

Chapter 4

Studying Secondary Science Student Teaching Experiences Within a Cohort Community of Practice: A Multi-planar, Multi-analysis Sociocultural Methodology

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While the student teaching experience is the most widely studied component of the field of teacher education (Feiman Nemser 1983), this is not the case for the more specialized field of science teacher education. In science teacher education, research typically examines preservice teacher conceptual change and science methods (Russell and Martin 2007). The science practicum experience has been less frequently studied, and there is a limited knowledge base about the experience of learning to teach secondary science during preservice student teaching. Historically, in teacher education, practicum components are studied using interview and observational data sources that focus on preservice teachers' instructional experiences. But is that enough to fully understand the process of learning to teach science? It has been argued that there is a need for broader understanding of the process of learning to teach with attention to the collective learning experience, and the role of the learning context and ecology (Clift and Brady 2005). Methodological approaches that utilize sociocultural theoretical frameworks could provide additional insights about the process of learning to teach high school science.

This purpose of this chapter is to articulate a multi-planar, multi-analytic methodological approach for studying student teaching experiences. The goal is not to present a detailed empirical study, but rather to highlight ways that this approach can be used to study sociocultural learning experiences within community, and to discuss implications for future research in science teacher education. Specifically, this methodology incorporates multiple qualitative research traditions to study experiences learning to teach science across multiple sociocultural planes of development (Rogoff 1995). By analyzing data across different planes of development one is able to gain insight into the spectrum of learning experiences that occur

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during a coteaching full practicum experience. The multiple analyses illuminate the learning experience and coalesce through the use of crystallization imagery (Richardson 2000).

I begin this chapter with a discussion of sociocultural frameworks used to shape this work. I then present the methodology. Next, I illustrate the potential for this methodological approach using examples from a study of the learning experienced by secondary science preservice teachers who participated in a cohort coteaching model for their student teaching experience. I conclude the chapter with a discussion of the implications of this approach for the field.

Sociocultural Frameworks

Etienne Wenger (1998) writes, “Our perspectives on learning matter: what we think about learning influences where we recognize learning” (p. 9). Historically, the student teaching, or full practicum, experience has been viewed as the place where preservice teachers apply theories learned in formal teacher education courses. As such, the research on practice frequently examines preservice teachers’ application of ideas from the university. The empirical research and literature reviews about field experiences suggest that additional research is necessary to better understand the student teaching experience, and that new questions and theoretical frameworks will enable novel understandings (Clift and Brady 2005). Using a sociocultural framework of learning can enable new insight into the landscape of student teaching, and open up questions about the role of context and the process of learning to teach within the student teaching setting.

From a situated perspective “the physical and social contexts in which an activity takes place are an integral part of the activity, and that the activity is an integral part of the learning that takes place within it” (Putnam and Borke 2000, p. 4). A key tenet of sociocultural theories of learning is that learning occurs through participation (Lave and Wenger 1991) and that outcomes of these learning experiences include the development of the practices of the community. In order to understand what is learned and how learning occurs, researchers need to develop a thorough understanding of the context and the cultural expectations within the setting. Numerous sociocultural theorists have argued that joining a new community prompts new members to develop ways of speaking, thinking, and behaving of the group. This process of becoming recognized as a member of a community has been called “legitimate peripheral participation” (Lave and Wenger 1991) and also the development of “Discourse” (Gee 1992). Development of community Discourse is part of the process of identity development and leads toward recognition as community members.

A Multi-planar, Multi-analysis Methodology

This research methodology enables researchers to study the types of learning opportunities and sociocultural experiences afforded in a professional community. Sociocultural learning experiences can be examined across multiple planes of development (Rogoff 1995). In this methodology multiple analyses are conducted to achieve this. Crystallization imagery (Richardson 2000) is then utilized to bring together the multiple analyses. Description of these approaches follows.

Barbara Rogoff (1995) argues that when studying development one can examine the experience across three different planes of development: community, interpersonal, and personal. While learning occurs concurrently in each of these areas, examining them simultaneously is difficult due to the complexity of the experience. Rogoff's framework foregrounds one plane of learning at a time while acknowledging the "mutually constituting" (p. 144) nature of each. This approach enables researchers to focus on a particular aspect of the situated learning experience and provides a lens for analyzing participant experiences within the larger community experience.

