation, planning, and personal comfort levels.

During the 15-week student teaching practicum, interns taught five classes a day. The interns cotaught four classes with a combination of at least two of their peers and two cooperating teachers. Each intern taught across grade levels and science content and assumed sole responsibility for one class. In the solo class, interns frequently drew upon resources and experiences from their cotaught classes and also had the opportunity to try out different pedagogical strategies from their coteaching arrangements.

To maximise the interns' planning time with multiple co-teachers, their preparation periods coincided with those of their cooperating teachers whenever possible. However, this arrangement did not work for some cooperating teachers such as Vincent, the environmental science teacher, who worked with five other teachers including interns and a science inclusion teacher. Early in the first year of the new model, he declared "Vincent Hour," a weekly, 1-h planning time after school for all Environmental Science co-teachers. He kept this practice in subsequent years.

In addition, all stakeholders (interns, cooperating teachers, clinical supervisors, researchers, and programme faculty) participated in a weekly seminar that was a forum for reflective practice on the teaching and learning of science. The seminar enhanced the establishment of a professional learning community that also impacted the cooperating teachers' practice.

6. Coteaching dialectic at State University: coteaching|co-generative dialogues|co-respect|co-responsibility

We developed our model for the coteaching|co-generative dialogues|co-respect|co-responsibility dialectic from previous studies focused on preparing high school science teachers (Tobin & Roth, 2006).

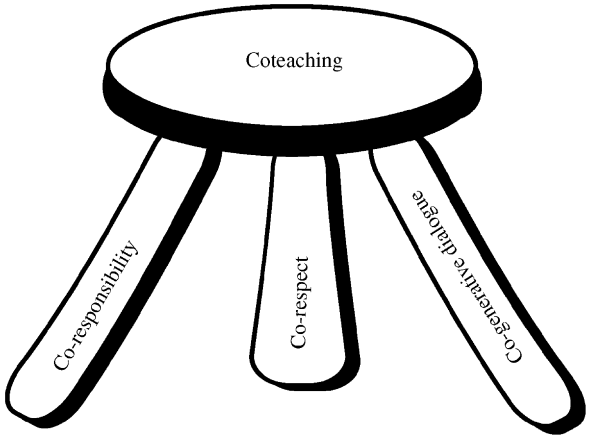

Fig. 1. Three-legged Stool: coteaching.

In this study of coteaching as a model for student teaching, three critical elements emerged: co-generative dialogues, co-respect, and co-responsibility. The three-legged stool shown in Fig. 1 illustrates the interdependence and recursive nature of these elements with coteaching and each other. Similar to the balance provided by three legs of a stool, coteaching is less effective if one element is missing, under-utilised, or compromised. In the following sections, we describe each of these key elements and discuss the dialectical nature of the model.

6.1. Coteaching

Coteaching occurs when multiple teachers (interns and cooperating) teach together in a classroom. All participants share mutual responsibility for the teaching and preparation of classroom practice. Through the praxis of teaching, co-teachers generate collective understandings of their practice together, thus expanding their knowledge about what it means to teach. It is a dialogic process that draws on reflective practice as a mechanism for making unconscious practices explicit. Coteaching is most successful when teachers focus on student learning. This requires communication (co-generative dialogues) about collectively generated practice, a mutual sense of co-respect for one another's contributions to the practice, and a shared sense of co-responsibility for meeting the students' needs.

6.2. Co-generative dialogues

Co-generative dialogues occur when co-teachers discuss the issues that impact teaching and learning,

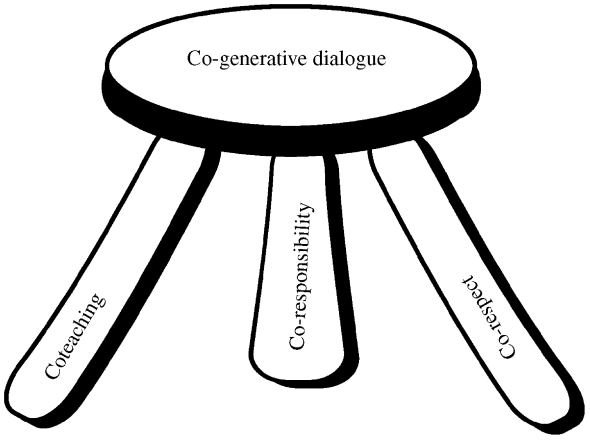

Fig. 2. Three-legged stool: cogenerative dialogue.

and collectively generate solutions to any problems. Co-generative dialogues are open discussions in which all participants' opinions and voices have equal value, and the participants co-generate a product (e.g. a solution to a teaching or learning issue) (Martin, 2007). Co-generative dialogues are in a dialectical relationship with coteaching, co-respect and co-responsibility. Thus, these four aspects impact each other. We illustrate in Fig. 2 how the other three elements support successful co-generative dialogues.

