COLLABORATIVE PLANNING FOR AN ELEMENTARY MATHEMATICS METHODS COURSE IN A THIRD SPACE:
THE ROLE OF EXPERTISE IN A COMMUNITY OF PRACTICE

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Courtney M. Lynch

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The dissertation of Courtney M. Lynch was reviewed and approved* by the following:

Gwendolyn Lloyd  
Professor of Education (Mathematics Education)  
Dissertation Advisor  
Chair of Committee

E. Frances Arbaugh  
Associate Professor of Education (Mathematics Education)

David Gamson  
Associate Professor of Education (Educational Theory and Policy)

Andrea McCloskey  
Associate Professor of Education (Mathematics Education)

William Carlsen  
Professor of Education (Science Education)  
Director of Graduate Studies in Curriculum and Instruction

*Signatures are on file in the Graduate School
ABSTRACT

This study examines the collaborative planning of a team of school- and university-based teacher educators who co-taught an elementary mathematics methods course in a grades K-4 Professional Development School (PDS). The PDS spans the boundaries between the school and university creating a third space for hybrid teacher educators (Martin, Snow, & Franklin Torrez, 2011). The team of four hybrid teacher educators formed a Methods Planning Community of Practice (MPCoP). This study focused on the MPCoP’s collaborative planning of elementary mathematics methods courses to prepare beginning teachers to select and adapt mathematical tasks. I conducted a domain analysis (Spradley, 1979) to identify and describe the MPCoP’s general co-planning activities (establishing goals, general brainstorming, and determining instructional details). Using the construct of boundary objects (Star, 1989) and theoretical perspectives from communities of practice (Wenger, 1998), I examined areas of expertise that influenced the MPCoP’s joint enterprise. Data was collected during Fall 2015 and consisted of audio recordings of four of the MPCoP’s co-planning sessions (80-85 minutes each), researcher notes, the MPCoP’s planning documents, individual background interviews, 16 semi-structured interviews (4 with each teacher educator), 2 semi-structured group interviews, and artifacts from the interviews. The MPCoP, operating without a guiding protocol, spent the majority of its time determining the instructional details for methods course experiences. Results indicate that shared areas of professional expertise explicitly influenced the group’s work. Other areas of professional expertise were individually influential yet not explicitly shared during the MPCoP’s joint
enterprise. The results of this study extend understandings about the integration of academic and practitioner knowledge in third spaces.
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Chapter 1
Introduction

“Traditionally, teacher education has been seen as a transfer of knowledge from educator to teacher…The traditional view sets up a hierarchy in which educators are superior in knowledge and teachers learn from educators,” writes Jaworski (2008, p. 337). Teacher education has a long history of being situated in the university, where theory and research are given a higher status than practitioner expertise (Labaree, 2008; Smagorinsky, Cook, & Johnson, 2003; Zeichner, 2010). Smagorinsky et al. (2003) describe the perspectives that emerge as a result of this divide in the field, “Theory and practice are set up as different concerns, with university-based faculty, aloof within the ivory tower, espousing ideals and the principles that govern them, while school-based teachers engage in practice in the teeming world of the classroom” (p. 1400).

While this disconnect persists in teacher education programs (Smagorinsky et al., 2003; Solomon et al., 2017; Zeichner, 2010), research has documented positive benefits for preservice teachers when mathematics methods courses, field experiences, and opportunities to interact with children are connected purposefully (e.g., Aguirre et al., 2012; Mewborn, 1999; Wood & Turner, 2015). Divisions between theory and practice also separate teachers from teacher education. There have been recent calls to change teacher education programs in ways that bring together university faculty and school practitioners to provide more meaningful experiences for preservice teachers (National Council for Accreditation of Teacher Education, 2010; Zeichner, 2010; Zeichner, Payne, & Brayko, 2015). Recent research has focused on creating these experiences for
preservice teachers through the inclusion of school teachers in methods courses as a way to leverage and honor both academic and practitioner expertise (e.g., Eppley, Shannon, & Gilbert, 2011; Wood & Turner, 2015).

The term *expertise* is used to capture related knowledge and experiences. *Academic expertise* is the more formalized knowledge and experience that is typically held by university faculty and informs university courses (Cochran-Smith & Lytle, 1999; Zeichner, 2010). *Practitioner expertise* is knowledge and experience related to practice, such as the expertise developed through teaching mathematics to elementary students. The transformative spaces that bring together both forms of expertise are known as *third spaces* (Gutiérrez, 2008; Gutiérrez, Baquedano-López, & Tejeda, 1999; Zeichner, 2010). Ideally, in third spaces, rather than privileging academic over practitioner expertise, the contributions of both are recognized as legitimate and valuable and utilized in teacher education work.

Although third spaces offer promise in bringing together academic and practitioner expertise in teacher education (Wood & Turner, 2015), they also increase the complexity of the work of teacher educators (Martin, Snow, & Franklin Torrez, 2011; Williams, 2014). In third spaces, individuals with diverse backgrounds must navigate tensions in their work, including relationships among participants (Gutiérrez, 2008; Martin, Snow, & Franklin Torrez, 2011; Williams, 2014; Yendol-Silva & Dana, 2004). This complexity can be viewed from the perspective of *communities of practice* (Wenger, 1998). Within third spaces, each individual belongs to multiple communities of practice.

Communities of practice are characterized by the mutual engagement, joint enterprise, and shared repertoire of the individuals involved. Wenger (1998) asserts:
We all belong to communities of practice. At home, at work, at school, in our hobbies – we belong to several communities of practice at any given time. And the communities of practice to which we belong change over the course of our lives. In fact, communities of practice are everywhere (p. 5).

Within a given school or university setting, teacher educators likely belong to multiple communities of practice that influence their work. From a communities of practice perspective, teacher educators’ areas of professional expertise may serve as boundary objects (Star, 1989; Star, 2010; Wenger, 1998). Wenger (1998) defines boundary objects in communities of practice as “artifacts, documents, terms, concepts, and other forms of reification around which communities of practice can organize their interconnections” (p. 105). As the field of teacher education moves towards increased roles for hybrid teacher educators who span the boundary between schools and universities (Zeichner, 2010), the work of teacher educators becomes increasingly complex (e.g., Martin, Snow, & Franklin Torrez, 2011, Williams, 2014; Wood & Turner, 2015). This complexity warrants further attention as the field of teacher education lacks a deep understanding of the integration of academic and practitioner expertise in third spaces.

Mathematics teacher educator (MTE) expertise is a small but emerging area of research (Castro Superfine & Li, 2014; Chauvot, 2009). Castro Superfine and Li (2014) remarked, “The knowledge MTEs use in their work is far from understood” (p. 303). Some research in this area has focused on the expertise used by MTEs when teaching mathematics to preservice teachers (e.g., Castro Superfine & Li, 2014; Zopf, 2010). In a self-study, Chauvot (2009) created a knowledge map based in pedagogical content knowledge perspectives (Grossman, 1990; Shulman, 1986) for her work as a mathematics teacher educator-researcher teaching university courses and mentoring doctoral students.
Her map includes subject matter content knowledge, pedagogical content knowledge, curricular knowledge, knowledge of context, and research knowledge for each of the two contexts in which she worked. While Chauvot offers insight into the diverse expertise of an MTE who followed a traditional trajectory towards becoming an MTE (i.e., mathematics teacher to doctoral student to MTE) working in a typical university setting, more research is needed to identify the expertise used by hybrid teacher educators in collaborative third spaces.

As hybrid teacher educators span the boundary between schools and universities, they are likely to engage in collaborative teaching (co-teaching) and collaborative planning (co-planning). Co-planning among and between preservice and inservice teachers has been used to support preservice and inservice teacher development (e.g., Bartell, 2013; Boylan, 2010; Lewis, Perry & Hurd, 2009; Murata, Bofferding, Pothen, Taylor & Wischnia, 2012; Sims & Walsh, 2009; Van Zoest & Bohl, 2002). It has also been the focus of professional development for inservice teachers as researchers collaboratively planned with teachers for their classrooms (e.g., Jung & Brady, 2016; Roth McDuffie & Mather, 2009). While these studies have provided insights to the benefits of collaborative planning, such as an awareness of pedagogical practices (Fernandez, 2010; Lewis, Perry, & Hurd, 2009; Watson & De Geest, 2014) and the deprivatization of planning (Bleiler, 2015; Goodchild, Fuglestad, & Jaworski, 2013), we lack studies on the co-planning of teacher educators, and more specifically, the co-planning of school- and university-based teacher educators in third spaces where the sharing of academic and practitioner expertise may become integrated.
This Study

The Professional Development School (PDS) movement was a response to the traditional separation of university and schools in teacher education from the Holmes Group, a consortium of research universities committed to improving teacher education programs (Holmes Group, 1990; Levine, 1992). A PDS is a special kind of partnership between universities and schools that is intended to be mutually beneficial to both entities with a focus on improving teacher education at the university and educational practices within the schools. Within a PDS, inservice teachers and retired teachers are considered experts of the classroom and may be asked to fill the role of a teacher educator alongside university faculty through the collaborative planning and teaching of methods courses (Burns, Yendol-Hoppey, & Jacobs, 2015). In this sense, PDSs offer a potential third space for academic and practitioner expertise to be united.

In this study, I examine the collaborative planning of a team of four school- and university-based teacher educators who co-taught an elementary mathematics methods course in a grades K-4 PDS. The team made up a community of practice (Wenger, 1998) which I refer to as the Methods Planning Community of Practice (MPCoP). These hybrid teacher educators had varied backgrounds and experiences that led them to their work within the PDS. Using the construct of communities of practice, I assume that each individual participant maintains memberships in multiple communities of practice, including the MPCoP. When the MPCoP comes together, it is operating in a boundary-spanning third space between the university and the school, where academic and practitioner expertise from those other communities of practice have potential to be shared. I also assume that the multimembership in communities of practice may
complicate the work of the teacher educators as they bring diverse expertise to their third space collaboration.

Over the course of the semester, as part of a larger curriculum, the MPCoP co-planned methods course experiences to prepare beginning teachers to select and adapt mathematical tasks. I focused my study on this area of the elementary mathematics methods course curriculum because selecting and adapting mathematical tasks has become a prevalent and important component of preservice mathematics teacher education (e.g., Drake, Land, & Tyminski, 2014; Lloyd & Pitts Bannister, 2011), is an area with an existing robust body of literature related to teaching and professional development (e.g., Arbaugh & Brown, 2005; Stein & Smith, 1998; Stein, Smith, Henningsen, & Silver, 2009; Watson & Mason, 2007), and seems to hold the potential to allow for contributions from both school- and university-based teacher educators.

In this study, I seek to respond to the following research questions:

1. What are the general co-planning activities that members of a MPCoP engage in as they prepare preservice teachers to select and adapt mathematical tasks through methods course experiences?

2. What areas of professional expertise do members of a MPCoP use while engaging in general co-planning activities for preparing beginning teachers to select and adapt mathematical tasks? How are the areas of professional expertise used by the MPCoP?

Responding to the first research question will allow me to extend the field’s knowledge about the boundary-spanning work of hybrid teacher educators by identifying and illustrating general activities in which they engage. The second research question considers the areas of professional expertise that are used in a third space collaboration.
Its sub-question explores how teacher educators with diverse expertise integrate that expertise into their work of co-planning. This study not only extends the literature about co-planning among teacher educators, it also contributes to the field’s understanding of the ways in which academic and practitioner expertise influence the work of hybrid teacher educators in a community of practice.
Chapter 2

Relevant Research and Theoretical Perspectives

In this chapter, I discuss both relevant literature and key theoretical perspectives that I have used to frame this study. The chapter is organized into four main sections. First, I discuss the historical divide between schools and universities, and the contributions of academics and practitioners, in teacher education, and examine how the perspective of third spaces offers a way to overcome this divide. Second, I examine literature related to the expertise of teacher educators including knowledge frameworks used in the fields of teacher education and mathematics education. Third, I explore collaborative planning in third spaces and characterize it as a boundary encounter, drawing on the theory of communities of practice. Fourth, I consider literature related to mathematical tasks for preservice and inservice teachers. Finally, I suggest the potential contributions of this study.

The School and University in Teacher Education

Prior to the 19th century, the field of teacher education was nonexistent; teachers were largely prepared for their professional roles through their own experiences as students (Labaree, 2008). In the 1830s, reformers introduced the state normal school as a new institution, which emerged from the common school movement, to provide more formalized and higher-quality training for teachers who would ultimately instruction children in the common schools. The emergence of normal schools resulted in the placement of teacher education in independent teacher training institutions. With the rapid increase of universities across the country in the late 1800s, normal schools and
teacher training programs were absorbed by universities. Universities provided credibility to teacher education. Labaree points out that because universities historically “value the academic over the vocational and the theoretical over the practical” (p. 298), teacher education in the university took on a low status in the university:

> It bears the legacy of a historical evolution that undermined its commitment to professionalism and marginalized it within a university setting where it is given little respect; it lacks the high status associations that enhance the prestige of the major professions; and it is stuck with problems of professional practice that are overwhelmingly difficult but that earn it little public credit. Under these circumstances, the advantages for teacher education in migrating from the normal school to the university seem compelling, as compelling as the advantages that lured European peasants to Ellis Island. In status terms, there seemed to be everything to gain and nothing to lose. (p. 299)

However, there was much to lose through the disconnect of academic courses and practicum experiences (Darling-Hammond, 1999). This disconnect creates a tension for preservice teachers (Solomon et al., 2017). In contrast, research has reported that connecting mathematics methods courses and field experiences can have significant positive effects on preservice teachers (e.g., Aguirre et al., 2012; Mewborn, 1999; Wood & Turner, 2015).

Dividing theory and practice has reinforced negative perceptions of the “other” on each side of the line (Smagorinsky, Cook, & Johnson, 2003). Labaree (2003) acknowledges that teachers and researchers “frequently carry with them sharply contrasting worldviews that arise from the distinctive problems of practice they encounter in their respective roles” (p. 16). This tension impacts the success and productivity of a partnership between schools and universities (Sztajn et al., 2014). As academic goals in American school system are shifting towards more challenging standards for K-12
students, there is increasing pressure on novice teachers to be able to engage in ambitious and sophisticated teaching, the success of which will depend, in part, on their teacher preparation programs (Forzani, 2014).