Merging research traditions provides a researcher with multiple tools for examining a phenomenon. James Gee and Judith Green (1998) demonstrated that when studying sociocultural learning experiences researchers can successfully merge multiple qualitative research traditions. They noted that researchers must utilize methodologies that best suit the research question, and do so in theoretically appropriate ways. In their sociocultural study they utilized ethnographic traditions and discourse analysis. For the study discussed here, multi-planar analyses of learning within community required reorganization of the data set, use of different units of analysis, and use of multiple qualitative methodologies.

The multiple analyses are then brought together to develop a coherent understanding of the experience. Crystallization imagery is a way to coalesce findings in "post-modernist mixed-genre texts" (Richardson 2000, p. 934). Laurel Richardson writes,

The central imaginary is the crystal, which combines symmetry and substance with an infinite variety of shapes, substances, transmutations, multidimensionalities, and angles of approach ... Crystals are prisms that reflect externalities *and* refract within themselves creating different colors, patterns, and arrays casting off in different directions. What we see depends upon our angle of repose. (*Italics in original*, p. 934)

Building on Richardson's work, I draw on the metaphor of a crystal with multiple faces and vantage points for interpreting the experiences of learning in community. The crystal provides a means to draw together the multi-planar analyses of the learning community. When the multiple findings are merged, they serve as facets of a crystal, creating multiple, differently positioned understandings of the experience. Collectively, these insights illuminate the learning process within the community. The discussion that follows illustrates how this methodological approach was used to study an alternative model for learning to teach within a full practicum coteaching community of practice.

Applying This Methodological Approach: Studying a Coteaching Community of Practice Across Multiple Planes of Development

Coteaching is a process of learning to teach that involves teachers at multiple points in their careers (preservice, inservice, and also occasionally university faculty) who teach together in order to learn *in-situ* (Tobin 2006). Coteaching is a mutual process where teachers share classroom responsibilities and expectations. State University's model of coteaching pairs student teachers and places them with multiple cooperating teachers. In Spring 2005 a cohort of eight coteaching student teachers were placed with eight cooperating teachers all within the science department at Biden High School (all names are pseudonyms). The teaching placement was a 16-week full practicum teaching experience in which the student teachers cotaught four out of five class periods each day, and "solo" taught one class period. Solo classes followed a more traditional model of student teaching where student teachers assumed independent responsibility of the class. The preservice and inservice science teachers cotaught together. Their practice was grounded in the science content areas that they taught: anatomy and physiology, biology/forensics, chemistry, environmental science, and 9th grade general science with a focus on earth science, chemistry, and physics. Throughout the day they cotaught and utilized content specific pedagogies.

Multiple data sources were collected about the teaching experience. These included student teacher and cooperating teacher interviews, field observations, audio data of coplanning meetings and on-sight seminars that were attended by both the student teachers and cooperating teachers, and program documentation (see Fig. 4.1).

The coteaching community of practice was studied using the multi-planar, multi-analytic approach. Analysis examined the process of learning to teach within the coteaching community of practice at the community level, micro-community level, interpersonal, and personal levels. I began analysis of the community learning experience by studying the community plane through general qualitative and ethnographic approaches. For this analysis, the entire coteaching community of practice was studied to develop an understanding of the types of cultural practices of all 16 coteachers. Data illuminated the fact that coteachers interacted in a wide variety of settings with varying groups of people using different norms for practice. Secondary analysis of the community plane experience was conducted using comparative cross-case analysis (Miles and Huberman 1994). This analysis enabled me to study contextual differences between sub-groups of coteachers (*micro-communities*). Next, interpersonal interactions of a group of three coteachers were studied through the use of discourse analysis with a focus on semiotics. This analysis illuminated the ways that coteachers worked together to develop plans for practice and extend their thinking about instruction. Finally, in order to study participant development on the personal plane, data pertaining to individual participants were studied using qualitative methods. Figure 4.2 presents this multi-planar, multi-analytic process and delineates the research methods used for each plane of development.