Co-generative dialogues may focus on the implementation of an activity, a lesson, or an assessment and provide the opportunity for teachers to reflect on their praxis. Through the discussion of collective teaching, teachers can become aware of explicit and tacit aspects to teaching (Tobin et al., 2003) For example, during our implementation of coteaching, co-generative dialogues occurred during weekly on-site seminars with all participants including interns, cooperating teachers, programme administrators, clinical supervisors, and programme researchers. These co-generative dialogues focused on issues related to the enactment of coteaching and coplanning, strategies for dealing with classroom management, student motivation and attitudes, and interactions with parents.

6.3. Coplanning

Weekly coplanning sessions provided the setting for another type of co-generative dialogues. Good coteaching is not haphazard or spontaneous, but the result of coplanning, which requires the participation and involvement of all co-teachers. Regular co-generative dialogues occurred during weekly coplanning sessions among co-teachers for their collective classes. The act was labour-intensive as all teachers reflected upon lessons, programme objectives and goals, related the learning goals to standards, and provided input on artefacts such as assessments or laboratories. Coplanning emerged as a professional development activity because during this time teachers shared ideas, reflected on past experiences, and collectively developed mutual understandings for practice. Without coplanning, teachers did not have common understandings of classroom instruction and had divergent goals for students.

Our analysis of coplanning sessions showed that five types of coplanning meetings existed. Coplanning sessions were co-generative or directed experiences. As Jaime explained:

> [Coplanning] worked really well with Vincent…we just tossed in ideas and discussed whether they were good, whether they were bad. And I think there was a lot of equality…With Anne sometimes she was a little more set in her ways, so it wasn't as easy to throw out your ideas. (Jaime, Teaching Intern, Interview, May 2004)

Jamie described coplanning with Vincent as a brainstorming event, while Anne *directed* coplanning. In *directed* coplanning sessions, teachers dealt with the logistics of lessons, however in *co-generative* coplanning sessions co-teachers collectively *brainstormed* ideas. For example, the following transcript from an Environmental Science course coplanning meeting with five co-teachers illustrates a session that shows *brainstorming* and *reflective* characteristics. Vincent was the cooperating teacher; the other four participants were interns.

Vincent	… it's a good way to show how oil is extracted. But I'm thinking if you do it as a demo lab you have much less quantities of waste, of oil, to clean up. And then you have much less, glassware and other issues with the equipment. So, that is a good demo. If we can find something [an] alternate, we can assign people here.
Luke	Do you want to base it on that type of activity, or—
Vincent	Some type of thing having to do with fossil fuels, coal, oil, non-renewable energy resources.

Julie	Don't you have samples of all the kinds of coal?
Vincent	I have samples of peat, lignite, bituminous and anthracite.
Bernadette	We could do like a qualitative analysis-look at them and the differences-
Vincent	I don't have multiple samples. I have one set.
Bernadette	One set?
Vincent	We could do it as a demo and pass it around. I guess we could hand a worksheet out and list the qualities.
Bernadette	That [idea] is a cross-curriculum kind-of thing. Getting into English and being scientific. We could do that and then quiz them on it. Have one, which one—like the minerals.
Vincent	I.D., compare, and contrast?
Julie	How many days are we giving for this? There are three sections?
Vincent	There's three sections. I don't have to do it this way and I can't hold everybody to doing it one way.
Javier	But you had a certain timeline that you usually follow.
Vincent	Right … So, right now, at this point and portion you think, about every section or two sections takes a day or explanation. And I can do some sort of activity to kind-of highlight what is going on with this. So, hands-on and visuals are good.
Julie	So plan on a day of like, notes for each section?
Vincent	A day and a half, and then exploratory kind-of demonstrations and a little video.
Bernadette	We will see what we can find.
Vincent	Please look into a geographic connection. Oil to burn, that's a nice one to do. And this is also one in the book on page 246, oil supply and demand, where they do some calculations based on United States' demand up until 2000. It is a graphing assignment.
Luke	I think it is definitely a good idea for the students to realise the difference between how much we use and how much less the world uses.
Bernadette	How greedy we are.
Luke	Yes. (Coplanning session, February 2005)

In this discussion, Vincent outlined his curriculum goals to his co-teachers and the group began to *brainstorm* teaching strategies. The interns learned about the lesson's material limitations from Vincent—equipment and lab clean up issues and only one sample set. He suggested potentially approaching this activity as a demonstration. Although the co-teachers were involved in coplanning a series of science lessons, Bernadette and Vincent made the suggestions to connect science to English and geography, and Julie and Javier considered the managerial aspects of the lesson's pacing for three class sections. While Vincent brought to the group his prior experience with the subject matter and the enactment of the curriculum, he engaged in the *brainstorming* session with the interns. Bernadette offered that the group would find other resources to teach the class while Julie was taking notes and planning an overview. The vignette illustrates how the coteaching and coplanning experience brought new ideas into the cooperating teachers' and interns' instruction.