In its Blue Ribbon Panel Report (2010), the National Council for Accreditation of Teacher Education (NCATE) implores a change to teacher education programs:

The education of teachers in the United States needs to be turned upside down. To prepare effective teachers for 21st century classrooms, teacher education must shift away from a norm that emphasizes academic preparation and course work loosely linked to school-based experiences. Rather, it must move to programs that are fully grounded in clinical practice and interwoven with academic content and professional courses. (p. ii)

Although this disconnect between the academic expertise and high status of university instructors and the practitioner expertise and lower professional status of inservice teachers continues in many teacher education programs (Smagorinsky et al., 2003; Zeichner, 2010), alternatives have been proposed (e.g., Wood & Turner, 2015; Zeichner, Payne, & Brayko, 2015).

**Third Spaces**

Whereas academic expertise has typically been privileged over practitioner expertise in teacher education, Zeichner (2010) calls for *third spaces* that “bring practitioner and academic knowledge together in less hierarchical ways” (p. 92). Zeichner describes third spaces in teacher education as “hybrid spaces in preservice teacher education programs that bring together school and university-based teacher educators and practitioner and academic knowledge in new ways to enhance the learning of prospective teachers” (p. 92). Third spaces have been identified as a transformative environment for learning (Gutiérrez, 2008; Gutiérrez, Baquedano-López, & Tejeda, 1999).
The notion of third spaces supports a dialectical rather than a dichotomous relationship between practitioner and academic expertise (Zeichner, 2010). Gorodetsky and Barak (2008) described this dialectical relationship in their analysis of an “edge community,” a third space comprised of preservice teachers, in-service teachers, and university faculty members. They write, “It was accepted that each participant has the potential for constructive contribution to the collaborative learning process, whether it stems from experience, theoretical knowledge, common sense or genuine novice questions that probe the obvious” (p. 1911). Third spaces create the potential to value the expertise of each participating member regardless of background; the differences in expertise are meant to complement one another. By their very nature, third spaces demand that participants cope with power differentials and multiple, sometimes conflicting roles in their teacher education work (Gutiérrez, 2008; Martin, Snow, & Franklin Torrez, 2011; Williams, 2014; Yendol-Silva & Dana, 2004).

**Professional development schools as a third space.** In response to the disconnect between universities and schools as sites for teacher preparation programs, and with a commitment to improving teacher education, the Holmes Group (1990) called for the creation of and investment in Professional Development Schools (PDSs). Many universities and schools work together in the preparation of teachers, but a PDS is a special type of partnership between schools and universities. The National Association of Professional Development Schools (NAPDS) provides nine essentials in its policy statement, “What it Means to be a Professional Development School,” that describe what a PDS entails:
1. A comprehensive mission that is broader in its outreach and scope than the mission of any partner and that furthers the education profession and its responsibility to advance equity within schools and, by potential extension, the broader community;

2. A school–university culture committed to the preparation of future educators that embraces their active engagement in the school community;

3. Ongoing and reciprocal professional development for all participants guided by need;

4. A shared commitment to innovative and reflective practice by all participants;

5. Engagement in and public sharing of the results of deliberate investigations of practice by respective participants;

6. An articulation agreement developed by the respective participants delineating the roles and responsibilities of all involved;

7. A structure that allows all participants a forum for ongoing governance, reflection, and collaboration;

8. Work by college/university faculty and P–12 faculty in formal roles across institutional settings; and

9. Dedicated and shared resources and formal rewards and recognition structures. (National Association of Professional Development Schools, 2008)

These characteristics distinguish a PDS from other partnerships with through the in-depth, mutually beneficial integration of the work of schools and universities.

Darling-Hammond, Bullmaster, and Cobb (1995) describe PDS partnerships as “collaborations between schools and universities that have been created to support the learning of prospective and experienced teachers while simultaneously restructuring schools and schools of education” (p. 87). A PDS partnership also attends to the calls in teacher education to provide more connected and concrete experiences for developing teachers (e.g., Ball & Cohen, 1999; Feiman-Nemser, 2001). PDS partnerships offer a unique model for the inclusion of both academic and practitioner knowledge in teacher education. In many PDSs, methods course instructors include both university teacher educators and inservice or retired teachers co-planning and co-teaching (Burns, Yendol-Hoppey, & Jacobs, 2015). This collaborative approach specifically addresses the 8th essential listed above.
Recent research reports in teacher education have addressed navigating the gap between the academic and practitioner expertise (e.g., Eppley, Shannon, & Gilbert, 2011; Lampert et al., 2013; Wood & Turner, 2015). Eppley, Shannon, and Gilbert (2011) created a third space for their preservice teachers through pen pal relationships with a second grade classroom centered on literature. In another study, Lampert et al. (2013) found that preparation, enactment, and analysis of lesson rehearsals with elementary preservice teachers in mathematics methods courses moved “the study of teaching back and forth between what normally happens in coursework and school-based experiences” (p. 238). Though not directly addressing the issues of expertise, the authors attempted to bridge the gap between theory and practice.

As these examples suggest, the third space literature in teacher education has focused more on preservice teacher learning (e.g., Eppley, Shannon, & Gilbert, 2011; Leeferink, Koopman, Beijaard, & Ketelaar, 2015) than it has on how participants in the third space draw on or are influenced by their academic and practitioner expertise (Wood & Turner, 2015). Wood and Turner documented an exploratory study of the inclusion of mentor teachers as teacher educators for elementary mathematics methods course experiences, noting that while mentor teachers offered significant contributions, they also increased the complexity of the teacher educators’ work. While research suggests that the opportunity exists to share expertise in a third space, such as a methods course in a PDS, there are few examples in the literature of integrating expertise from the two worlds.

**Communities of Practice in Third Spaces**

E. Wenger-Trayner and B. Wenger-Trayner (2015) succinctly describe *communities of practice* (CoP) as “groups of people who share a concern or a passion for
something they do and learn how to do it better as they interact regularly” (What are Communities of Practice? section, para. 2). The dimensions of practice of a community of practice include (1) mutual engagement, (2) joint enterprise, and (3) a shared repertoire (Wenger, 1998). To have mutual engagement, members must be engaged in practice; it is not enough to be a group of people who share a characteristic. As Wenger points out, “whatever it takes to make mutual engagement possible is an essential component of any practice” (p. 17). The joint enterprise of a CoP “is not just a stated goal, but creates among participants relations of mutual accountability that become an integral part of the practice” (p. 19). Along with the mutual engagement and joint enterprise, a community of practice develops a shared repertoire through its work. Wenger describes this final characteristic of a community of practice:

> The repertoire of a community of practice includes routines, words, tools, ways of doing things, stories, gestures, symbols, actions, or concepts that the community has produced or adopted in the course of its existence, and which have become part of its practice. The repertoire combines by reificative and participative aspects. It includes the discourse by which members create meaningful statements about the world, as well as the styles by which they express their forms of membership and their identities as members. (p. 22)

Teacher educators working in third spaces come to their roles with varied experiences, even within the field of education, and belong to multiple communities of practice. These teacher educators may have membership in communities of practice, such as those belonging to the university or the schools. E. Wenger-Trayner and B. Wenger-Trayner (2015) contend “that the ‘body of knowledge’ of a profession is best understood as a ‘landscape of practice’ consisting of a complex system of communities of practice and the boundaries between them” (p. 13). While third spaces create opportunities for
horizontal expertise (defined later) and boundary crossing between schools and universities, they also open the doors to widen the landscape of practice and increase the complexity of understanding the expertise of teacher educators.

Bleiler (2015) found this to be the case in examining the collaboration between a mathematician and a mathematics teacher educator. The participants belonged to a community of practice with each other due to their collaboration and to a community of practice with their respective departments. The mathematics teacher educator in the study noted the difficulty of expressing the rationale for practices within her mathematics education community to the mathematician during collaboration because he did not belong to the same community of practice. Navigating multiple communities of practice can be challenging. In a study by Solomon et al. (2015), preservice elementary teachers encountered difficulty in this navigation as they engaged in an early field placement for mathematics teaching due to the disconnectedness between communities of practice at the university and the schools. Preservice teachers (PSTs) needed constructive support from mentors as they transitioned from the university into the classroom setting. Constructive support was indicated by providing the appropriate amount of scaffolding for designing lessons, not allowing PSTs total autonomy initially nor providing scripted lessons. Further, the PSTs were impacted in their ability to participate in the school community of practice by their mentor teachers’ perception of their knowledgeability.

Fenton-O’Creevy et al. (2015) highlighted a challenge in the work of communities of practice, “Not all participants in communities of practice understand their journeys as leading to full participation; some are just visiting” (p. 44). Levels of participation in a community of practice are influenced by the imagined trajectory of the
individual. Fenton O’Creevy and colleagues suggest that students may assume the identity of a *tourist* and “engage superficially in the academic practices but with no commitment to an academic identity and no engagement with the meaning of these practices” (p. 46). Conversely, those on a *sojourner* trajectory “are actively engaged in integrating their understanding of academic and workplace practices, and in reconciling their different experiences of themselves in these different domains” (p. 46). Supporting PSTs as they transition to inservice teaching, or inservice teachers to teacher educators, requires appropriate support. Otherwise participants are more likely to maintain a tourist identity, perceiving a disconnect between communities of practice.

Dinkelman, Margolis, and Sikkenga (2006) contend, “Even if one becomes a teacher educator at the moment one begins working as a teacher educator, one’s professional identity as a teacher educator is constructed over time” (p. 6). These researchers found that classroom teachers who became teacher educators during a doctoral program struggled to make sense of the differences between school and university settings and to reconcile the lack of connection between doctoral coursework and their teaching. Murray and Male (2005) similarly found that inservice teachers turned teacher educators required two to three years to develop a professional identity change from teacher to teacher educator. They were experts of their teaching practice only to find themselves novices in the field of teacher education where they experienced challenges in relinquishing their identities as inservice teachers. Given various paths to becoming a teacher educator, including the aforementioned discussion of inservice teachers, those in this profession may find themselves identifying with different professional communities depending on their expertise (Berry & Van Driel, 2012). These studies and others (e.g.,
Berry, 2008; Loughran, 2014) underscore the challenges to becoming a teacher educator that are directly linked to navigating the differences between communities of practice relating to the university and the schools.

**Boundary Objects**

Star (1989) coined the term *boundary object* which has since been employed as a construct in the community of practice literature in education (e.g., Cobb, McClain, de Silva Lamberg, & Dean, 2003; Gorodetsky & Barak, 2008). Inherent in the landscape of practice is the overlap and interaction of the boundaries of communities of practice. Star (2010) defines a boundary as “a shared space, where exactly that sense of here and there are confounded” (p. 602-603). Wenger (1998) describes boundary objects as they relate to communities of practice as “artifacts, documents, terms, concepts, and other forms of reification around which communities of practice can organize their interconnections” (p. 105). Boundary objects have an aspect of interpretive flexibility; the same object can have different meanings for different individuals (Star, 2010). E. Wenger-Trayner and B. Wenger-Trayner (2015) explain the diversity of landscapes of practice in relation to boundaries:

> Because of the lack of shared history, boundaries are a place of potential misunderstanding and confusion arising from different regimes of competence, commitments, values, repertoires, and perspectives. In this sense, practices are like mini-cultures. Even common words and objects are not guaranteed to have continuity across a boundary. (p. 17)

Boundary objects do not have to be perfect; they give common language and support discourse among individuals (Star, 2010). Boundary objects are essential to collaboration within a community of practice. Kubiak et al. (2015) describe the function of boundary objects:
Boundary objects enable collaborative working and sharing of practice across the landscape. They facilitate communication and collaboration by providing a structure to align activity, which is meaningful to all involved...The boundary object supports connection and collaboration but does not force consensus of meaning. (p. 82)

Boundary objects organize the activity of a community of practice, but do not necessarily require unanimous understanding of the object in order to move forward with the joint enterprise.

**The Expertise of Teacher Educators**

Expertise in teacher education spans both theoretical and practical knowledge and skills. Focusing specifically on the knowledge of mathematics teacher educators (MTEs), Jaworski (2008) highlights the complexity of this essential boundary spanning expertise, “In a synthesis of the theoretical and the practical, MTEs develop knowledge of how teaching and new practices are learned, how such learning occurs, and the associated pitfalls and this parallels teachers knowing and sensitivity to students learning” (p. 2).

This visual representation of teacher educator knowledge highlights the value of knowledge held by both teacher educators and inservice teachers. Many MTEs have professional experience teaching mathematics in K-12 school settings (Jaworski, 2008) and would therefore perhaps intersect even more with the teacher side of the diagram.

This diagram can also be viewed as portraying the overlap between academic and practitioner expertise in teacher education (Zeichner, 2010).

**Academic and Practitioner Expertise**

Zeichner (2010) uses the term *academic knowledge* “to represent the diverse forms of knowledge and expertise that exist among college and university faculty and
staff” (p. 89). Cochran-Smith and Lytle (1999) also detailed academic or formal knowledge:

The general theories and research-based findings on a wide range of foundational and applied topics that together constitute the basic domains of knowledge about teaching…These domains generally include content or subject matter knowledge as well as knowledge about the disciplinary foundations of education, human development and learners, classroom organization, pedagogy, assessment, the social and cultural contexts of teaching and schooling, and knowledge of teaching as a profession. (p. 254)

Hiebert, Gallimore, and Stigler (2002) characterized this professional knowledge as public, storable, shareable, and having a mechanism for validation.

In contrast to academic knowledge, Cochran-Smith and Lytle (1999) define knowledge-in-practice, or practitioner knowledge, as “what very competent teachers know as it is expressed or embedded in the artistry of practice, in teachers' reflections on practice, in teachers' practical inquiries, and/or in teachers' narrative accounts of practice” (p. 262). Practitioner knowledge is detailed, concrete, specific, and linked to practice (Hiebert, Gallimore, & Stigler, 2002). Hiebert, Gallimore, and Stigler (2002) define practitioner knowledge in a way that aligns with Cochran-Smith and Lytle’s view: “the kinds of knowledge practitioners generate through active participation and reflection on their own practice” (p. 4).

Inservice teachers offer horizontal expertise; they bring valued and relevant expertise to a collaborative activity (Zeichner, Payne, & Brayko, 2015). Anagnostopoulous, Smith, and Basmadjian (2007) introduce the construct of horizontal expertise as emerging from boundary crossings as professionals from different domains enrich and expand their practices through working together to reorganize relations
and coordinate their work…it emphasizes the commitment and capacity to move between activity contexts and to engage in the exchange and mixing of domain-specific expertise. (p. 139)

Zeichner, Payne, and Brayko concisely describe horizontal expertise as “the unique knowledge and understanding that each professional brought to the collective activity” (p. 125). The authors contend that considering expertise in this manner, “treats the knowledge [of each professional] as equally valuable, relevant, and important” (p. 125). Zeichner, Payne, and Brayko also noted, “in the examples that best denote horizontal expertise, classroom teachers are active participants in the planning, instruction, and evaluation activities related to a [methods] course, thereby creating more authentic, acceptable, and accessible possibilities for inclusion of teachers’ expertise” (p. 127).