Participants	Data Source	Frequency	Totals
Eight teaching interns and eight cooperating teachers	Interviews		
	• Intern	Three formal interviews with an average of 3.5 hours per intern	Twenty-eight hours of intern interviews
	• Cooperating teacher	Two formal interviews about one hour each	Sixteen hours of cooperating teacher interviews
	Observations		
	• Fieldnotes	Each intern was observed at least 20 times over fifteen weeks	
	Recordings of meetings		
	• Coplanning sessions	A minimum of two per participant	Twenty coplanning sessions
	• Seminars	Five seminars located at BHS attended by interns and cooperating teachers	Five seminars
	Program Documentation		
	• Fall methods course syllabus, intern reflective journal entries, weekly schedules and lesson plans, miscellaneous instructional materials		

Fig. 4.1 Data sources

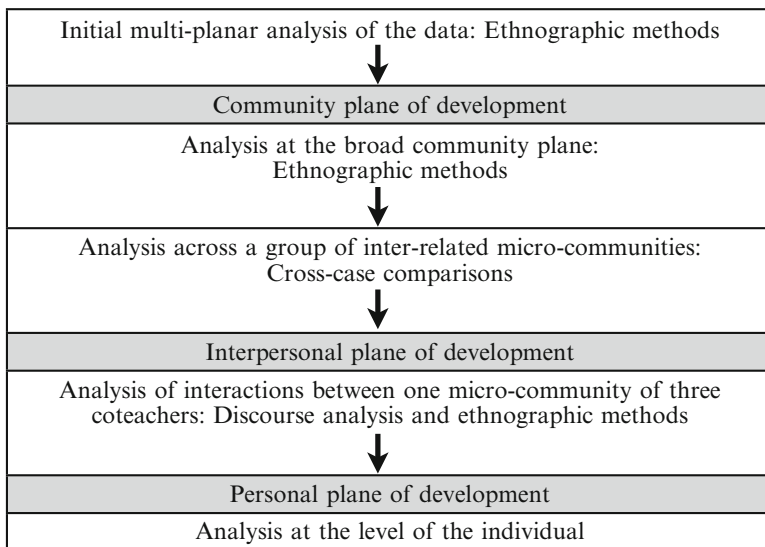


Fig. 4.2 Multiple analyses focused in on increasingly narrower planes of development using differing analytical methods

As will be discussed later in the chapter, each layer of analysis illuminated different aspects of the sociocultural learning experiences that occurred within the coteaching community of practice. This research as a whole illuminated the fact that across these experiences the preservice teachers developed the Discourses (Gee 1992) of the community and professional identities as high school science teachers. The discussion that follows describes analyses for each the three planes and identifies the learning and practices the preservice teachers developed at each level.

Broad Level Analysis of Cultural Practices at the Community Plane

Most studies of practicum experiences focus on the student teachers' instructional experiences, however, opening up the research lens beyond these experiences poses opportunities for understanding the way that sociocultural contexts impact teachers' practice (Warren 1969). Using data generated across the 16-week student teaching semester, data were analyzed across the full coteaching day. It was found that all coteachers (student teachers and cooperating teachers) moved between a wide range of contexts, types of activities, and Discourses during each day. Types of activities included: formal coplanning meetings, coteaching, solo teaching, lunch, morning gatherings when teachers geared up for the day, informal preparation periods, quick exchanges between classes, lunch, informal debriefing, and work at home. These varied activities took place in a range of contexts such as different classrooms at Biden High, in the faculty lounge, in hallways, and carpools. Furthermore, depending on the context and who was present, different Discourses, or ways of acting and talking, were the norm. As part of their work within the community of practice, the preservice teachers learned to move seamlessly between these spaces participating in ways similar to their more experienced community members, the cooperating teachers.

Findings from data analysis of the community plane illustrate how through participation within the coteaching community of practice at Biden High School student teachers were exposed to the pacing and rhythm of the school day from the teachers' perspective. Experiences at this level were connected to the process of becoming a member of the community of practice and learning how to look, act, and feel like a high school science teacher. For example, during school assemblies the preservice teachers roamed the aisles staring down students who were talking, or being disruptive. They also sat and interacted casually with colleagues over breakfast and lunch, and engaged in focused conversations about curriculum and instruction during planning meetings.