The vignette above is also an example of a coplanning session as a safe space to collectively generate visions of coteaching. Cooperating teachers were frequently enthusiastic when they talked about coplanning. They reported that these sessions were important sites for thinking about and enriching or transforming existing curricula. As Vincent described:

> In terms of coplanning, the benefits are that you [have] a lot more minds kind of conversing. If you do it well it is kind of is inspiring. You also [have] more minds, more ideas and you kind of bounce ideas around. So you [have] more avenues of how to cover things. And you [have] more support. You build a network of people who can help you out. (Vincent, Cooperating Teacher Interview, May 2004)

During the study, we defined five different kinds of coplanning-based co-generative dialogues: *managerial, brainstorming, critical, directed,* and *reflective.* These co-generative dialogues had different purposes and characteristics and often occurred in combination. For example, *managerial co-generative dialogues* primarily focused on solving issues related to the division of labour in teaching and occurred in two ways. First, co-teachers arranged time for a weekly meeting to coplan curriculum and discuss other issues related to coteaching. In these sessions, co-teachers generated "to do" lists. Who would

prepare lesson notes, laboratory materials and solutions, or worksheets for planned activities? What papers, worksheets or tests needed to be graded or developed? Most coplanning meetings ended with co-teachers assigning roles for writing the required lesson plans. Decisions regarding which co-teacher would take the lead for introducing a lesson, a particular activity or following up with students generally occurred closer to the lesson's enactment.

A second type of co-generative dialogue was *brainstorming*. Co-teachers planned curriculum, discussed how to introduce the curriculum to students using various pedagogical approaches, and considered how those approaches should vary depending on the available resources. During *brainstorming co-generative dialogues,* co-teachers shared ideas and explored possibilities for instruction. As they worked together, they often referred to available material resources such as the textbook and its associated materials, such as labs, worksheets, and/or Power Point presentations.

Critical co-generative dialogues occurred when co-teachers noted limitations in the curriculum. Often they identified a suitable activity to align with curricular goals and standards, or decided to seek alternative resources, such as video clips or information from the Internet. Co-teachers often collectively agreed to individually reflect upon the issues raised by the group and later reconvened for further planning. In the interim, co-teachers connected with other teachers for suggestions, and accessed electronic or print material resources.

Fourth, *directive co-generative dialogues* occurred when one or more group members showed a lack of respect or responsibility towards their co-teachers. In these circumstances, coplanning was not a collaborative responsibility. For example, when cooperating teachers came to the meetings with curriculum resources, interns interpreted the practice as a directive on what to teach (Bernadette, Research Meeting, October, 2005). In contrast, cooperating teachers viewed this action as sharing their material resources and curricular knowledge. In situations where *directive co-generative dialogues* occurred, one teacher—typically the cooperating teacher—moved into an authoritative role, assumed individual responsibility and made decisions about planning and assessments without co-generating solutions. With *directive co-generative dialogues,* coplanning moved from collective responsibility|co-generative to individual responsibility|hierarchical. The resultant coplanning session was not co-generative, but this did not make coteaching unattainable. However, it relegated co-teachers to peripheral roles in the coteaching classroom, such as grading papers, and checking student work rather than a more central and shared instructional role (Tobin, 2006). In these situations, a cooperating teacher's authoritative stance to planning defined the division of labour and teaching roles. If the interns assumed responsibility for the assigned tasks, they successfully cotaught the lesson. However, interns frequently lost respect towards cooperating teachers who enacted *directive* coplanning.

Coplanning sessions often became sites where interns gained or lost social capital. For example, when interns were unprepared to discuss lesson ideas because they had not read book chapters, familiarised themselves with the relevant state standards, or did not complete preparatory activities such as writing a quiz or worksheet, they lost their cooperating teachers' respect. If interns appeared to show a lack of responsibility towards curriculum planning, cooperating teachers quickly took control of coplanning, thus truncating the interns' agency. Conversely, interns began to lose respect for cooperating teachers who did not "step back," who spoke over them thus diminishing their roles in the "understood" collective process, or who advocated science education reform teaching practices such as the use of inquiry in public forums (such as the seminar), but rarely implemented this practice in the classroom.

Reflective co-generative dialogues occurred when co-teachers used the data they had collected through teaching lessons and/or student work to make decisions on future directions. For example, in *reflective co-generative dialogues* co-teachers decided if topics should be re-taught to all students or if one co-teacher would work with a sub-set of students. The teachers' limited time often constrained how often they engaged in *reflective co-generative dialogues* during formal coplanning sessions. Reflective sessions often occurred during informal co-generative dialogues when teachers gathered to prepare for classes, or socialised at lunch or after school.

Coteaching and co-generative dialogues required co-respect and co-responsibility between interns and cooperating teachers. In addition, coteaching relied upon effective and productive coplanning. Coplanning that embraced a notion of collective responsibility for student learning and teaching had different goals and agendas than sessions that were directed

by individuals. In *brainstorming* co-generative dialogues, co-teachers co-generated ideas for effective teaching and assessment practices. *Critical co-generative dialogues* served to identify curricular gaps and served as a stimulus for future work. During *reflective co-generative dialogues,* co-teachers discussed effective approaches to build upon students' knowledge. *Managerial co-generative dialogues* focused on lesson and other teaching logistics such as assigning roles, preparing materials, arranging for lab preparation or student access to other resources such as the library or computer labs. These types of coplanning sessions were co-generative and reflected a collective responsibility among co-teachers. In comparison, *directive co-generative dialogues* were problematic as one teacher assumed individual responsibility and assigned duties to the other co-teachers; in doing so they influenced other co-teachers' agency and voice.