PDSs offer a unique model for this inclusion of horizontal expertise to occur as methods courses can and have included a university teacher educator and an inservice or retired teacher co-planning and co-teaching the methods courses (Burns, Yendol-Hoppey, & Jacobs, 2015). Collaborative planning and teaching of methods courses are activities with potential to integrate academic and practitioner expertise.

**Understanding Teacher Educators’ Academic and Practitioner Expertise**

Teacher educators may draw upon diverse expertise to support their work in third spaces. Deeper understanding of that expertise is needed since it may or may not fall neatly into academic or practitioner categories. A number of frameworks have offered insights into aspects of teacher educators’ academic and practitioner expertise (e.g., Chauvot, 2009; Kennedy, 2002; Zopf, 2010).

Building on the work of Hill, Ball, and Schilling (2008), Zopf (2010) proposes the construct *mathematical knowledge for teaching teachers* (MKTT) as “the mathematical
knowledge used by mathematics teacher educators in the work of teaching mathematics to teachers” (p. xi). This construct accounts for similarities and differences in the work of mathematics teachers and mathematics teacher educators.

In a self-study seeking to document and understand her own development as a mathematics teacher educator-researcher, Chauvot (2009) draws on several frameworks to produce a knowledge map that includes subject matter content knowledge, pedagogical content knowledge, curricular knowledge, knowledge of context, and research knowledge. This map recognizes the influence of the various contexts in which Chauvot worked as a teacher educator on the knowledge she used in each of those contexts. It also recognizes the relationships among types of knowledge that she drew upon. This knowledge map offers transparency into the complexity of the knowledge of a mathematics teacher educator.

Kennedy (2002) proposes three sources of teacher knowledge that could be applied to teacher educators: craft, systematic, and prescriptive knowledge. Craft knowledge is the knowledge and experience that is mostly acquired through practice. It tends to be less formal than the other forms of expertise and may come from outside sources available to educators including colleagues, friends, newspapers, magazines, etc. Systematic knowledge is acquired through more formal avenues such as college courses, research articles, professional development programs, etc. Prescriptive knowledge comes from the governing institution and can include curriculum and standards. This framework is helpful as it focuses on the blending of the academic and practitioner worlds, and honors developing knowledge from practice.
Although these frameworks offer important insights into teacher educators’ knowledge, they are limited in their potential to explain how different forms of knowledge interrelate or interact in third spaces. Zopf’s MKTT captures the specialized knowledge needed to teach mathematics to teachers, rather than K-12 students, and focuses on individuals rather than knowledge drawn upon by a group of educators in a third space. Chauvot applied her knowledge map to herself as a mathematics teacher educator-researcher who has followed a more typical path into her role as a university teacher educator (i.e., school teacher to graduate student to assistant professor). The application of her knowledge map to a group of hybrid teacher educators within a third space may be difficult as these teacher educators are on diverse career paths. Beyond categorizing types of knowledge, Kennedy’s framework does not offer additional insight into how the knowledge is used or drawn upon in third spaces.

**Collaborative Planning in a Third Space as a Boundary Encounter**

E. Wenger-Trayner and B. Wenger-Trayner (2015) note challenges to boundary crossing: “Crossing a boundary can force one to marginalize aspects of identity if some forms of identification from one context conflict with claims to competence in another context. Such marginalized aspects of identity can even become completely inexpressible” (p. 25) The work of teacher educators in third spaces results in boundary crossings as they navigate the landscape of practice wherein they must navigate memberships in multiple communities of practice. Many professionals experience challenges when they cross boundaries and enter unfamiliar territory (Suchman, 1994).

We can consider some teacher educators in a third space to be *boundary spanners* or *boundary brokers* (Sztajn et al., 2014; Wenger, 1998). Wenger (1998) notes, “The job
of brokering is complex. It involves processes of translation, coordination, and alignment between perspectives. It requires enough legitimacy to influence the development of a practice, mobilize attention, and address conflicting interests” (p. 109). These individuals have the capacity to introduce objects from one practice into the other (Wenger, 1998). Martin, Snow, and Franklin Torrez (2011) acted as boundary spanners in their work developing a third space in a school-university partnership. They cultivated relationships with various stakeholders in the partnership, including preservice teachers, mentor teachers, and principals. Brokering the boundaries between school and university, the teacher educators discovered tensions as they navigated complex relationships.

**Collaborative Planning**

Collaborative planning is an example of a *boundary encounter* in education. Boundary encounters occur when two or more individuals with differing membership in communities of practice interact (Wenger, 1998). To conceptualize collaborative planning (“co-planning”), I draw on practical approaches for co-teaching. When more than one teacher or teacher educator teach together, they are said to be *co-teaching*. Villa, Thousand, and Nevin (2008) describe four forms of co-teaching in which teachers assume different roles and responsibilities. In supportive co-teaching, “one teacher is assigned primary responsibility for designing and delivering a lesson, and the other member(s) of the team provides support to some or all of the students in the class” (p. 34). The parallel co-teaching approach describes teachers instructing different groups of students at the same time in the classroom where the teachers may or may not be teaching the same content; this approach includes station teaching. Complementary co-teaching involves a one lead teacher who has the primary responsibility for designing a lesson or
presenting new content while the other teacher(s) do something to enhance the
instruction. In this approach, one teacher is considered the expert. The fourth approach is
team-teaching in which “two or more people do what the traditional teacher used to do”
(p. 64). There is a shared responsibility for planning, teaching, and assessing.

Drawing on the four conceptions of co-teaching described above, I propose the
following categories on a continuum of co-planning (Figure 2-2): unilateral co-planning,
parallel co-planning, and team co-planning. Table 2-1 summarizes the three categories.
Unilateral co-planning consists of one teacher educator assuming primary responsibility
for designing part of a class session. In parallel co-planning, teacher educators
independently plan for the same lesson and then decide together to choose one plan or
another or to merge the plans together. Team co-planning describes teacher educators
fully developing the plan together. The continuum of co-planning (see Figure 2-2) allows
for other forms of co-planning to exist. For example, we might consider unilateral-
parallel co-planning, in which two teacher educators independently plan separate sections
for the same episode, to fall between unilateral and parallel co-planning.

Figure 2-1: Continuum of co-planning.
Table 2-1: Roles and responsibilities for co-planning

<table>
<thead>
<tr>
<th>Approach to Co-planning</th>
<th>Roles and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unilateral Co-planning</td>
<td>• One teacher educator has primary responsibility for designing (part of) a lesson</td>
</tr>
</tbody>
</table>
| Parallel Co-planning    | • Teacher educators independently plan for the same lesson  
                          | • Together teacher educators decide which plan to use or merge the plans |
| Team Co-planning        | • Shared responsibility for planning  
                          | • Obvious equity and parity in the planning process |

Most existing research about co-planning assumes a team co-planning approach. This research has documented the benefits of co-planning among teachers (e.g., Goodchild, Fuglestad, & Jaworski, 2013; Lewis, Perry, & Hurd, 2009; Watson & De Geest, 2014). Co-planning can lead to an awareness of practice that keeps students at the center of the learning (Fernandez, 2010; Lewis, Perry, & Hurd, 2009; Van Zoest & Bohl, 2002). Goodchild, Fuglestad, and Jaworski (2013) discovered that co-planning “exposed the teachers’ rationale for adaptations and additions in order to meet their educational and pedagogical ideals” (p. 403). Co-planning also deprivatizes practice, allowing teachers to develop a collective attitude and sense of ownership towards the collaboratively planned lesson(s). The deprivatization of planning removes the sole ownership of the planned lesson from one individual teacher and places the ownership on the group thereby removing the personal attachment teachers can have towards their work (Boylan, 2010).

Collaborative planning provides the opportunity for teachers to engage in natural discussions of pedagogical content knowledge. Pedagogical content knowledge as defined by Shulman (1986) “includes an understanding of what makes the learning of
specific topics easy or difficult: the conceptions and preconceptions that students of
different ages and backgrounds bring with them to the learning of those most frequently
taught topics and lessons” (p. 9). Collaborative planning creates the environment for
teachers to discuss and broaden their pedagogical content knowledge because they may
be asked to make their own knowledge and understanding knowable to others (e.g.,
Goodchild, Fuglestad, & Jaworski, 2013; Roth McDuffie & Mather, 2009).

While we have some examples of teachers co-planning, we have few examples in
the literature of teacher educators co-planning (Nevin, Thousand, & Villa, 2009). In an
example of third spaces in mathematics teacher education research, Wood and Turner
(2015) examined the potential contributions of mentor teachers to an elementary
mathematics methods course for preservice teachers. The mentor teachers engaged in the
planning, enactment, and analysis of task-based interviews collaboratively with the
preservice teachers and university teacher educators. The researchers identified
contributions of the mentor teachers to the learning experiences of the preservice
teachers. However, Wood and Turner note that although university teacher educators can
leverage the mentor contributions by providing structure from academic expertise to
enhance the third space, this effectively increased the complexity of the work of the
teacher educators.

In documenting collaboration between a mathematics teacher educator and a
mathematics teacher at the collegiate level, Bleiler (2015) reports, “Through
collaboration and participation in the practice of ‘the other,’ they were able to increase
the awareness of their own practice and the practices characterizing their respective
communities” (p. 3). In this case, the mathematics teacher educator reported the need to
justify instructional decisions and the mathematics teacher gained an increased understanding of student needs (Bleiler, 2015). Both participants identified team co-planning as having a significant impact on their development as teacher educators.

Both Wood and Turner (2015) and Bleiler (2015) examined the impact of collaboration among traditional and non-traditional teacher educators with the intention of supporting preservice teachers in their methods coursework. While these studies extend our understandings of that work, there are few studies that focus on the details of teachers’ collaborative planning. Many reports that include co-planning do so as part of other activities, such as lesson study or professional learning communities, and therefore, lack details about the work of the teachers (e.g., Fernandez, 2010; Wake, Swan, & Foster, 2016). Further, we lack studies about the co-planning of teacher educators. Specifically, we do not know what activities teacher educators engage in or the expertise they may draw upon as they co-plan mathematics methods course experiences for preservice teachers.

The Potential Contribution of This Study

This study examines the work of diverse teacher educators collaboratively planning to prepare preservice teachers to select and adapt mathematical tasks in an elementary mathematics methods course and associated field experience. The teacher educators, the co-instructors of the methods course, form a community of practice that exists in a boundary-spanning third space between the university and the local elementary schools. I refer to the team of teacher educators as a Methods Planning Community of Practice (MPCoP).
Though there have been calls for the intentional development of third spaces in teacher education (Zeichner, 2010) and research about third spaces has documented the complexity of engaging with multiple stakeholders in education (e.g., Martin, Snow, & Franklin Torrez, 2011), we know little about the collaborative work of teacher educators. In particular, we lack research-based understanding of how hybrid teacher educators work together and how their diverse knowledge and experiences is drawn upon in third spaces. In the growing field of teacher education research, studies about the knowledge needed for the work of mathematics teacher educators have begun to emerge (e.g., Chauvot, 2009; Zopf, 2010). However, at present, this literature falls short of describing how diverse teacher educators’ expertise is drawn upon in collaborative work.

While this study is informed by scholarship in both teacher education and mathematics education, its primary contribution is to the field of mathematics teacher education. In examining the collaborative work of school- and university-based teacher educators in a community of practice in a PDS, I focus on the teacher educators’ co-planning related to developing elementary mathematics methods course experiences intended to help preservice teachers learn to select and adapt mathematical tasks. This focus on mathematical tasks is important because it is a critical component of preservice teacher education and potentially creates opportunities for both academics and practitioners in teacher education roles to contribute expertise during collaboration. By investigating co-planning related to selecting and adapting mathematical tasks, this study offers new insights into the nature of mathematics methods co-planning activities (Chapter 4) and the specific areas of expertise used by the teacher educators in this mathematics teacher education work (Chapter 5). Results have potential implications for
future research about and practice in preservice mathematics teacher education (Chapter 6).
Chapter 3
Methods and Procedures

The purpose of this study was to develop an understanding of the collaborative work of a Methods Planning Community of Practice (MPCoP). In this chapter I describe the methods and procedures for this study. To begin, I describe the design of the study that influenced my methods of data collection and analysis. Then, I provide detail about the context of the study, data collection, and data analysis.

Design of the Study

The interpretive research genre and ethnographic traditions informed the design of this study (Borko, Liston, & Whitcomb, 2007; Borko, Whitcomb, & Byrnes, 2008; Spradley, 1979; Wolcott 1994). Borko et al. (2008) describe teacher education research within this genre as “[seeking] to perceive, describe, analyze, and interpret features of a specific situation or context, preserving its complexity and communicating the perspectives of the actual participants” (p. 1025). This study focused specifically on the collaborative planning of a team of teacher educators with diverse backgrounds as they designed experiences for preservice teachers in one focus area (selecting and adapting mathematical tasks) of an elementary mathematics methods course. I sought to explore and describe the team’s co-planning activities and to communicate the types of varied expertise that the team members drew upon in those co-planning activities.

For observational case studies, Bogdan and Biklen (2003) explain, “the major data-gathering technique is participant observation (supplemented with formal and
informal interviews and review of documents) and the focus of the study is on a particular organization (school, rehabilitation center) or some aspect of the organization” (p. 55). Borko et al. (2008) emphasize the importance of representing participant voice in teacher education research through “record[ing] interactions in naturalistic settings, conduct[ing] interviews, and review[ing] written artifacts” (p. 1026). I applied these aspects of the interpretive genre to the co-planning sessions through qualitative data collection and analysis methods.

**Context of the Study**

**Setting**

**Professional development school.** The setting for this study is the collaborative planning among teacher educators in a long-standing *Professional Development School* (PDS) partnership between a large research university and the elementary schools of the local school district. Preservice teachers from the university who are accepted into the PDS program complete a yearlong internship within the local school district as they concurrently finish their bachelor’s degree and PreK-4 certification requirements over two semesters. The extended field experience that PDS interns complete is one unique aspect of the teacher education setting of this study; another is the composition of instructional teams for methods courses.