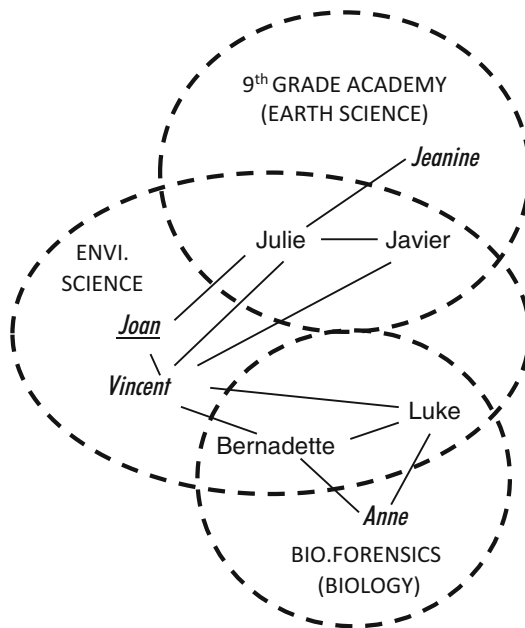
Analysis of sociocultural learning experiences at the community plane of analysis reveals that preservice teacher participation at the community level encompassed the broad activities and the overarching culture of teaching within the science department at Biden High School. These experiences afforded student teachers with opportunities to learn how to participate in the practice of teaching, and also how to interact professionally with colleagues, students and other community stakeholders.

Micro-community Practices

All participants participated in the broad activities of the community. However, throughout the day, different combinations of student teachers and cooperating teachers worked together. Each student teacher participated in two or three different coteaching groups. When the entire data-set was re-organized according to these cases (Miles and Huberman 1994) and analyzed accordingly, it became apparent that each coteaching group had different Discourses of practice. I call these collaborative coteaching workgroups *micro-communities*, because each of these sub-communities developed their own Discourses including local language, local teaching tools and practices, and constructed their roles and interactive practices differently.

Two student teachers, Javier and Julie, participated in both the Environmental Science and 9th Grade Academy micro-communities. In these micro-communities, the coplanning and coteaching practices were notably different. In this section, I describe these differences through a discussion of Julie and Javier’s experience within the 9th Grade Academy and the Environmental Science [Envi. Science] micro-communities. These micro-communities are represented in Fig. 4.3. In the

Fig. 4.3 Microcommunities studied



Key:
<i>Cooperating teachers: Anne, Jeanine, Vincent</i>
<i>Student teachers: Bernadette, Julie, Javier, Luke</i>
<i>Special education cooperating teacher: Joan</i>

figure, different fonts are used to differentiate the coteachers' status as student teachers, cooperating teachers, or special education cooperating teacher.

The Environmental Science micro-community was an interdisciplinary group of science coteachers (biology, chemistry, earth science, and environmental science) who collectively brought a wide range of resources and experiences into their teaching practice, and strongly supported one another's practice. Coplanning was a mutual process of brainstorming and sharing ideas. As a collective the interns felt that they had a strong voice in the process. Throughout the semester, Vincent (the cooperating teacher) guided the interns, openly shared insights from his classroom experience, and challenged them to ask questions about the effectiveness of the pedagogical approaches they used in instruction (Coplanning meetings, February 17 and April 20).

Within this micro-community, the interns were part of a collective of supportive colleagues who worked together to develop, support and implement instruction. The sense of mutuality and support experienced within this micro-community and in the broader coteaching community of practice, led the interns to value the role of colleagues in supporting one another's practice.

Experiences within the Environmental Science micro-community provided a marked contrast to the 9th Grade Academy micro-community. The coteaching model adapted within the 9th Grade Academy micro-community supported a view of teachers as self-reliant individuals. Coteachers shared resources and decreased their workload when possible by dividing the tasks of planning and preparing for instruction. As a pair Julie and Javier struggled to get along; they welcomed this approach, because it minimized their need to interact and rely on one another. Jeanine (the cooperating teacher) was generally available to provide advice outside of instruction. With Jeanine out of the classroom during much of the instructional day, there were limited opportunities for Javier and Julie to observe Jeanine's teaching practices, or to teach alongside her and talk about practice as lessons were occurring. This decreased collaboration constricted opportunities for learning from one another in practice.