Co-generative dialogues have emerged as an effective pedagogical approach to improving practice and students' learning (Emdin, 2007). They are a major tenet of successful coteaching, especially when used as the structure for coplanning. As coplanning sessions, co-generative dialogues may have different characteristics, but the participants' focus remains on the shared education experiences and what actions should individuals and the collective take to improve students' learning.

6.4. Co-respect

As the study evolved, two other critical constructs, co-responsibility and co-respect, became evident. Co-respect described the mutual respect between co-teachers that fostered communication and created an environment open to constructive criticism, the sharing and generation of new ideas, and potentially a productive coteaching experience. Co-respect occurred when teachers viewed each other as peers and had the expectation that each person provided valuable insight and knowledge that improved her/his teaching. For successful coteaching, all teachers, regardless of experience or expertise, had to respect each other's talents and value the contributions that each individual could make to the classroom. Mutual co-respect provided teachers room to manoeuvre within coteaching, and share voices, ideas and control (Fig. 3).

The process of gaining co-respect was multifaceted and entwined with constructing social capital and networks. Co-respect was built upon

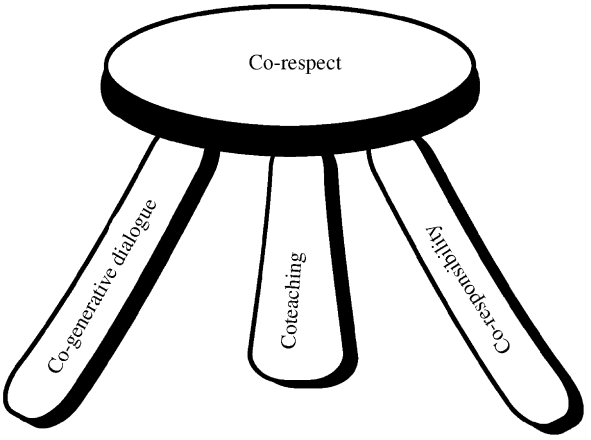

Fig. 3. Three-legged stool: co-respect.

relationships and rapport that were constructed in both formal coteaching, coplanning, and seminar settings and also informal interactions during lunch, happy hours, group socials, and carpooling to and from school. Issues of trust, honesty, and confidence were critical as teachers took chances to share ideas and to develop their practice. Co-teachers frequently commented about having, gaining or losing, respect. When co-respect existed, teachers viewed each other as peers, and each person provided valuable insight and knowledge that improved teaching.

Cooperating teachers and interns noted practices, conscious and unconscious, that resulted in teachers losing respect. Interns quickly lost respect through practices that cooperating teachers viewed as unprofessional. Cooperating teachers had tacit expectations that "good, dedicated science teachers" worked in the school for longer than the required school day. Teachers' arrangements varied due to personal responsibilities such as childcare or coaching. However, one aspect of the department's cultural schema was that if teachers left school at the end of the formal schedule, then s/he typically arrived at least one-hour before school in the morning. Conversely, those teachers who arrived on time in the morning typically worked after school. Teachers viewed interns who remained at the school only during the required hours as unprofessional. Additionally, interns quickly lost respect from teachers if they left when the lessons for the next day were unprepared (e.g. photocopies not made, incomplete or inadequate lab preparation), or if they were unwilling to change social schedules, (e.g. remaining at school on a Friday

afternoon) to work on assessments, plans for the following week or to discuss student performance. Cooperating teachers lost respect for interns in instances where interns did not appropriately access the departmental culture and utilise the appropriate Discourse (Gee, 1992).

In contrast, interns lost respect for cooperating teachers when they positioned themselves as more powerful (Davis & Harre, 1990) effectively treating interns with less respect than they expected within the model's construct. Such practices occurred when cooperating teachers did not equally share the class grading or preparation and interns felt that they were being taken advantage of. Other examples of interns losing their respect of cooperating teachers occurred when they were excluded from the decision-making process, and curricular or pedagogical decisions were not explained to them but rather presented as "The Decision". Sometimes cooperating teachers assumed power positions because the interns were not fulfilling the expectations of the community and occasionally, the interns realised that they were not meeting expectations, but this was not always the case. In such instances, explicating culturally expectations proved helpful. Co-generative dialogues were one mechanism for addressing issues around practice.