As part of their fall semester coursework, the interns complete an elementary mathematics methods course that is co-taught by a university teacher educator and one, or more, other *Professional Development Associates* (PDAs) in a local elementary school classroom. Both the university and school-based teacher educators who work in the PDS are known as *Professional Development Associates* (PDAs). PDAs include university
faculty members (both tenure track and non-tenure track), graduate students, retired teachers, and reassigned teachers. Reassigned teachers are a special category of PDAs who are released for 1-3 years from K-5 classroom responsibilities to work full time in the PDS. Most, but not all PDAs are also responsible for supervising interns in their grades K-4 classroom internship sites. The PDS instructional team for elementary mathematics methods in Fall 2015 included a current doctoral student who is a former elementary teacher, a reassigned teacher from the school district in her 5th year co-teaching the methods course, a tenured mathematics education faculty member from the university with over 20 years of experience as a teacher educator, and a retired teacher from the school district who is a former graduate student of the university. Participants are described in detail in a subsequent section of this chapter.

**Interns and elementary students.** In the semester of this study, there were a total of 56 interns (one male, 55 females) in the PDS placed in classrooms (grades K-4) in each of the district’s nine elementary schools. In addition to elementary mathematics methods course, interns enroll in methods courses for science and social studies, as well as a course focused on creating a productive classroom learning environment. The interns participated in weekly meetings with their PDAs. The interns were paired with 58 mentor teachers (2 males, 56 females) and there were 2,374 students enrolled in grades K-4 in the district. The students in the district were predominantly white from middle class families.

**Methods course schedule.** For the fall semester of methods courses, the 56 interns comprised two cohorts of 28 interns. Prior to the start of the university semester, all 56 interns were together for two days of methods courses as part of a two-week
program called “Jumpstart.” After Jumpstart, each cohort met for three hours, one time per week for the remainder of the semester. Table 3-1 provides the schedule for task-related methods course experiences during the Fall 2015 semester; these experiences were of interest in this study. Every three weeks the interns participated in an “embedded week” in their placement classrooms. Instead of attending normal methods course meetings, which interrupted their time in classrooms, they spent the entire week “embedded” in their placements. During this week, the methods instructors visited and observed the interns in mathematics lessons in the schools.

Table 3-1: Semester schedule for methods course.

<table>
<thead>
<tr>
<th>Week</th>
<th>Task-related course experiences</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/17/15 (Jumpstart)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Adjectives to Describe Mathematical Tasks</td>
<td>8/28/15 (Jumpstart)</td>
</tr>
<tr>
<td>3</td>
<td>School Starts – no class meeting</td>
<td>9/1/15, 9/2/15</td>
</tr>
<tr>
<td>4</td>
<td>Classifying Place Value Tasks</td>
<td>9/8/15, 9/9/15</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>9/15/15, 9/16/15</td>
</tr>
<tr>
<td>6</td>
<td>Procedures and Concepts in Mathematical Tasks</td>
<td>9/22/15, 9/23/15</td>
</tr>
<tr>
<td>7</td>
<td>Embedded week #1</td>
<td>9/29/15, 9/30/15</td>
</tr>
<tr>
<td>*8</td>
<td>Task Sorting</td>
<td>10/6/15, 10/7/15</td>
</tr>
<tr>
<td>9</td>
<td>Characteristics of Mathematical Tasks</td>
<td>10/13/15, 10/14/15</td>
</tr>
<tr>
<td>*10</td>
<td>Kindergarten Mathematical Tasks</td>
<td>10/20/15, 10/21/15</td>
</tr>
<tr>
<td>11</td>
<td>Embedded week #2</td>
<td>10/27/15, 10/28/15</td>
</tr>
<tr>
<td>12</td>
<td>Task Sharing from Assignment #4</td>
<td>11/3/15, 11/4/15</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>11/10/15, 11/11/15</td>
</tr>
<tr>
<td>*14</td>
<td>Chart Talk Reflection</td>
<td>11/17/15, 11/18/15</td>
</tr>
<tr>
<td>15</td>
<td>Thanksgiving – no class</td>
<td>11/24/15, 11/25/15</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>12/1/15, 12/2/15</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>12/8/15, 12/9/15</td>
</tr>
</tbody>
</table>

*weeks that were planned during recorded co-planning meetings
Methods course framework. Prior to the time of this study, in 2014, Olivia, the university mathematics teacher educator in the collaborative planning team, designed a guiding framework for the elementary mathematics methods course (Figure 3-1). She received contributions and feedback on the framework from both Sara and Colleen who had previously co-taught the course with Olivia. The four domains were intended to guide the design of methods course experiences throughout the semester and to communicate big ideas and questions to interns. The framework was posted on the classroom wall and described in the course syllabus:

Our work in [the elementary mathematics methods course] will occur in four interconnected domains: (1) doing and learning meaningful mathematics, (2) selecting and adapting mathematical tasks, (3) planning and facilitating mathematical discourse, and (4) understanding and honoring children’s mathematical thinking. Within each domain, we will be guided by several essential questions. As we inquire in these four domains, we will focus on the broad mathematical area of number and operations (and we will make connections to other mathematical areas as well). Furthermore, we will be aware that our mathematical and pedagogical inquiry takes place within a PDS community of learners in which we each bear responsibility for supporting one another’s ongoing development. (Fall 2015 syllabus)

The focus of this study is the team’s co-planning around Domain 2: Selecting and Adapting Mathematical Tasks. Prior to the start of the study, I anticipated that co-planning for this particular domain might draw on a wide range of expertise, including knowledge of mathematics and other areas of knowledge identified in the literature such as pedagogical content knowledge, curricular knowledge, and research knowledge (Chauvot, 2009).
Our work in [blacked out] will occur in four interconnected domains. Within each domain, we will be guided by several essential questions. As we inquire in these domains, we will focus on the broad mathematical area of number and operations (and we will make connections to other mathematical areas as well). Furthermore, we will be aware that our mathematical and pedagogical inquiry takes place within a PDS community of learners in which we each bear responsibility for supporting one another’s ongoing development.

<table>
<thead>
<tr>
<th>DOMAIN:</th>
<th>ESSENTIAL QUESTIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Doing and Learning Meaningful Mathematics</td>
<td></td>
</tr>
</tbody>
</table>
| We will study different kinds of mathematical understanding and the complex web of ideas that support children’s developing number sense. We will personally experience mathematical sense-making and problem-solving so that we can analyze and learn from those experiences. | 1a. What does it mean to “do mathematics” and “understand mathematics”?  
1b. What are the key elements of a deep understanding of number and operations, and how does this understanding develop during early childhood and elementary school?  
1c. How does number sense relate to other important mathematical ideas in the elementary curriculum? |
| 2: Selecting and Adapting Mathematical Tasks |
| We will consider the kinds of problems and tasks that challenge students to engage in mathematical reasoning and sense-making. We will engage in cognitively demanding tasks that allow multiple entry points and a variety of solution strategies. | 2a. What makes problem-solving a productive activity for learning mathematics?  
2b. What are the qualities of problems and tasks that most effectively elicit students’ thinking and support students’ learning of mathematics?  
2c. What strategies can teachers use to adapt tasks (e.g., those found in textbooks) so that children are appropriately challenged? |
| 3: Planning and Facilitating Mathematical Discourse |
| We will explore classroom discourse that invites students to share their emerging mathematical understandings. We will engage in discourse that focuses on sharing, listening to, and analyzing one another’s ideas, reasoning, and solutions. | 3a. What are the key characteristics of classroom discourse that supports children’s learning of meaningful mathematics?  
3b. What talk moves (or math talk) and questions will support students in sharing their thinking and engaging with one another’s ideas?  
3c. How can teachers deliberately position students in mathematical discourse so that students’ ideas and strategies become central? |
| 4: Understanding and Honoring Children’s Mathematical Thinking |
| We will consider how to elicit students’ thinking through our careful selection of tasks and development of mathematical discourse. We will treat children’s thinking with respect, strive to understand it, and learn to see it as the basis for instructional decision-making. | 4a. How can teachers draw on children’s existing intuitions and knowledge about number and operations to support further development of their understandings?  
4b. How can different problem structures be used to create opportunities for teachers to elicit and develop particular solution strategies by children?  
4c. How can teachers’ knowledge of children’s thinking guide instructional decisions? |

Figure 3-1: Methods course framework developed by Olivia.¹

¹ Portions of the framework have been blacked out to maintain confidentiality.
Selecting and adapting mathematical tasks. Engagement with mathematics curricular materials has become a popular focus for preservice teacher education (e.g., Drake, Land, & Tyminski, 2014; Lloyd & Pitts Bannister, 2011). When preservice teachers are engaged in the analysis of mathematics curricular tasks in teacher education coursework and field experiences, they gain opportunities to explore curriculum potential (Lloyd, 2008; Lloyd, 2009; Nicol & Crespo, 2006; Tyminski, Zambak, Drake, & Land, 2013). These opportunities are important in teachers’ development because, as Ben-Peretz (1990) states, “Without such insights teachers may remain ‘text bound,’ using textbooks or teacher guides because they ‘are there,’ without attempting adaptation or enrichment of existing materials” (p. 109).

As Stein, Remillard, and Smith (2007) stated, “curriculum materials vary considerably with respect to the nature of the mathematical tasks that are found within them” (p. 347). Mathematical tasks comprise much of the activity in mathematics classrooms (Stein et al., 2009). However, not all mathematical tasks create the same opportunities for students’ thinking and learning as they can vary in the cognitive demand placed on the student (Silver & Stein, 1996; Stein & Smith, 1998; Stein et al., 2009). Stein, Remillard, and Smith (2007) stated, “the tasks with which students become engaged in the classroom form the basis of their opportunities to learn what mathematics is and how one does it” (p. 347). Watson and Mason (2007) pointed out, “[Mathematical] tasks do not in themselves generate learning, but are initiating, structuring or framing devices for pedagogy and learning” (p. 207).

Mathematical tasks provide a basis for instruction, yet the cognitive demands of a mathematical task can change as the task is implemented (Stein, Grover, & Henningsen,
The Mathematical Tasks Framework (MTF) and the associated Task Analysis Guide (TAG) (Stein & Smith, 1998) provide characteristics for identifying tasks according to lower-levels of cognitive demand (memorization and procedures without connections) and higher-levels of cognitive demand (procedures with connections and doing mathematics). For example, Stein & Smith describe procedures without connections tasks as having the following characteristics:

- Are algorithmic. Use of the procedure is either specifically called for or its use is evident based on prior instruction, experience, or placement of the task.
- Require limited cognitive demand for successful completion. There is little ambiguity about what needs to be done and how to do it.
- Have no connection to the concepts or meaning that underlie the procedure being used.
- Are focused on producing correct answers rather than developing mathematical understanding.
- Require no explanations or explanations that focus solely on describing the procedure that was used. (p. 348)

Several studies have examined the role of tasks in teacher development (e.g., Arbaugh & Brown, 2005; Norton & Kastberg, 2012; Osana, Lacroix, Tucker, & Desrosiers, 2006). For example, Arbaugh and Brown (2005) engaged in task sorting interviews with high school mathematics teachers after the teachers were exposed to the MTF through a professional development experience. Arbaugh and Brown found that learning about the levels of cognitive demand of tasks enabled teachers to reflect more deeply on the relationship between tasks and students’ learning. Other research has documented partnerships between teachers and researchers that engage teachers as co-designers of mathematical tasks (e.g., Jung & Brady, 2016; Roth McDuffie & Mather, 2009; Sztajn et al., 2014; Wake, Swan, and Foster, 2016). Sztajn et al. (2014) facilitated boundary encounters between researchers and mathematics teachers in a professional
development project centered on designing mathematical tasks for certain learning trajectories. These researchers found that teachers’ valuing the research-based goals of the professional development was crucial to a productive and successful partnership.

**District resources.** As the PDS program is a partnership with all the elementary schools in one school district, the interns and instructors had access to common district resources. Among those resources, the interns’ placement classrooms used a common mathematics textbook series across the grades. The district employed instructional coaches, who were reassigned classroom teachers, to provide support to their colleagues in specific subject areas, including mathematics. The teacher educators (TEs) in this study invited the instructional coaches into the elementary mathematics methods classroom to work with the interns on the implementation of the district mathematics resource. The instructional coaches held “curriculum discussions” with the interns about how to make use of the district textbook. This work is closely related to selecting and adapting mathematical tasks because the interns used the Mathematical Tasks Framework to analyze and adapt the tasks found within the district. Further, the methods instructors co-planned the coaches’ activities to support methods course experiences about selecting and adapting mathematical tasks and took those activities into account when co-planning new methods course experiences (see e.g., Vignette A in Chapter 4).

**Collaborative planning meetings.** The instructional team began their collaborative work over the summer to brainstorm ideas for the course. Olivia shared, “We start talking about plans in the summer. But a lot of what happens in the summer is [talking] or writing about [the course] and generating ideas more so than actually making specific plans” (Background Interview, 9/21/15). During the semester, the instructional
team met seven times. The co-planning meetings lasted for approximately 90 minutes. During that time, the team discussed plans for the upcoming weeks. The team maintained a folder of shared documents that included an extensive file containing weekly plans for the semester. A tentative outline for the course was developed over the summer by Olivia, drawing on and adjusting previous year’s course experiences. These plans were adjusted both in and out of the team co-planning meetings. At times the team did not determine all details of upcoming classes, and additional information was added to the planning document outside of the co-planning meetings. In addition, at times, one or more team member(s) submitted proposed plans to the shared planning file prior to a co-planning meeting. Descriptions for the major course assignments were written primarily by Olivia outside of the meetings. During the co-planning meetings, the team worked within their shared folders including their planning document.

**Selecting the Setting and Participants**

I intentionally selected the PDS elementary mathematics methods co-planning team for my study because due to my own experience teaching an elementary mathematics methods course individually in the on-campus wing of the university’s PreK-4 program, I was interested in teacher educators’ co-planning. I had previously conducted a pilot self-study about my work with an inservice 5th grade teacher to co-plan my methods course and I was left with questions about what knowledge and experiences we drew upon during that work. This particular team was the only group of university- and school-based TEs formally working to co-plan an elementary mathematics methods course in my vicinity at the time of the study. The team seemed like a fruitful choice for study because three of the four members of the team had long-term relationships, through
prior work in the PDS. This suggested that by studying this particular team’s co-planning, I might gain access to activities that are more established and stable than those of a new co-planning team. I hoped that by examining stable activities, rather than those in flux, that I could better gain insights into relationships between the team’s co-planning and expertise. Bleiler (2015) suggested, “In order to build on and learn from collaborative efforts...it is imperative to investigate the nature and process of existing collaborations” (p. 232). Although the team gained a new member during Fall 2015, it seemed likely, based on my informal conversations with team members, that planning would proceed in ways similar to previous semesters. In keeping with the interpretive research genre, I aimed to understand the nature of the work of this particular group without adding my own influence or asking them to deviate from their normal collaborative planning.