The multiple coteaching contexts provided student teachers with opportunities to develop multiple frames of reference for their work. As Javier explained, "*I compare, Vincent's class to Jeanine's class a lot, because they are so different*" (Javier Interview, March 16, 2005). Studying participant experience across micro-communities illuminates different ways that the coteachers constructed their roles and participated in the settings. In the micro-communities discussed here coteachers used different models for planning and practice, and collaboration while also fostering student and participant learning.

Analysis of Participation Structures at the Interpersonal Plane

Moving from the community plane of analysis to the interpersonal plane shifts emphasis from cultural practices of the group to verbal interactions and participation structures within specific micro-communities. This level of analysis affords different insight into the learning experiences by enabling researchers to examine

verbal patterns of interaction and meaning-making processes that occur between specific community members. In this section I discuss analysis of the Anatomy and Physiology coteachers' development of a muscle unit. The data set used for this analysis includes all data pertaining to the opening lessons of the muscle unit including: a coplanning meeting, a lunch meeting, classroom instruction, and teacher reflections on the experience. This data set spans the full 4 months of data collection. Data were analyzed using discourse analysis with a focus on semiotics. Specifically, I analyzed teacher talk by first breaking conversation into *episodes of pedagogical reasoning* [EPR] (Horn 2002). Parsing the text by topic affords the creation of EPRs; each time topical emphasis shifts a new episode is created. Each episode was then analyzed to understand the meaning-making processes and participation structures that the coteachers utilized as they worked together.

Within the initial coplanning meeting the coteachers collectively developed plans for instruction and worked to create a unified vision for practice. Through their conversation they proposed and explored nine variations for their opening lessons about the sarcomere—the smallest contracting unit of striated muscle tissue.

Analysis of the coteacher conversations uncovered participation structures that they utilized to support collaborative meaning-making processes and their ability to envision their ideas for practice and examine possibilities for their work. For example, as they planned the coteachers identified over 15 potential pitfalls in their evolving plans. Judith Little and Ilana Horn (2007) have noted that when groups of teachers identify problems in practice other teachers often normalize these problems through comments that suggest that an issue of practice also occurs in their own classroom work. This normalizing practice typically ends conversation and limits opportunities for learning. Using dilemmas as an impetus for collective problem solving is a less common teacher practice.

Problematizing practice was one participation structure that the coteachers in this study utilized to move their thinking about practice forward. Problematizing plans for instruction prompted coteachers to problem-solve and create new plans for practice. In the excerpt below, Sean (student teacher) problematizes the group's plan to have students create models using pipe cleaners. He later builds on Patsy's (cooperating teacher) feedback to generate a solution.

SEAN: Do you think the students will be able to— I would not know how to make the two circles [out of pipe cleaners]. You know what I mean?

PATSY: I don't know. What do you think? Can we give them some directions? Should we give them the idea?

As indicated by Sean's response, which follows Patsy's comments helped him think of possibilities for addressing the problem. Drawing on Patsy's ideas, Sean suggested a way to scaffold the students' experience in order to increase potential for success. His new suggestion also provided a mechanism for teachers to provide further support for students as necessary.

SEAN: We could have them brainstorm it—"How would you build it?" Give them the materials. Say, "Okay, maybe write out a plan of what you are going to do."

PATSY: Uh hmm.

SEAN: And then go over the plans with them—

This exchange provides an example of how the Anatomy and Physiology coteachers worked together to anticipate and proactively solve potential problems of practice, thus collectively reconceptualizing their plans for practice. Throughout the process of coplanning these teachers continued to re-envision their practice and worked to improve their plans. Problematizing and problem-solving enabled the coteachers to further develop and envision their instructional plans for the classroom. These practices were visible across the larger data set of the entire coteaching community, however, the extent to which these things occurred varied by micro-community.