During one seminar, with the teachers' consent, the programme coordinators[6] showed a videotape of a class in which the interns hung back and did not assume responsibility for students' learning during the lesson and asked, "Does this illustrate coteaching?" In the ensuing co-generative dialogue, the co-teachers courageously verbalised their frustrations with coteaching and together explored their reasons. Interns viewed the cooperating teachers as coming to coplanning sessions with the lessons already planned because of their prior understanding of the curriculum. Cooperating teachers stated that the interns arrived to the class unprepared to teach. They cited that the interns had not read the text materials, or familiarised themselves with homework answers. This co-generative dialogue provided room for co-teachers to clear the air and gain perspective about one another's views of the situation. It provided opportunity to strengthen rapport and means to address issues that were compromising coteaching opportunities. The co-generative dialogue also provided opportunities for participants to understand their practice in new light and provided space to talk about the concepts of co-respect and co-responsibility. As Pat, one of the interns, commented:

> The ideas of co-respect and co-responsibility—I think those were two issues that definitely needed to be tackled in the beginning. The idea, that we as student teachers needed to [step up] because we didn't; it was she's got responsibility or he's got responsibility. But it went both ways. As soon as that got into the mix it was like, well, we're both responsible for everything that happens. Once we realised that it's *our* kids, *our* classroom, it's *our* grading, it's *our* test; I think then it got a lot better. (Pat, Teaching Intern, May Interview, 2004).

6.5. *Co-responsibility*

All co-teachers were equally responsible for making sure that coteaching occurred successfully. Co-responsibility occurred when each teacher assumed responsibility for all aspects of the classroom: the instruction, the students, and the teaching and learning outcomes. Co-responsibility incorporated equally shared authority, classroom preparation, instruction, and other aspects of management. Participants described a balanced "give and take" between co-teachers when co-responsibility for coteaching occurred. This took multiple forms: all teachers could participate in on-going instruction differently at the same time. For example, some led class discussion, while others worked individually or in small groups with students, or addressed issues of classroom management. Regardless of how they were involved in the coteaching, all co-teachers were involved and responsible for what was occurring in the room (Fig. 4).

In the earlier statement, Pat identified a pivotal point when he realised that successful coteaching required co-teachers to maintain responsibility for their teaching actions in both individual and collective ways. Critical to co-responsibility is the sense of both collective and individual responsibilities. All events that unfold in the classroom, including the planning and maintenance of teaching, require collective responsibility. Co-teachers must understand that coteaching is a joint endeavour; yet achieving collective responsibility is not possible without individual preparation and

[6]The head of science at Biden High School and the university faculty responsible for the secondary science education program collaborate on program coordination.

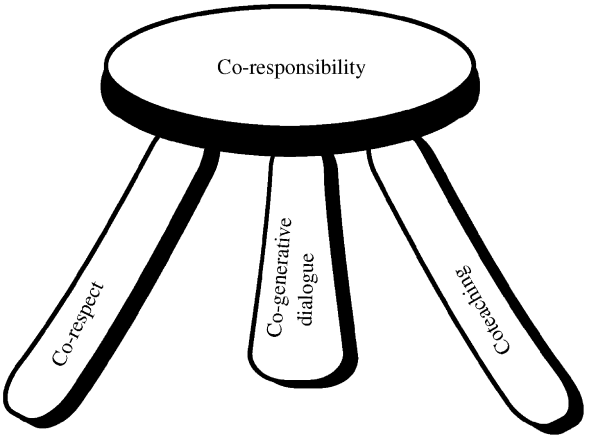

Fig. 4. Three-legged stool: co-responsibility.

contributions. Coteaching can be challenging for teachers who have worked in isolation for many years, as they need to share the teaching space and move from an individual to a collective model of practice and accountability.

Interns quickly assumed co-responsibility in terms of sharing instructional space and time, however co-responsibility around issues of classroom authority generally evolved more slowly. Classroom management is frequently a focus of the student teaching experience and is a common concern for most beginning teachers (Adams & Krockover, 1997). Interns framed the sharing of authority in the classroom as co-authority. Achieving this was not an easy task, but one that required interns to "step up" to meet the teaching goals. It was also important that cooperating teachers step back and support the interns as they moved to attain the status of equal co-teacher in the eyes of students and colleagues. As Jack explained in his interview at the end of his coteaching experience:

Beth: What about co-authority? Do you think the kids perceived you as much an authority figure as [the other teachers]?

Jack: Anne, she's pretty possessive of her class. … She did share the class, but I still felt that she positioned herself as the head of the teachers in the room. My Envi[ronmental] Sci[ence] class that I cotaught with Pat and Vincent [and Joan] were such a handful. … So very quickly I got used to taking charge and taking on classroom management issues. We were always hovering around doing the authority thing-classroom management and I think the students perceived us on a level plane with Vincent and Joan.

Jack established his authority quickly in Vincent's in class, in part because the students were challenging, but also because the cooperating teachers stepped back and allowed Jack to develop those skills. Anne had more difficulty in relinquishing control of her class and the interns found it more difficult to establish their authority as teachers in that classroom.

Teachers and interns showed co-responsibility for students' learning and the teaching of those students in a variety of ways. At times, teachers such as Anne found it difficult to share the responsibility of ensuring her students learned science. Cooperating teachers varied in their ability to step back from the teaching space and provide interns the opportunities to assume co-responsibility for the class. Additionally, problems between interns and cooperating teachers occurred when interns failed to 'step up'. The assumption of co-responsibility for teaching and learning is a critical leg in successful coteaching.