Participants

The participants for this study were the four teacher educators (TEs) who comprised the instructional team for the elementary mathematics methods course in the PDS in Fall 2015. The four TEs were white females of varying ages. Table 3-2 offers a summary of participants. At the time of the study, Colleen, Olivia, and Sara had been working together for three years to collaboratively plan and teach the elementary mathematics methods course; Ainsley was a new member of the instructional team. Olivia and Sara co-taught the methods class for the Tuesday cohort of interns, and Olivia and Colleen co-taught on Wednesdays. Ainsley, by her own choice and with the agreement of the co-instructors, alternated between the Tuesday or Wednesday class each week. Each participant was asked to give a brief history of her career leading up to her
Fall 2015 work within the PDS. The following sections are summaries of the responses from each participant.

Table 3-2: Table of participants.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ainsley Townsend</td>
<td>Second-year doctoral student who is a former elementary teacher, new to PDS the year of the study</td>
</tr>
<tr>
<td>Colleen Reese</td>
<td>Reassigned teacher from the school district</td>
</tr>
<tr>
<td>Olivia Soprano</td>
<td>Tenured mathematics education faculty member from the university</td>
</tr>
<tr>
<td>Sara Cambridge</td>
<td>Retired teacher from the school district who also served as the university coordinator for the PDS beginning in August 2015 and is a former graduate student of the university</td>
</tr>
</tbody>
</table>

**Ainsley.** Ainsley Townsend was a second-year graduate student at the university studying for a Ph.D. in Curriculum and Instruction with an emphasis on Curriculum and Supervision. Ainsley described her educational background:

I got my Bachelor’s degree in elementary education...Then I got an elementary school teaching job that I maintained for ten years; most of that was teaching third grade. I got my Master’s degree in Educational Leadership in 2009. This is my second year in the Curriculum and Supervision doctoral program. (Background Interview, 9/23/15)

The year prior to this study, Ainsley’s assistantship involved supervising and teaching a seminar class of undergraduate students in preschool classrooms. In the semester of this study she had moved into the PDS for her assistantship, supervising interns and co- teaching the elementary mathematics methods course for the first time.

**Colleen.** As part of the PDS partnership agreement between the university and the school district, classroom teachers can be re-assigned to full-time work within the PDS for a period of three years as Professional Development Associates (PDAs). PDAs
supervise interns and co-teach the methods courses. Colleen Reese was one such PDA. She was in her 27th year of teaching; she taught second or third grades for 24 of those years. Colleen had participated in the “Mathematics Teacher Learning Project2” with the university and considered it a pivotal period in her teaching career – one that greatly impacted her views about teaching and learning mathematics. She began working with the PDS in 2002-2003 during a teaching sabbatical. Colleen shared, “[I] spent my sabbatical working with the PDS program...I went to the PDA meetings. I went to all the math classes” (Background Interview, 10/2/15). She co-taught the elementary math methods course for two years with a university professor while she was teaching full time prior to moving into her role as a PDA. During this study, Colleen was in her third year as PDA, fifth time co-teaching elementary mathematics methods, and returned to her 3rd grade classroom full-time in Fall 2016.

**Olivia.** Olivia Soprano was a tenured mathematics education faculty member at the university. Olivia recounted her career:

I graduated from college in 1991. I was a math major. During the time that I was a math major I wanted to be a high school math teacher. I changed my mind and decided to do a doctorate in math to become math professor. (Background Interview, 9/21/15)

During her time in the mathematics doctoral program, she taught a Mathematics for Elementary Teachers course, which sparked her interest in mathematics education. She left her mathematics doctoral program as a doctoral candidate prior to completing her dissertation, and she moved to a doctoral program in mathematics education at another university.

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2 This is a pseudonym for the study to maintain confidentiality.
I finished in 1996 and then I became a faculty member doing research in mathematics education. I was a faculty member for 13 years in a math department, teaching math courses for preservice teachers. I occasionally taught a methods course but my job was really teaching math courses for preservice elementary teachers. (Olivia, Background Interview, 9/21/15)

In 2009, she moved to the College of Education at the university where this study took place to become more involved with methods courses and student teaching. Upon arrival at the university, she held a leadership position in the elementary teacher education program coordinating the various methods courses. Next, Olivia shared, “I became the director of the whole elementary program and took our program through a big transition. As my time in that leadership role came to an end, I had the opportunity to start working in the PDS” (Background Interview, 9/21/15). In Fall 2015, she was in her fourth year co-teaching the elementary mathematics methods course in the PDS.

Sara. Sara Cambridge was a retired teacher from the local school district. She stated, “I have a lot of years under my belt. I started teaching a long time ago. And math was always my favorite subject.” In 1995, she participated in the same Mathematics Teacher Learning Project as Colleen with the university and was similarly impacted. She taught for 11 years in another school district before taking a short break from teaching, and returned to classroom teaching in the local school district for 10 years. Sara explained the work she did when she returned to the classroom:

In that period of time I did a number of things. I taught a couple different grade levels. I taught 3rd grade...Then I moved to another school and taught fifth and sixth grade. I moved to the middle school and taught sixth grade in the middle school for a number of years, and then in 2001, I left the classroom and became a curriculum support teacher in math and science. (Background Interview, 9/30/15)
Sara finished out her tenure in the school district as the Math and Science Coordinator from which she retired in 2009. Sara shared that after her retirement:

I enrolled in the Ph.D. program in Curriculum and Instruction with an emphasis on Curriculum and Supervision. And, for the last four years prior to this one, I had an assistantship in the PDS and I supervised interns and taught [the elementary mathematics methods course]. (Background Interview, 9/30/15)

In the Fall 2015 semester of this study, Sara began her work as the university coordinator for the PDS.

**My role as researcher.** Including the semester of this study, I taught the same elementary mathematics methods course for six semesters (nine sections) on campus. I was familiar with the course, but in a different context. I collaborated with teachers from the local school district to plan methods course experiences for preservice teachers on campus. I co-taught weekly in one of those teacher’s classrooms for the 2014-2015 school year. In 2014, I led a station at a Mathematics Manipulative Seminar in the PDS for interns during their spring semester. In 2015, I participated in the same seminar with my co-teacher from that school year.

Prior to the study, I had professional relationships with the participants. I had graduate courses with both Sara and Ainsley. I completed a class project with Ainsley in 2014 for which we co-taught two days in the PDS elementary mathematics methods course led by Olivia, Sara, and Colleen. I interacted with Sara and Colleen in other PDS activities such as Jumpstart (2012, 2015), a Video Analysis Workshop (2014), and Math Manipulative Seminars (2014, 2015). I participated in university retreats for the elementary education program with Olivia. I also took graduate courses with Olivia and worked on several research projects with her, which included presenting at conferences.
Consistent with the interpretive research genre and ethnographic research methods (Borko, Whitcomb, & Byrnes, 2008; Patton, 2002; Spradley, 1979), I spent significant time within the research setting. I attended each of the team’s collaborative planning meetings throughout the semester. During the co-planning sessions, I took field notes and audio recorded the meetings. I established my role within the meetings as an observer and not a participant. Though not part of the data collected for this study because it was outside of the scope of my research questions, I attended two methods course class meetings (10/6/15 and 11/17/15) to better understand the context for the team’s co-teaching. The team gave me access to all of their collaborative planning files, which were stored and edited electronically.

**Linking Methods and Research Questions**

Table 3-3 provides an overview of how the methods for data collection and analysis connect to the research questions for this study. More detail is provided in the following sections.
Table 3-3: Linking methods and research questions.

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Sources</th>
<th>Methods of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the general co-planning activities members of a MPCoP engage in as they prepare preservice teachers to select and adapt mathematical tasks through methods course experiences?</td>
<td>3 co-planning meetings</td>
<td>Domain analysis (Spradley, 1979)</td>
</tr>
<tr>
<td></td>
<td>- Recorded version and transcribed version</td>
<td>Analytic Memos (Groenewald, 2008)</td>
</tr>
<tr>
<td></td>
<td>- Field notes</td>
<td>Vignettes (Erickson, 1986; Geertz, 1973)</td>
</tr>
<tr>
<td></td>
<td>Interview transcripts</td>
<td>Timelines (Chatman, 1981)</td>
</tr>
<tr>
<td>What areas of professional expertise do members of a MPCoP use while engaging in general co-planning activities for preparing beginning teachers to select and adapt mathematical tasks?</td>
<td>Background interviews</td>
<td>Card-sorting (Wolcott, 1994)</td>
</tr>
<tr>
<td></td>
<td>- Develop initial list</td>
<td>Tentative Taxonomy (Spradley, 1979)</td>
</tr>
<tr>
<td></td>
<td>Interview #1</td>
<td>Analytic memos (Groenewald, 2008)</td>
</tr>
<tr>
<td></td>
<td>- Participant-generated areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interview #2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Participants sort their areas into emergent categories and apply to transcript</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Co-planning meetings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interviews #3 and #4</td>
<td></td>
</tr>
<tr>
<td>How are the areas of professional expertise used by the MPCoP?</td>
<td>Findings from RQ #2</td>
<td>Applied theory of boundary objects (Star, 1989) in a community of practice (Wenger, 1998)</td>
</tr>
<tr>
<td></td>
<td>Likert-scale results from Interview #3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Co-planning meetings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Transcribed version</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Field notes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Semi-structured group interview and Slam books</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interviews</td>
<td></td>
</tr>
</tbody>
</table>
Data Collection

Data Sources

Data sources for this study consisted of audio recordings of three of the team’s co-planning sessions, during which I took field notes as an observer, individual background interviews, 16 semi-structured interviews (4 with each team member), 2 semi-structured group interviews, and the team’s planning documents. Artifacts from interviews (e.g., slam books) also became part of the data corpus. Table 3-4 displays the data collection timeline.
Table 3-4: Data collection timeline.

<table>
<thead>
<tr>
<th>Event Description</th>
<th>DATE</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background Interviews</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olivia</td>
<td>9/21/2015</td>
<td>30 m</td>
</tr>
<tr>
<td>Ainsley</td>
<td>9/23/2015</td>
<td>14 m</td>
</tr>
<tr>
<td>Sara</td>
<td>9/30/2015</td>
<td>27 m</td>
</tr>
<tr>
<td>Colleen*</td>
<td>10/2/2015</td>
<td>44 m</td>
</tr>
<tr>
<td>*Colleen’s background interview and interview #1 were combined into one session due to scheduling constraints</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Co-planning A</strong></td>
<td>10/1/2015</td>
<td>1 h 26 m</td>
</tr>
<tr>
<td>Interview #1 (with participant generated areas of expertise and Co-planning A transcript chunk)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colleen*</td>
<td>10/2/2015</td>
<td>15 m</td>
</tr>
<tr>
<td>Ainsley</td>
<td>10/6/2015</td>
<td>28 m</td>
</tr>
<tr>
<td>Sara</td>
<td>10/7/2015</td>
<td>28 m</td>
</tr>
<tr>
<td>Olivia</td>
<td>10/8/2015</td>
<td>56 m</td>
</tr>
<tr>
<td><strong>Semi-structured Group Interview and Co-planning B</strong></td>
<td>10/15/2015</td>
<td>1 h 20 m</td>
</tr>
<tr>
<td>Interview #2 (with emergent areas of expertise and Co-planning B transcript chunk)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olivia</td>
<td>10/20/2015</td>
<td>45 m</td>
</tr>
<tr>
<td>Sara</td>
<td>10/21/2015</td>
<td>40 m</td>
</tr>
<tr>
<td>Ainsley</td>
<td>10/22/2015</td>
<td>43 m</td>
</tr>
<tr>
<td>Colleen</td>
<td>11/2/2015</td>
<td>33 m</td>
</tr>
<tr>
<td><strong>Co-planning C</strong></td>
<td>11/5/2015</td>
<td>1 h 26 m</td>
</tr>
<tr>
<td>Interview #3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colleen</td>
<td>11/12/2015</td>
<td>14 m</td>
</tr>
<tr>
<td>Olivia</td>
<td>11/17/2015</td>
<td>24 m</td>
</tr>
<tr>
<td>Ainsley</td>
<td>11/18/2015</td>
<td>9 m</td>
</tr>
<tr>
<td>Sara</td>
<td>11/18/2015</td>
<td>11 m</td>
</tr>
<tr>
<td><strong>Semi-structured Group Interview (with slam books) and final planning meeting</strong></td>
<td>11/19/2015</td>
<td>1 h 35 m</td>
</tr>
<tr>
<td>Interview #4 (with Likert-scales)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colleen</td>
<td>12/9/2015</td>
<td>59 m</td>
</tr>
<tr>
<td>Olivia</td>
<td>12/9/2015</td>
<td>50 m</td>
</tr>
<tr>
<td>Ainsley</td>
<td>12/15/2015</td>
<td>47 m</td>
</tr>
<tr>
<td>Sara</td>
<td>12/17/2015</td>
<td>46 m</td>
</tr>
</tbody>
</table>
**Collaborative planning meetings.** For this study I audio recorded four consecutive collaborative planning meetings that took place on October 1, October 15, November 5, and November 19, 2015. Each of the co-planning meetings lasted approximately 90 minutes. The data for this study was limited to the sections of the co-planning meetings that related to Domain 2 of the course framework. I created verbatim transcripts of these portions of the co-planning meetings.

**Transcript chunks.** For Interviews #1 and #2, described below, I selected a chunk of the collaborative planning meeting immediately preceding the interview for the participants to examine. Similar to videos used in studies about teacher noticing (Sherin & van Es, 2005; van Es & Sherin, 2008) and pivotal teaching moments (Stockero & Van Zoest, 2013), I selected the chunk of transcript based on a decision point that occurred within the meeting to create a stimulated recall (Calderhead, 1981) so that participants would not be forced to rely solely on memory. For example, below is the transcript chunk used in interview #1.

**OLIVIA:** So when we’re talking with them about those tasks, we are going to try to draw their attention back to that list of concepts that they talked about when the coach was there and try to focus them on so are these tasks challenging students to make connections to those concepts? Is that what we’re doing?