Analysis of Discourse Development at the Personal Plane

Within the teaching profession the notion of teacher as individual is strongly emphasized. This concept is reinforced by the culture of isolation in which individual teachers work independently in their classrooms (Lortie 1975). This study examined the experiences of individuals participating in a model of collective practice. Analysis primarily focused on the collective processes of teaching as a part of a community. However, the notion of teacher as an independent individual was also evident in community member discourse. Teachers spoke about how teachers each have their own teaching style, and the need for preservice teachers to figure out which approaches worked best for them. For example during the final coteaching seminar, Pam, a cooperating teacher and department chair said to the group, “What might work for one of us, isn’t [necessarily] going to work for the others—because it’s like counter to your own personality.” (Seminar, May 10, 2005)

Analysis on the personal plane of development revealed two very different perspectives of identity/ies. One perspective reflected student teacher development of identities as individual teachers. This notion was reflected in both their individual sense of belonging, and in their growing personal perspective of themselves as teachers. Indicative of this development was their growing confidence in their personal abilities. For example, when asked, “What are you learning about your teaching through this experience?” Sean responded:

That I actually can do it; that I can stand in front of the room and the kids will actually listen to me.... I’m not the oldest looking person.... I learned that it doesn’t really matter as long as you project yourself in that way—in that teacher-mode, that’s how they’re going to see you. (Interview, April 30, 2005)

The student teachers also participated in the activities and practices of the community. Student teachers attended school events, departmental social events, and collectively called themselves, “the posse.” Additionally, as discussed earlier, they developed the cultural practices of the community, and through these experiences came to view themselves as members of the science teacher coteaching community.

Research and Methodological Implications

The practicum poses a conundrum. Despite the fact that the practicum is typically viewed by teacher educators as one of the most problematic components of teacher education, practitioners typically identify it as the most valuable aspect of their teacher education program (e.g., McIntyre et al. 1996). Why? Linda Darling-Hammond has written, “Learning to teach...requires that new teachers learn not only to ‘think like a teacher’ but also to ‘act as a teacher’” (Hammond 2006, p. 305). This process of learning to think, act, and feel like a teacher can be understood as part of the process of developing the professional identity of the community. In order for this to occur, preservice teachers must develop the Discourses of community practice and become recognized by themselves and others as members of the community. This multi-planar multi-analytic approach enables us to interpret the experiences of one cohort of secondary science preservice teachers and understand their experiences learning the cultural practices of one community of practice.

The multi-planar analysis illuminates different ways that the coteaching preservice teachers participated in the cultural practices of the coteaching community and were afforded opportunities to become high school science teachers. These analyses expose ways that the student teachers were able to access the Discourses of practice and integrate them into their own practice. Furthermore, this research provides insights into the complex process of learning to participate in a science coteaching community. At the community level we see that the student teachers were integrated into the many different cultural activities and contexts of practice that their cooperating teachers participated in daily. The student teachers learned to move seamlessly between formal and informal contexts within the classroom, the hallway, and the faculty lounge while learning how to interact with students, parents, administrators, cooperating teachers, and other teachers in the school. At the micro-community level, the preservice teachers participated in different constructions of practice according to the group of coteachers with whom they were working. Roles were constructed differently and participants operated in alignment with local practice as they moved between settings. On the interpersonal plane, analysis enables us to see how participants in one micro-community coplanned instruction and utilized participation structures to develop their plans for practice. Finally, analysis of the personal plane illuminates ways that individual student teachers developed both individual and collective identities.

As a composite, the multi-planar analyses illuminate the complexity of learning to teach within coteaching and the situated nature of learning within multiple contexts. Each analytical vantage point illuminates ways that the coteaching experiences reinforced participant beliefs that there is no single “correct” way to practice, but that multiple approaches can be successful or even appropriate in various situations. Historically, the research lens used to study the student teaching experience has focused on classroom instruction. By broadening the research focus to include full teaching days across the 4 months time we are able to glean insight into the cultural

learning and membership development of the student teachers. These findings illustrate a process of development of professional identities and Discourse.

Although this methodology was used to study a coteaching full-practicum model, it would be appropriate for studying other student teaching experiences, and could potentially expand the field's understanding of the process of learning to teach by opening up new research questions and theoretical frameworks for studying the sociocultural learning experience. Findings could also be used to help inform and shape new practicum models. Utilizing this methodology will enable researchers to develop new insights into the complexity of learning to teach. The new understandings that will result could extend current understanding of the process of learning to teach as researchers will be able to gain an understanding of the collective, situated and cultural nature of student teaching experiences and the ways that they impact teacher identity and Discourse development.

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