7. Lessons learned

Re-structuring student teaching by implementing coteaching and placing multiple student teachers at one school produced a learning community among the interns cooperating teachers. During their teaching schedule, the interns divided their time between coteaching with peers, coteaching with cooperating teachers, and solo teaching with minimal supervision from the cooperating teachers. This structure afforded interns the opportunity to work in multiple classroom settings, to experience multiple teaching styles, and to work in inclusion classes.

Coteaching|co-generative dialogues provided interns the opportunity to develop and accumulate cultural capital; in this case, it entailed learning to teach science. These constructs also enabled interns the opportunity to accrue social capital by establishing social networks with their co-teachers and fellow interns. Overall, the interns noted the support they received from various teaching colleagues. For the interns, the establishment of coteaching as the student teaching model, and their experience working with different teachers meant they drew on multiple human resources. For example, Bernadette noted that Tim, a cooperating teacher with whom she had no assigned teaching connection, was supportive and helpful.

> Tim always said hi, and I went to ask him, "Anne's going to be out, but I really want to do a demonstration for chem. Can you help me out?" He helped me out. I definitely felt like everyone was willing to work with me and everyone was together… It's like a safe learning environment. I felt really comfortable there with all the other science teachers. I don't know what I would have done if they weren't as nice as they were. Vincent—I mean, he would just go into his room when I'd be like, "I need to figure out something to do." And he'd pull a book off the shelf and say, "Here you go, try that." So it was really nice to have all that [support]. (Bernadette, Intern, May 2005)

The interns at Biden High School became full participants in a professional learning community in which they utilised each other and their cooperating teachers as resources. In the community, the interns had extensive opportunities for reflection on their practice as beginning teachers and learned how to collaborate with others in the planning, instruction and assessment processes. Within the coteaching model, interns interacted with interns both within and outside of their science discipline, multiple cooperating teachers and other peripheral participants, such as researchers and student teaching supervisors, all of whom were resources to enhance their agency, and thus, their experiences as beginning science teachers. Overall, the cooperating teachers reported learning from the interns in multiple ways (Gallo-Fox & Scantlebury, 2006). For example, interns had more recent science knowledge than many of the cooperating teachers. In some cases, interns were more technologically adept than their cooperating teachers. Coteaching and co-generative dialogues provided a structure for the sharing of these resources between interns and cooperating teachers.

Coteaching fostered several unique structures—human, temporal and material resources that were supported by the schemas, or beliefs, held by the co-teachers involved. Consequently, the interns' agency as new teachers was augmented by their access to and appropriation of resources, for instance, when they shared teaching materials, or cooperating teachers' pedagogical knowledge. Furthermore, interns' access and appropriation of each other's resources was maintained by beliefs that sharing was an appropriate and profitable endeavour within the community. Despite this, at times, the interns' agency was truncated by structures that were inherently defined by coteaching, for example, their busy schedules and juggling time to meet with the multiple co-teachers.

All participants in coteaching needed to understand the model's objectives in teachers learning about teaching at the 'elbow of another'. Co-teachers assume individual and collective responsibility for student learning and recognise that extra time and flexibility required to establish the social networks between individuals for successful co-teaching. In successful coteaching, teachers respected each other as colleagues and were collegial in their interactions. Teachers incorporated the coteaching model into their practice and affirmed their conceptual understanding of the framework in their teaching.

7.1. Challenges to effective coteaching

One purpose of introducing coteaching as a model for student teaching was to establish a structure that could enhance interns' agency by building their cultural and social capital. The model assumed that cooperating teachers would relinquish some of their teaching authority, share responsibility for the class and in doing so afford respect to the interns. A drawback and strength of the model is the increased number of teachers involved and the complexity of the social networks that emerge. This became particularly problematic for teachers who worked with more than two interns and for the inclusion teacher who worked with several cooperating teachers and interns. However, despite the difficulties, these larger social networks were a significant strength of the model, due to the large amount of support and exposure to resources accessed by co-teachers.

Another reason for implementing coteaching was to reduce beginning teachers' feelings of isolation. Nevertheless, interns' teaching placements in multiple classrooms sometimes meant that lesson plans were modified without consulting all of the co-teachers. The interns' schedule structures directly affected their capacity to communicate with one another and thus hindered their agency. In addition, opportunities through informal conversations with cooperating teachers (for example, eating lunch together or socialising after school during which they were accessing resources, building their social network and garnering social capital) afforded some interns to develop their social and cultural capital.

Time is a limited resource in coteaching. Instead of the traditional arrangement where cooperating and student teachers work in a one-to-one arrangement, coteaching prompts and requires multiple relationships. This arrangement created time pressures for the teachers who needed to plan, reflect on instruction, and follow-up with students. Patsy discussed this as follows:

> It's all about time, I think. Trying to find a time when we all could sit down together, we all could work together and again, myself even adjusting to the fact that these are three different people with three different teaching styles and trying to gear up during the day, trying to work with three different people and getting used to that in the classroom. (Patsy, Cooperating Teacher, Interview, September 2004)

After the first year of implementation we worked to minimise these issues by (1) placing the interns as pairs with different cooperating teachers; (2) limiting the number of cooperating teachers assigned to an intern; and (3) when feasible, arranging the interns' schedule such that their non-teaching time aligned with the cooperating teachers' planning period. Several cooperating teachers resolved this third issue by establishing a common coplanning time.