**SARA:** I think so.

**AINSLEY:** Mhm.

**OLIVIA:** And based on the response to that question, they should be able to classify the task.

**COLLEEN:** So the very first word says array. That first thing with the fruit is having them develop an array. But it’s on the side, the definition of an array is putting things in rows or columns. That’s it. So they may say,
“Oh yeah, it’s helping them build a better understanding of an array.”
Really? I don’t know that it is.

**OLIVIA**: But the array is made for them. I mean it’s going to- we’re going to have to talk about it.

**COLLEEN**: Should be interesting.

**OLIVIA**: So, is that going to be a whole class discussion? How are we going to do that?

**COLLEEN**: You mean after they’ve identified the tasks?

**OLIVIA**: We’re going to pass these three tasks out.

**SARA**: I think we should have them either talk in a pair or get with an appointment or do a desk set, two or three of you in each desk set. I think maybe they could have small conversations about it first. Otherwise our non-talkers aren’t going to really participate in the conversation.

**OLIVIA**: What would you think of- this sounds super traditional. What if on that page where the three tasks will be if I put these bullets [referring to TAG\(^3\)]? What if I made a copy of the middle two categories? And we actually ask them to circle or cross off the bullets that seem to apply to that problem. I feel like part of what’s happening is they’re not really engaging with this [TAG].

**AINSLEY**: Mhm.

**SARA**: We’ve only done it once with them. I think that’s a fine idea to force them-

**OLIVIA**: But is it too much that way? It’s really hand-holding. It’s really like…

**SARA**: Well…I don’t think so. Do you?

**AINSLEY**: No, no. Look at how long it took the four of us to try and decide where those tasks were classified. And they’re brand new to mathematics tasks in general. Let alone trying to figure out if they’re high or low cognitive demand.

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\(^3\) Task Analysis Guide referring to characteristics of the levels of cognitive demand for mathematical tasks (Stein, Smith, Henningsen, & Silver, 2009)
OLIVIA: Maybe I’ll make the copies on three separate slips of paper and then each piece of paper is going to have the task and then these categories and they have to decide and they can cross it off or circle it.

SARA: I think it’s a great way to make sure they’re all engaged in the conversation.

COLLEEN: And to force them to make-

OLIVIA: To narrow down to one of these [four types of tasks].

COLLEEN: Right.

Transcript chunks were printed for each participant to review and write on during interviews.

Field notes. As I attended each co-planning meeting, I took comprehensive field notes on the content of the meeting (Wolfinger, 2002). I recorded the times of the meeting that focused on selecting and adapting mathematical tasks. I noted moments during the meeting, and corresponding times, that seemed to allude to participants drawing on expertise, for example, when the team engaged in a discussion about sorting mathematical tasks.

Interviews. Hatch (2002) summarized the purpose of interviews that align with the methods of this study:

When interviews are used in conjunction with observation, they provide ways to explore more deeply participants’ perspectives on actions observed by researchers. They also provide avenues into events and experiences that have not been observed. (p. 91)

I began data collection with a background interview with each participant. After each of the co-planning meeting that I recorded, I conducted individual interviews with each participant. In this way, I engaged in reflective conversations with participants about their work (Bleiler, 2015). The purpose of the individual interviews was, as Bogdan and
Biklen (2003) state, “to gather descriptive data in the subjects’ own words so that the researcher can develop insights on how subjects interpret some piece of the world” (p. 95). I used a semi-structured interview protocol for individual interviews; I asked each participant the same questions to maintain consistency across the participants and generate comparable data (Bogdan & Biklen, 2003; Lichtman, 2013). I also conducted two semi-structured group interviews with all four participants for which I had a list of questions and a predetermined plan for the course of the interview (Lichtman, 2013). Interviews were audio recorded and transcribed verbatim. Each interview is further described below.

**Background interview.** In the background interviews, I asked participants to describe their educational and career backgrounds leading up to their work in the PDS to elicit a brief “career history” (Wolcott, 1973). I also asked them to describe the work of the team, particularly their co-planning. The purpose of this information was to help me better understand the diverse backgrounds of the team members. I asked the following questions to elicit initial knowledge and experiences that each participant believed she and the team drew upon in co-planning:

- In your work co-planning, what experience and knowledge do you feel you draw on the most?
- Overall, what kinds of knowledge and experiences do you feel that the team draws on the most in planning for the class?

After the interviews, I generated a list of knowledge and experiences that each participant mentioned in response to the aforementioned questions.

**Interview #1.** The first interview was conducted after Co-planning A (10/1/15). For the first interview, I created a set of index cards for each participant (with the
exception of Colleen who constructed hers during her combined background interview and interview #1) with one item from her list of knowledge and experiences generated from the background interview on each card. I asked each participant to examine a chunk of verbatim transcript from Co-planning A and, based on her cards, select which areas of knowledge and experience seemed to come into play in that part of the co-planning meeting. I intentionally used language from the participants’ previous interview to capture areas of knowledge and experience in their own words (Bogdan & Biklen, 2003).

To gain access to shared knowledge and experience that may not be apparent in the transcript alone, I asked participants: “In this part of the planning meeting, which of these areas of knowledge and experience seemed to come into play?” Then, I engaged the participants in a form of cognitive interviewing similar to Hill, Dean, and Goffney (2007) by asking participants to retrospectively examine their own contributions to the co-planning meeting and to explain which areas of knowledge and experience they were drawing upon during those contributions.

**Interview #2.** After Interview #1, I sorted the cards from each individual into eight areas of professional expertise (described in analysis below) with the aim of developing an agreed upon set of participant-generated areas of expertise. To start the interview, I asked participants to sort their own cards into my eight areas to assure that I had accurately captured all of the participant-generated areas of professional expertise. This activity also served to familiarize the participants with the eight areas. After sorting the cards, I prompted the participants to create a concept map “drawing lines, using arrows or not, to indicate any relationships you see among the categories.” The purpose of this activity was to see how the participants understood the categories and made
connections among the areas of professional expertise. I then asked the participants to examine a chunk of transcript from Co-planning B (10/15/15) and to answer the following questions:

- Which of these categories do you think most influenced the group’s decision here?
- Go down the transcript and mark where you see these 8 categories.

I suspected that participants would have different insights to offer about their own and each other’s areas of professional expertise. I wanted to have the opportunity to compare across responses using the same areas of professional expertise to see if there was consensus and to determine if there were areas of professional expertise that TEs said they were using but were not noticed by others.

**Interview #3.** During Co-planning C, it became apparent that the team offered the interns a methods course experience during week 12 that was planned outside of the previous co-planning meeting. As such, I attempted to elicit information from the participants about the co-planning of that methods course experience by first asking each TE to describe the experience, then to explain how the experience was planned (if known), and finally to select areas of professional expertise that were drawn upon in the planning of that experience. I also inquired about any other methods course experiences that occurred in class but had been planned outside of the co-planning meetings.

**Semi-structured group interviews.** I conducted two semi-structured group interviews. The first group interview occurred before Co-Planning B. The second occurred after completing Interview #3 with each participant. Bogdan and Biklen (2003)
state the benefit of a such an interview, “Group participation can stimulate each other to articulate their views or even to realize what their own views are” (p. 101).

In the first interview, I asked participants to examine Assignment #4: Mathematical Tasks Project, the major course assignment within for Domain 2. While examining this document, I asked the TEs to use the eight areas of professional expertise (described in analysis below) to identify where those areas influenced the development of the assignment. The purpose of this interview was two-fold. First, I wanted the participants to become familiar with the areas of professional expertise, which we would use in the next individual interview, and to be able to provide feedback on the categories. Second, at the time, I was trying to capture more detail about methods course experiences that had occurred outside of the co-planning meetings.

During the second group interview, I asked the participants to reflect on the methods course experiences they had designed throughout the semester to address Domain 2: Selecting and Adapting Mathematical Tasks. The purpose of the semi-structured group interview was to give participants the opportunity to respond to one another about their co-planning. I facilitated this interview through the use of slam books.

*Slam books.* During the third co-planning meeting, when determining how interns would record their responses to a reflective methods course experience, Olivia suggested using “slam books.” She described slam books as they were used in her middle school to the team:

You had to have a secret name so everyone wrote their secret name in the front. Then there were all these questions in there like “What boy do you like? What's your favorite sports team?” And you would fill it out and it would be passed around the class. (Co-planning C, 11/5/15)
The TEs and the interns already used composition books as “math journals” for the methods course. Inspired by this discussion and knowledge of their use of math journals, I created four slam books, made from composition books, that the participants could record in and pass to one another to facilitate reflection in the semi-structured group interview. In the front of each slam book on the first page, I pasted a copy of the plan for one methods course experience that the team had designed for the interns related to Domain 2 of their course framework (see Figure 3-2). I selected these experiences by examining the final planning document from the semester and highlighting the experiences that related to Domain 2.

I asked each participant to take a slam book, turn to the second page, and write her name on the top (see Figure 3-3). On the left-hand page, I listed the 8 areas of knowledge and experience we had worked with all semester. On the right-hand page, where each participant wrote her name, I asked participants to write down which areas of

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4 A portion of the plan has been blacked out to maintain confidentiality.
knowledge and experience influenced the planning of the methods course experience listed on the first page. When they finished writing, they turned the page, used the paperclip to keep answers private, and passed the book to another team member. This activity repeated until all four TEs had completed the task for each book. The purpose of this activity was to re-familiarize the participants with the areas of professional expertise and to prime their ideas for the next activity. To check that this activity was not completed haphazardly, I conducted a member check with one team member after the group interview and asked her to complete the task verbally. I found consistency among her responses; her verbal responses were consistent with her written responses in each book identifying influential areas of professional expertise.

Figure 3-3: List of areas of professional expertise in the slam books.

Next, I asked the team members to think more about the ways in which the areas of knowledge and experience influenced the planning of the methods course experiences. I wrote the name of each area of professional expertise on the top of a separate page (see Figure 3-4). I asked the TEs to select two or three areas of professional expertise they
saw as most influencing the planning of the mathematical tasks-related methods course experience in their respective books and to describe how that area of professional expertise influenced the methods course experience. By doing this, I hoped to gain more insight about the areas of expertise that were most influential from the perspective of the participants. This is consistent with Spradley’s (1979) argument to “study a few, selected domains in depth, while still attempting to gain a surface understanding of a culture or cultural scene as a whole” (p. 134). After completing this task, the TEs passed the books again, but this time they could build on each other’s responses. Each TE had the opportunity to engage with each book one time, then they each had one final look at the original book and were prompted to find something that someone else wrote and respond to it.
Because I was interested in what areas of professional expertise the group as a whole drew upon, I developed and used this instrument to allow for a collective reflection on the work of the team. I also selected methods course experiences for each slam book that were not planned during the three co-planning meetings to try to elicit data about each one.

Figure 3-4: Example of completed slam book reflection page.
Interview #4. At this point in data collection, I suspected that the team was drawing heavily on the context for their teaching in the PDS. I began the interview by asking participants to “Describe the specific context for teaching the methods course in the PDS.” Then I offered the written plans printed from the shared planning document for all of the methods course experiences related to selecting and adapting mathematical tasks and asked participants, “How did the team take that into account for planning about math tasks?”

Knowledge of effective teaching, experience as teacher educators, and knowledge of the specific context for teaching were the three most prominent areas marked and discussed during the previous interviews. I wanted more insight into how each team member perceived the level of her own expertise as well as the level of the team’s expertise, and the extent to which she perceived herself and the team drawing upon that expertise.

I provided a Likert-scale to facilitate reflection on the eight areas of expertise used in co-planning (see Figure 3-5). I asked each TE to rate her own level of expertise in each area of expertise. Once she had completed that, I asked her to rate the extent to which she individually drew on that expertise in co-planning. Then we repeated the process, this time reflecting on the team as a whole (see Figure 3-6). I looked for discrepancies in the ratings where the TE may have marked herself high for her level of expertise but low for drawing on that expertise in co-planning, or vice versa, and asked for explanations.
<table>
<thead>
<tr>
<th>1. Experience as Teacher Educators</th>
<th>Rate YOUR level of expertise</th>
<th>Rate the extent to which YOU individually drew on the expertise in co-planning for selecting and adapting mathematical tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. Research Knowledge and Experience</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. Elementary Teaching Experience</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. Knowledge of Mathematics</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. Knowledge of Effective Teaching</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. Knowledge of the Specific Context for Teaching</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. Knowledge of Math Task Framework</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8. Knowledge of How to Teach Math Conceptually</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 3-5: Likert-scale about individual expertise.
The team maintained a shared folder with course materials including a planning document that was continually updated throughout the semester as plans were finalized for the methods course. The final planning document served as a record of the methods course experiences that were designed, and was a tangible artifact produced by participants (Eisenhart, 1988). This document was also used in Interview #4 and for the construction of the slam books.

**Methods of Analysis**

Borko, Whitcomb, and Byrnes (2008) describe data analysis in the interpretive research genre: “Data analysis is a recursive process that begins during data collection; themes and patterns are developed both inductively from the data and deductively from
the conceptual framework” (p. 1026). Consistent with this description, data analysis for this study occurred in three phases (see Figure 3-7). In the following sections, I detail each phase of data analysis.

**Phase 1: Areas of Professional Expertise**

At the beginning of the background interview, each participant listed areas of knowledge and experience she perceived to be influential to co-planning. After each background interview, I reviewed the audio recording and verbatim transcript to create index cards with participant-generated areas of knowledge and experience used in co-planning (Table 3-5). I wrote each of area of professional expertise on an index card. Spradley (1979) notes, “writing terms on cards helps to elicit, verify, and discuss a domain [with participants]” (p. 130). I used each participant's set of index cards in Interviews #1 and #2.

Figure 3-7: Phases of analysis.