8. Strategies for the way forward

The university established a professional development school (PDS) between the Secondary Science Education programme and Biden High's school district. The secondary science education majors complete all their field experiences and student teaching at the district's middle and high schools. The university provided a full-time supervisor to oversee the placements, coordinate the professional development programme with the district's staff, and work with preservice and inservice teachers to support the district's science instruction, and to improve the implementation of coteaching and co-generative dialogues as frameworks for teacher reflection and praxis. Additionally, two interns have returned to Biden High School as classroom science teachers.

Within the PDS, our goal is to develop co-respect and co-responsibility at a level beyond an individual teacher's classroom and move towards establishing a continuum of professional development for preservice and inservice teachers. Interns learn many facets that underpin effective teaching during their practicum such as coplanning curriculum, building professional relationships with one's peers and administrators, and interactions with parents. The university formally evaluates the interns on these issues but we have never addressed concerns regarding the teaching and learning of science with teachers and/or school/district administrators. Concurrent with the professional development programme for inservice teachers, we are planning to improve the infrastructure to support effective preservice and inservice science teacher education. The programme is beginning to merge the needs of different stakeholders, preservice, inservice teachers, teacher preparation, induction, mentoring and ongoing professional development into a connected model using coteaching and co-generative dialogues supported through co-respect and co-responsibility for the learners and teachers (Feiman-Nemser, 2001).

We recognise that the model is not a panacea. However, our data show that the benefits from placing interns into an established, collegial, professional teaching community provided all co-teachers with multiple resources for teaching. There is evidence throughout the data of co-teachers' willingness to support each other's teaching through the formal and informal connections. Moreover, beginning teachers who have cotaught draw on the schema that they develop in the coteaching experience. For example, Juck and Scantlebury (2006) found that all of the first year teachers sought and/or established communities of practice to provide support for their teaching when they moved into their own classrooms. Also, we have noted elsewhere (Gallo-Fox & Scantlebury, 2006) that coteaching serves as a strong mechanism for inservice teacher professional development and supports cooperating teachers development as school-based teacher educators (Feiman-Nemser, 1998) and educational leaders. However, further research is warranted on the long-term effects of coteaching on beginning teachers' careers, in addition to a comparative investigation of coteaching and traditional student teaching experiences.

Acknowledgements

The Delaware Teacher Center partially supports the research in this paper. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors.

References

Adams, P., & Krockover, G. (1997). Concerns and perceptions of beginning secondary science and mathematics teachers. *Science Education*, *81*(1), 29–50.

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258). New York, NY: Greenwood Press.

Clift, R. T., & Brady, P. (2005). Research on methods courses and field experiences. In M. Cochran-Smith, & K. Zeichner (Eds.), *Studying teacher education: The report of the AERA panel on research and teacher education* (pp. 309–424). Mahwah, NJ: Lawrence Erlbaum Associates.

Council of Chief State School Officers (CCSSO) (2007). Interstate New Teacher Assessment and Support Consortium (INTASC) Retrieved August 15, 2007 from 〈http://www.ccsso.org/projects/Interstate_New_Teacher_Assessment_and_Support_Consortium/〉.

Davis, B., & Harre, R. (1990). Positioning: The discursive production of selves. *Journal for the Theory of Social Behavior*, *20*(1), 43–63.

Davis, E. A., Petish, D., & Smithey, J. (2006). Challenges new science teachers face. *Review of Educational Research*, *76*(4), 607–651.

Eick, C. J. (2004). Coteaching in a secondary science methods course: Learning through a coteaching model that supports early teacher practice. *Journal of Science Teacher Education*, *15*(3), 197–209.

Eick, C. J., & Dias, M. (2005). Building the authority of experience in communities of practice: The development of preservice teachers' practical knowledge through coteaching in inquiry classrooms. *Science Education*, *89*(3), 470–491.

Eick, C. J., & Ware, F. N. (2005). Coteaching in a science methods course: An apprenticeship model for early induction to the secondary classroom. In W.-M. Roth, & K. Tobin (Eds.), *Teaching together, learning together* (pp. 187–206). New York, NY: Peter Lang.

Emdin, C. (2007). Exploring the contexts of urban science classrooms. Part 1: Investigating corporate and communal practicesim. *Cultural Studies of Science Education*, *2*, 1502–1871.

Feiman-Nemser, S. (1998). Teachers as teacher educators. *European Journal of Teacher Education*, *21*(1), 63–74.

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record*, *103*(6), 1013–1055.

Feiman-Nemser, S., & Buchmann, M. (1987). When is student teaching teacher education? *Teaching & Teacher Education*, *3*(4), 255–273.

Gallo-Fox, J., & Scantlebury, K. (2006). *Coteaching: A professional development model for cooperating teachers* Paper presented at American Educational Research Association Annual Meeting, San Francisco, CA, April.