**Phase 1**
- Identify areas of professional expertise

**Phase 2**
- Conduct domain analysis to identify co-planning activities
- Write memos describing areas of professional expertise

**Phase 3**
- Construct timelines and develop vignettes
- Identify boundary and non-boundary objects
After the first interview, I sorted the 50 cards generated by the four participants’ responses into eight areas of professional expertise. These areas, which I considered to be shared participant-generated areas of expertise, were used throughout data collection with the participants: 1. Experience as Teacher Educators, 2. Research Knowledge and

<table>
<thead>
<tr>
<th>Ainsley</th>
<th>Colleen</th>
<th>Olivia</th>
<th>Sara</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience teaching undergraduates</td>
<td>Being a 2nd grade teacher</td>
<td>Past experience teaching with Sara and Colleen</td>
<td>Experience in Mathematics Teacher Learning Project</td>
</tr>
<tr>
<td>Knowledge of teaching elementary school</td>
<td>Mathematics background &amp; pedagogy</td>
<td>Past experience teaching preservice teachers</td>
<td>Experience being uncomfortable teaching mathematics</td>
</tr>
<tr>
<td>Knowledge of what preservice teachers should know for elementary teaching</td>
<td>Active engagement of 20-21 year olds</td>
<td>Knowledge from journals</td>
<td>Experience with elementary math content</td>
</tr>
<tr>
<td>Teacher educator experience</td>
<td>Knowledge of potential adaptations</td>
<td>Knowledge of research</td>
<td>Knowledge of mathematics</td>
</tr>
<tr>
<td>Knowledge of the school district</td>
<td>Background in why mathematics practices are preferred</td>
<td>Math background</td>
<td>Experience transitioning teaching practice</td>
</tr>
<tr>
<td>Knowledge of mathematics</td>
<td>Developmental stages of preservice teachers</td>
<td>Lack of elementary teaching experience</td>
<td>Knowledge of how to teach math conceptually</td>
</tr>
<tr>
<td>Knowledge of curriculum</td>
<td>Background knowledge in mathematics practices</td>
<td>Context for teaching (interns’ stress and responsibilities &amp; demands)</td>
<td>Experience losing valued curriculum program</td>
</tr>
<tr>
<td>Experience selecting and adapting tasks</td>
<td>Knowledge of potential adaptations</td>
<td>District knowledge</td>
<td>Research knowledge</td>
</tr>
<tr>
<td>Experience teaching</td>
<td>Inviting people into classroom</td>
<td>Elementary teaching experience</td>
<td></td>
</tr>
<tr>
<td>Research knowledge</td>
<td>Experience with district curriculum committee</td>
<td>Experience supervising</td>
<td></td>
</tr>
<tr>
<td>Knowledge of the Math Task Framework</td>
<td>Experience in research project</td>
<td>Experience as math learners</td>
<td></td>
</tr>
<tr>
<td>Knowledge of strategies for teaching preservice teachers</td>
<td>Knowledge about interns</td>
<td>Experience in research project</td>
<td></td>
</tr>
<tr>
<td>Knowledge of mathematics problems</td>
<td>Research knowledge of tasks</td>
<td>Knowledge about interns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conducting research about preservice teachers</td>
<td>Research knowledge of tasks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Experience using K-5 curriculum</td>
<td>Experience using K-5 curriculum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Math knowledge</td>
<td>Math knowledge</td>
<td></td>
</tr>
</tbody>
</table>

I spread the cards on a table and then started to group them, similar to category sorting described by Wolcott (1994). For example, I grouped “knowledge of the goals of our class/these curriculum discussions,” “knowledge of the district,” “knowledge about interns (including stress and responsibility),” and “knowledge of opportunities for our professional growth or learning” together under knowledge of context for teaching. Although I was aware of areas of professional expertise of mathematics teacher educators from the literature (e.g., Chauvot, 2009; Zopf, 2010), as well as teacher knowledge frameworks (e.g., Hill, Ball, & Schilling, 2008; Shulman, 1986), my primary aim was to develop categories that reflected the shared perspectives of the participants.

I continued to sort the cards, similar to a taxonomic analysis (Spradley, 1979) for which I was considered the domain to be “areas of professional expertise.” I constructed a tentative taxonomy (Spradley, 1979) (see Figure 3-8) and identified four main areas from this sorting: experience as teacher educators, research knowledge, elementary teaching experience, and knowledge of mathematics. Related to, and overlapping with, those areas were four other seemingly prominent areas based on the participant-generated cards confirmed in Interview #1. The bolded words within Figure 3-8 indicate the eight areas of professional expertise that include the cards that participants initially created.

In Interview #2, I asked each participant to sort her original cards into my eight categories to ensure that I had represented each participant’s views about the areas of
expertise in my categories. Spradley (1979) advocates the use of individual cards for card sorting, “This gives informants a visual sense of the relationships among the folk terms you are investigating and enables them to cooperate more fully” (p. 131). Each participant was able to sort her cards into my categories. Small changes were made to the wording of a few categories. “Knowledge of effective teaching principles” became simply “knowledge of effective teaching” to potentially broaden the area of professional expertise. Conversely, “knowledge of context for teaching” became “knowledge of the specific context for teaching” to narrow the focus of this area of professional expertise for the participants, though they needed repeated explanations of this area, while still capturing the diverse versions of the context the participants described in interviews. These areas of professional expertise were further refined in Phase 3 of data analysis.
### Experience as teacher educators

<table>
<thead>
<tr>
<th>Knowledge of effective teaching principles</th>
<th>Knowledge of context for teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmental stages of preservice teachers</td>
<td>Knowledge of the goals of our class/these curriculum discussions</td>
</tr>
<tr>
<td>Knowledge of teaching strategies</td>
<td>Knowledge of the district</td>
</tr>
<tr>
<td>Experience teaching with other TEs in study</td>
<td>Knowledge about interns (including stress and responsibility)</td>
</tr>
<tr>
<td>Experience supervising</td>
<td>Knowledge of opportunities for our professional growth or learning</td>
</tr>
<tr>
<td>Active engagement of 20-21 year olds</td>
<td>Knowledge of creating tasks for preservice teachers</td>
</tr>
<tr>
<td>Knowledge of how people learn</td>
<td>Experience teaching undergraduates</td>
</tr>
<tr>
<td>Knowledge of classroom management</td>
<td>Experience teaching</td>
</tr>
<tr>
<td>Knowledge of strategies for teaching preservice teachers</td>
<td>Experience teaching preservice teachers</td>
</tr>
<tr>
<td>Knowledge of creating tasks for preservice teachers</td>
<td>Attended methods course – co-taught methods course</td>
</tr>
</tbody>
</table>

### Elementary teaching experience

- Knowledge of what preservice teachers should know for teaching elementary math
- Invited multiple people/parents into math classroom (as a k-4 teacher)
- Unwilling member of district’s committee to review math curricula
- Experience losing valued curriculum
- Experience being uncomfortable teaching math
- Experience with elementary math content
- Being a 2nd/3rd grade teacher
- K-4 Students and best practices
- Math background and pedagogy
- Experience adapting tasks
- Knowledge of different ways of teaching mathematics
- Experience selecting and adapting tasks
- Knowledge of curriculum
- Experience using k-5 curriculum

### Research Knowledge

- Research Knowledge of Tasks
- Knowledge from journals and literature
- Experience conducting research about supporting PSTs’ learning
- Experience conducting research about PSTs

### Knowledge of mathematics

- Weak mathematics background
- Background of confusion, misunderstanding, frustration
- Experience as math learners
- Knowledge of math problems

### Knowledge of how to teach math conceptually

- Experience in Mathematics Teacher Learning Project
- Experience changing/transitioning teaching practice
- Experience in research project

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**Figure 3-8:** Tentative taxonomy (Spradley, 1979) for areas of professional expertise.
Phase 2: Memo Writing and Domain Analysis

During Phase 2, I focused on developing the areas of professional expertise through memo writing and identifying the co-planning activities through a domain analysis. Each part of this phase is described in detail below.

**Memo writing.** Upon completion of data collection and transcription of the interviews and co-planning meetings, I read through the transcripts of the co-planning meetings and took notes on the activity of the meetings so that I could easily read through a summary of the co-planning meetings without needing to read through the entire transcript or listen to the recording. I analyzed the planning meetings for the eight areas of knowledge and experience, guided by the taxonomy of Figure 3-8. I coded each of the planning meeting transcripts for the eight areas, sorted the transcript data according to the codes, and wrote an analytic memo of each area with support from the transcripts (Groenewald, 2008). For example, I coded the following pieces of a co-planning meeting transcript as “experience as a teacher educator:”

- “I remembered that last year, when we did this kindergarten lesson that [the district instructional coaches] are going to be doing with us, that was the first lesson we did last year” (Co-planning #2, 10/15/15).

- “I feel like part of what’s happening is [the interns] are not engaging with this list [of characteristics for the levels of cognitive demand]” (Co-planning A, 10/1/15).

As a check on my coding, I returned to the data from the first interview in which the participants sorted the cards from the background interviews into these eight areas. I was looking for confirming or disconfirming evidence that these areas covered all the areas they had generated. Maxwell (2013) advocates “rigorously examin[ing] both the supporting and the discrepant data to assess whether it is more plausible to retain or
modify the conclusion” (p. 127). In addition, I ensured that the areas reflected the participants’ understandings as well as my own understandings of the areas. For example, “knowledge of effective teaching” carries different meanings for individual participants and myself. Whereas I have come to understand effective teaching in relation to student learning, I understood through this process that some participants viewed effective teaching as an instructional activity that was implemented without difficulties in the classroom. This process also allowed me to recognize subtle differences among team members’ views of particular areas and to capture those differences within areas. For example, Olivia viewed “teaching mathematics conceptually” as part of “effective teaching,” whereas Sara and Colleen viewed these as distinct areas. Once the eight areas were confirmed, I then examined all interview transcripts for additional illustrative evidence.

**Domain analysis.** To identify co-planning activities, I conducted a domain analysis (Spradley, 1979). Spradley describes the process of domain analysis, “Analysis proceeds by examining some phenomenon, dividing it into its constituent parts, then identifying the relationships among the parts and their relationship to the whole” (p. 92). I began the domain analysis by examining my initial notes that summarized the activity of the meetings. I sought to chunk my notes into sections and to name each chunk that satisfied the form “X is a kind of Y” or in this case “X is a kind of co-planning activity.” This analysis resulted in four activities: “establishing a goal,” “general brainstorming,” “engaging with potential activity,” and “developing instructional details.”

Once I had determined the activities, I went through the transcripts for each co-planning meeting and coded for the four types of activities. I wrote analytic memo
descriptions (Groenewald, 2008) of each type of activity and described an example from a co-planning meeting. Then I listed any other examples of that activity that I found in the transcripts of the co-planning meetings. As I worked through the transcripts I discovered that “engaging with potential activity” was part of “developing instructional details.” I renamed “developing instructional details” to be “determining instructional details” as the language better captured the group’s work. As a final step, I reviewed the transcripts for the interviews looking for descriptions of the group’s work to confirm or disconfirm the results of my domain analysis.

Phase 3: Vignettes, Timelines, and (Non-)Boundary Objects

In the final phase of data analysis, I developed vignettes and constructed timelines of the co-planning meetings to illustrate and further examine the co-planning activities. In this phase I also examined the areas of professional expertise and identified both boundary and non-boundary objects within the MPCoP.

**Vignettes.** In Chapter 4, I use vignettes and timelines to provide the reader with details about the co-planning meetings. Erickson (1986) offers an advantage of vignettes, “The moment-to-moment style of description in a narrative vignette gives the reader a sense of being there in the scene” (p. 150). The vignettes provide the reader with a narrative of the co-planning meetings (Connelly & Clandinin, 1990; Erickson, 1986).

To construct the vignettes, I listened to the recordings of the planning meetings while reading through the transcripts as I listened and took handwritten notes on what occurred. Then I took my notes and constructed a summary of the meeting attempting to create a “thick description” of the meetings (Geertz, 1973). I hoped to avoid repeated sections of transcripts that I used in my reporting of results about the eight areas of
expertise. For example, I included the details of how tasks were chosen by the team for the interns to provide evidence of expertise about mathematics and expertise about the Mathematical Tasks Framework. I included details of the discussion when a participant initiated a new activity, but decreased details when the activity was on-going. For example, Olivia suggests using slam books as a way for the interns to engage with the reflective questions described in Vignette C. There is a discussion about what slam books are and how they would be used, but this idea is not used because the interns would not have a record of responses to each question but rather many responses to only one question. This discussion is excluded because the idea was not taken up, but occurred within the on-going general brainstorming depicted in Vignette C.1.

In writing the vignettes I focused on the planning related to methods course experiences that addressed Domain 2: Selecting and Adapting Mathematical Tasks. I excluded the discussions about Assignment #4, the culminating assignment about mathematical tasks because it was developed outside of the co-planning meetings.

After constructing the vignettes, all participants were asked to read and provide feedback about the accuracy of the content. Colleen, Olivia, and Sara responded to the request. Colleen and Sara offered no content adjustments. Olivia suggested areas where greater detail could be given and changes in wording for the sake of clarity.

**Timelines.** The vignettes provide the “timeline of discourse” (Chatman, 1980); the precise timing of the co-planning meetings does not necessarily align with the narrative form seen in the vignettes (i.e., the length of paragraphs does not indicate a corresponding passage of time). The vignettes allow the reader to better understand the nature of the co-planning meetings. To complement the vignettes, the timelines provide
the actual time progression, or “timeline of the story” (Chatman, 1980). The timelines (Figure 4-4) illustrate of flow of activities, and relative time spent on individual activities, for each of the three co-planning meetings. To create the timelines, I simultaneously listened to the recordings of each planning meeting while I read through the corresponding transcript that had been coded for the co-planning activities from the domain analysis. I noted the start and end time of each co-planning activity as I progressed through the recordings.

(Non-)boundary objects. Using the construct of boundary objects (Star, 1989) within a community of practice (Wenger, 1998), I examined the analytic memos for the areas of professional expertise. Boundary objects unify the work of a community of practice, and require some understanding by all members, but maintain interpretive flexibility, i.e., the object can carry different, yet valid, meanings for all individuals (Kubiak et al., 2015; Star, 2010). I applied these tenets of boundary objects to the areas of professional expertise.

Guided by theory about communities of practice (Wenger, 1998), I was interested in noticing the areas of professional expertise that resonated with all or most team members. I did so by creating a conceptual diagram (see Figure 3-9). Maxwell (2013) supports the use of alternate strategies for qualitative data analysis:

I want to emphasize that reading and thinking about your interview transcripts and observation notes, writing memos, developing coding categories and applying these to your data, analyzing narrative structure and contextual relationships, and creating matrices and other displays are all important forms of data analyses. (p. 105)
As shown in Figure 3-9, I aimed to find overlap in areas of professional expertise for the participants. This led me to search for possible groupings of the areas of professional expertise that may have influenced their work.

Figure 3-9: Tentative concept map in field notes.

To identify the possible groupings of the areas of professional expertise, I used the Likert-scale results from Interview #4 as a primary source. Then I went to the analytic memos to look for confirming and disconfirming evidence (Maxwell, 2013). For example, the Likert-scale results suggested that “knowledge of how to teach conceptually” may have been an area of overlap for the team as each member rated herself a 4 or higher, however, Olivia rated herself a 3 when asked about the extent to which she drew upon the knowledge in co-planning (see Figure 3-10). In reviewing the analytic memos, I discovered that Olivia shared in an interview, “This one [teaching mathematics conceptually] doesn't resonate with me” (Interview #4, 12/9/15). Therefore, I labeled teaching mathematics conceptually along with research as non-boundary objects because they were not embraced by all members of the team. This process resulted in identifying course curriculum, context, Mathematical Tasks Framework, and strategies for effective teaching as boundary objects. Initially, course curriculum was part
of context, however, during this process, I realized that there was significant evidence to support it as its own boundary object.