Gallo-Fox, J., Wassell, B., & Scantlebury, K. (submitted). Coteaching: A professional development model for cooperating teachers. *Journal of Science Teacher Education.*

Gee, J. P. (1992). *The social mind: Language, ideology, and social practice*. New York: Bergin & Garvey.

Gleason, S., Fennemore, M., & Scantlebury, K. (2006). Choreographing teaching: Coteaching with special education/inclusion teachers in science classrooms. In K. Tobin (Ed.), *Teaching and learning science: A handbook* (pp. 235–238). New York: Praeger Publishing.

Guyton, E., & McIntyre, D. J. (1990). Student teaching and school experiences. In R. W. Houston (Ed.), *Handbook of research on teacher education* (pp. 514–534). NY: MacWilliams Publishing Co.

Juck, M. & Scantlebury, K. (2006). *''Oh, you're the newbie'': The influence of coteaching on first year science teachers' agency.* Paper presented at National Association of Research in Science Teaching Annual Meeting, San Francisco, CA, April.

Kluth, P., & Straut, D. (2003). Do as we say and as we do: Teaching and modeling collaborative practice in the university classroom. *Journal of Teacher Education*, *53*(3), 228–240.

LaVan, S.-K., & Beers, J. (2005). The role of cogenerative dialogue in learning to teach and transforming learning environments. In K. Tobin, R. Elmesky, & G. Seiler (Eds.), *Improving urban science education: New roles for teachers, students, and researchers* (pp. 149–166). NY: Peter Lang.

Martin, S. (2007). Where practice and theory intersect in the chemistry classroom: Using cogenerative dialogue to identify the critical point in science education. *Cultural Studies of Science Education*, *1*.

McIntyre, D. J., Byrd, D. M., & Foxx, S. M. (1996). Field and laboratory experiences. In J. Sikula, T. J. Buttery, & E. Guyton (Eds.), *Handbook of research on teacher education* (2nd ed.). New York: Macmillan.

Milne, C., Scantlebury, K., Blonstein, J., & Gleason, S. (2006). *Yours, mine and ours: Modeling professional collaboration by coteaching in teacher education.* Paper presented at the Association for Science Teacher Education Annual Meeting, Portland, OR, January.

Murphy, C., & Beggs, J. (2005). Coteaching as an approach to enhance science learning and teaching in primary schools. In W.-M. Roth, & K. Tobin (Eds.), *Teaching together, learning together* (pp. 207–231). New York, NY: Peter Lang.

Murphy, C., Beggs, J., Carlisle, K., & Greenwood, J. (2004). Students as 'catalysts' in the classroom: The impact of coteaching between science student teachers and primary classroom teachers on children's enjoyment and learning of science. *International Journal of Science Education*, *26*(8), 1023–1035.

Roth, W.-M., & Tobin, K. (2001). The implications of coteaching/cogenerative dialogue for teacher evaluation: Learning from multiple perspectives of everyday practice. *Journal of Personnel Evaluation in Education*, *15*, 7–29.

Roth, W.-M., & Tobin, K. (2002). *At the elbow of another: Learning to teach by coteaching*, Vol. 204. New York, NY: Peter Lang.

Roth, W. -M., & Tobin, K. (Eds.). (2005). *Teaching together, learning together*. New York, NY: Peter Lang.

Roth, W.-M., Tobin, K., Carambo, C., & Dalland, C. (2004). Coteaching: Creating resources for learning and learning to teach chemistry in urban high schools. *Journal of Research in Science Teaching*, *41*(9), 882–904.

Scantlebury, K. (2005). Gender issues in coteaching. In W.-M. Roth, & K. Tobin (Eds.), *Teaching together, learning together* (pp. 233–248). New York: Peter Lang Publishing.

Sewell, W. H. (1992). A theory of structure: Duality, agency and transformation. *American Journal of Sociology*, *98*, 1–29.

Sewell, W. H. (1999). The concept(s) of culture. In V. E. Bonnell, & L. Hunt (Eds.), *Beyond the cultural turn: New directions in*

the study of society and culture (pp. 35–61). Berkeley, CA: University of California Press.

Smith, E. R. (2005). Learning to talk like a teacher: Participation and negotiation in coplanning discourse. *Communication Education*, *54*(1), 52–71.

Tobin, K. (2006). Learning to teach through coteaching and cogenerative dialogue. *Teaching Education*, *17*, 133–142.

Tobin, K., & Roth, W.-M. (2006). *Teaching to learn: A view from the field*. Rotterdam, NL: Sense Publishing.

Tobin, K., Roth, W.-M., & Zimmermann, A. (2001). Learning to teach in urban schools. *Journal of Research in Science Teaching*, *38*, 941–964.

Tobin, K., Zurbano, R., Ford, A., & Carambo, C. (2003). Learning to teach through coteaching and cogenerative dialogue. *Cybernetics & Human Knowing*, *10*(2), 51–73.

Wideen, M., Mayer-Smith, J., & Moon, B. (1998). A critical analysis of research on learning teach: Making the case for an ecological perspective on inquiry. *Review of Educational Research*, *68*(2), 130–178.