![Knowledge of How to Teach Math Conceptually](image)

**Figure 3-10:** Knowledge of how to teach math conceptually Likert-scale results of for individual participants.

Through this process, I came to these four broad categories because the smaller categories, *mathematics, elementary teaching,* and *teacher education,* were not as distinct as they initially had appeared to be. I refined the boundary objects by clustering these areas of professional expertise in order to preserve the original categories to respect the participants’ voices, but I recognized that there was significant overlap in those areas that could be subsumed by the boundary objects. My goal in this process was to identify boundary objects for this specific group of teacher educators rather than for a generalized population.

**Trustworthiness**

At each phase in my analysis, as described above, I used multiple sources of data in my analysis, known as *triangulation.* Denzin and Lincoln (2011) suggest, “the use of
multiple methods, or triangulation, reflects an attempt to secure and in-depth understanding of the phenomena in question” (p. 5). Maxwell (2013) further describes the value of triangulation, “This strategy reduces the risk of chance associations and of systematic biases due to a specific method, and allows a better assessment of the generality of the explanations that one develops” (p. 128). When examining multiple data sources, I sought confirming and disconfirming evidence.

I utilized respondent validation, also known as member checks, to evaluate my analysis. Maxwell (2013) describes respondent validation as “systematically soliciting feedback about your data and conclusions from the people you are studying” (p. 126). I employed these member checks (Lincoln & Guba, 1985) throughout my analysis. I organized the participant-generated areas of professional expertise into eight categories. Then I asked each participant to sort her own cards (areas of professional expertise) into my eight categories. This ensured that I captured each individual’s thoughts and gave me insight into her understanding of the areas of professional expertise.

Though I was the only rater for identifying evidence of the use of areas of professional expertise in the co-planning meetings, I engaged in another form of member check to protect against researcher bias when I presented participants with transcript chunks from co-planning meetings (Interviews #1 and #2). I asked participants to identify areas of professional expertise influencing the group’s work in the transcript chunk. By doing this, I was able to capture each participant’s perceptions of the expertise used so that the results were not limited to my own views. Further, as previously described in the analysis, I used interviews to deepen my understanding of each area of professional expertise.
expertise, which would have been difficult to share with other raters as this understanding developed over the time I spent with the participants.

As a final form of respondent validation, I asked all participants to read the vignettes of the co-planning meetings to check that they were consistent with the participants’ sense of the nature of the discussions in the meetings and to identify any suggestions or concerns (Leeferink, Koopman, Beijaard, & Ketelaar, 2015). Sara and Colleen responded with confirmation that the vignettes were accurate. Olivia offered line edits and asked for clarification of some passages.

It is important to acknowledge that one of the participants played a dual role in this study. To protect the identity of that participant and others, I will not disclose the dual role, however, I wish to share what measures I took to ensure that the results of the study were not impacted. First, I reviewed the full data corpus so as not to omit any data source that may have altered the findings and I engaged in systematic and rigorous analyses of all data sources, as described in this chapter. Second, the research questions and analysis did not include judgements of effectiveness or quality of contributions, so I did not face the challenge of trying to “please” this participant. Third, I consulted with multiple committee members during data collection and analysis to make sure that I did not miss a potential bias. Finally, I performed the abovementioned respondent validation measures to conclude that I accurately represented the data.
Chapter 4

Co-Planning Activities

The four teacher educators (TEs) in this study formed a Methods Planning Community of Practice (MPCoP). The joint enterprise of the MPCoP was to co-plan for the elementary mathematics methods course in the Professional Development School (PDS). Not all groups that work together are a community of practice. The team’s work exemplifies the dimension of practice that characterize a community of practice (CoP): mutual engagement, joint enterprise, and shared repertoire. The team interacted regularly to design course experiences that would prepare interns to select and adapt mathematical tasks, which the team would co-teach to the interns. The very act of deliberately meeting on a regular basis allowed for the mutual engagement in the MPCoP. The joint enterprise dimension is demonstrated by the co-teaching of the planned course experiences; members were responsible for enacting the course experiences with the interns in subsequent class meetings. Finally, the MPCoP developed a physically shared repertoire through their record-keeping within a working electronic instructional planning document (a lengthy Google Doc). They also shared expertise in developing the course experiences, the focus of Chapter 5.

Each team member brought her own unique background and experiences to the group’s work and, as such, maintained membership in multiple communities of practice. In order to understand the expertise that was drawn upon by the TEs in their co-planning meetings, it will be helpful to first understand what happened during the meetings. This
chapter responds to the first research question: What are the general co-planning activities that members of a MPCoP engage in as they prepare preservice teachers to select and adapt mathematical tasks through methods course experiences? In response to this question, I present vignettes of segments of three meetings of the MPCoP to portray the nature of the co-planning. Then I draw upon aspects of the vignettes to describe the types of general co-planning activities (CPAs) in which the MPCoP engaged and to identify patterns in the CPAs.

Vignettes

Each vignette describes the events of a co-planning meeting as members of the MPCoP worked to make decisions about in-class instruction related to “selecting and adapting mathematical tasks,” one of the four main course domains and the domain of focus in this study. The vignettes appear in chronological order and contain paragraph numbers for ease of reference later in the findings. Each vignette begins with a short introduction to orient the reader to the co-planning meeting along with a table that depicts the portion of methods class for which the team planned. The vignette segments are also labeled by types of CPAs which are discussed in subsequent sections. Establishing goals (EG) involved stating or inquiring about the purpose of the co-planning meeting. General brainstorming (GB) involved the suggestion of ideas for a methods course experience. Determining instructional details (DD) involved sorting out the details of the methods course experience taken up by the group within the co-planning meeting.

As detailed in Chapter 3, members of the MPCoP were: Ainsley, a doctoral student and a former elementary teacher; Colleen, a teacher from the school district reassigned to work in the PDS; Olivia, a tenured mathematics education faculty member
from the university; and Sara, retired teacher from the school district in her first year working for the university as the coordinator for the PDS.

Vignette A

The team co-planning about “selecting and adapting mathematical tasks” depicted in Vignette A took place on October 1, 2015. The entire meeting lasted 1 hour and 25 minutes as the team came together to plan for Week 8 (October 6 and 7, 2015) of the methods course. Table 4-1 shows an overview of the final plan for the entire methods class meeting for Week 8, taken from the team planning document. On four occasions during the semester, district instructional coaches joined the methods course to co-teach the interns about mathematics curriculum using specific district textbook lessons as a launching point. Vignette A focuses on the section of class that was scheduled to take place between 2:00-2:30pm after a visit from a district instructional coach.

Table 4-1: Overview of week 8 methods course plans in the shared planning file.

<table>
<thead>
<tr>
<th>Time in Class</th>
<th>Content for Class Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:45-12:45</td>
<td>Discussion of the TCM article “13 Rules that Expire”</td>
</tr>
<tr>
<td>12:45-1:30</td>
<td>Math Exploration #6 - Thinking about Arrays.</td>
</tr>
<tr>
<td>1:30-2:00</td>
<td>Mathematical Task Discussion w/ District Instructional Coach: Arrays, Partitioned Rectangles, and Equal Shares</td>
</tr>
<tr>
<td>2:00-2:30</td>
<td>Focus on tasks from the Arrays lesson. (There will be homework follow up to this) Interns will use bulleted descriptions of Procedures without Connections and Procedures with Connections to classify three tasks. We will ask them to cross off bullets and circle bullets.</td>
</tr>
<tr>
<td>2:30-2:45</td>
<td>Wrap Up - return participation slips, mention photograph instead of drawing next time</td>
</tr>
</tbody>
</table>
The co-planning meeting begins with Sara explaining what the district EG instructional coaches have planned for their “Mathematical Task Discussion” with the interns. Colleen asks what will follow the coaches’ discussion in class that week. Sara and Olivia simultaneously respond that the team needs to talk about this in the co-planning meeting.

Olivia proposes the idea to follow up the coaches’ discussion by asking the GB interns to respond to the question: “Given a list of concepts in the lesson, what are the procedures?” This idea builds upon the coaches’ planned activity which included use of 14 cards containing the mathematical concepts from a lesson from the district mathematics resource. Colleen wonders aloud if the interns really understand the difference between procedures and concepts when she says to Olivia, “I’m not sure they really get what you meant and that it’s okay that things are procedures, but it’s really more how they’re used and how they’re taught that you’re really focusing on.” Olivia responds that she wants the interns to realize that procedures are not bad. Olivia revises her proposed idea to give the interns a list of the concepts from the lesson in the coaches’ activity and ask them to classify tasks within that lesson. She says, “In the past we haven’t been clear with [the interns] what the concepts are. We’ve been trying to get [the interns] to try to generate lists. That’s what we were doing last time, trying to get [the interns] to generate the list of concepts then the list of procedures so we could talk about which kind of task it was. So this time they’ve got a list of concepts. Is there a way that we can have them try to classify the tasks given this list of concepts?”
She suggests, “Part of what’s really hard is thinking about, Is it a procedure with a connection to a concept or is it just a procedure?” Colleen shares, “I’ll be perfectly blunt and honest that my understanding of this has been changing over the past couple of years...I was thinking of more, ‘Well, these types of things [tasks that allow for invented strategies and discussion of those strategies] are better because they’re more student-driven, they’re more open-ended.’ But I never thought about the fact that you probably consider those still a procedure. Because to me they were focused so much on building the underpinnings of what kids understand.” She suggests, “if I was confused by about that,” the interns must be confused. She then suggests comparing tasks from the district textbook, which the team viewed as tending to be lower-level, with tasks the team views as having more explicit connections between procedures and concepts. Sara reminds Colleen that the interns’ upcoming homework will be focused on just such an activity, and the team decides not to use tasks from outside the lesson.

Olivia refocuses the group. “My thought was, this week, in this little tiny half hour that we have after the lesson [with the coaches], we could do something with these tasks from this lesson.” Originally, she suggests that interns will classify and adapt the lesson’s tasks, but she then reconsiders, “For homework, they are going to read about adapting... Maybe what we need to do is just talk about classifying the tasks.” Sara affirms Olivia’s suggestion by reminding the team that the interns have only sorted tasks once so far this semester. Olivia talks aloud as she revises
the homework recorded in the Google Doc to also focus on the district textbook
tasks:

What I have down here for the homework is read the article
[“Turning Traditional Textbook Problems into Open-Ended
Problems” (Kabiri & Smith, 2003)], choose any two problems
from that Google doc two weeks ago when they gave us problems.
So let’s not do that...Let's use the [district lesson] tasks. So ‘Revisit
the tasks from class.’ I’ll add details to this later. They’re going to
have to re-write the problems so that they have a high-level
cognitive demand. So we need to pick out problems from this
lesson.

4 The team starts to look at the tasks in the lesson. Olivia wonders if the team
DD should look for other tasks outside the lesson or use only tasks from within the
lesson. Sara worries that if they use other tasks, they assume that the interns will
be able to apply knowledge to new tasks rather than using something with which
they are already familiar. The team resumes looking at the tasks in the lesson.

5 One of the tasks the team considers using with the interns asks students to
DD partition a square to make a 4x4 area model and then shade regions to show
halves in two different ways (see Figure 4-1). The team discusses their thoughts
about the level of cognitive demand of this task:

OLIVIA: So there’s that one [Given an open array: Measure in
inches. Draw rows and columns. Write the number of small
squares.] and then there’s the one we were just talking about with
the halves. They’re very similar in terms of the level of cognitive
demand.

SARA: Well, showing it two ways bumps it up [from lower to
higher level of cognitive demand] a little bit.
OLIVIA: Does it?

COLLEEN: Not when you’re being told you have to do it this way.

SARA: What do you mean?

OLIVIA: Are you saying it bumps it up to another category?

SARA: Well, within a category maybe, yeah. “Shade to show halves two different ways.”

Olivia invites Ainsley to share her thoughts about the level of cognitive demand of the task. Ainsley hesitates with her response and expresses uncertainty when she says, “I don’t know if that makes it...high-level.” Sara concedes that this task might be categorized as procedures without connections, a low-level task. Olivia asserts that it is a low-level task.

Colleen continues the discussion of this task by commenting on the textbook’s DD expectations for students: second-graders will use a ruler to draw straight lines and make equal sized boxes. Colleen comments, “Part of what bothers me about this entire lesson is you want kids ‘to attend to precision’ is one of their phrase and yet you are asking them to use rulers and draw straight lines and make equal-sized boxes. Ever work with a second grader? It doesn’t work. Why don’t they just use tiles?” Sara agrees with Colleen. Ainsley expresses concern over the expectations as second graders are asked to “Shade to show halves in two different ways” then to “Show fourths in two different ways” in two different but equal sized boxes. The solution in the teacher’s manual (as copied into field notes) shows the following:
Sara suggests that students could show halves by shading in four squares in the top corner and four in the opposite bottom corner. Ainsley responds, “I don’t know if the way you said works because if you look at #14 [the second prompt in Figure 4-1, which seems to show halves, not fourths], and it asks them to do fourths. Shading in four here and four here [in two opposing corners]...looks like fourths instead of halves the way they’re demonstrating it here.” Sara then wonders about the intentions of the authors of the task.

Olivia asks the team what they want the interns to consider when looking at a task:

Normally we just give them a task that doesn’t have the whole lesson. In this case, they’re going to have the whole lesson. They’re going to have more information. Do we want them to use that information?... Do they interpret [the task] from within this lesson? Which I think makes more sense because that’s the reality of what their work is going to be.

Colleen suggests they discuss this with the interns during class and remarks that considering a task within the context of a lesson may influence how teachers and students view the task.
The team continues reading the lesson in search of meaningful tasks for use in class. Olivia comments on the concepts in a task about arrays (see Figure 4-2):

Olivia suggests that, at first glance, the task seems to have potential to make connections to multiplication. Sara points out that the task, as written, builds to fractions rather than to multiplication. Olivia responds that the task will prompt a good conversation with the interns. Olivia then summarizes:

Okay, so there’s that one. There’s the one on page 302, any of those. I think it’s easiest to take a screenshot of #5 because you can get the instructions above it. And then there’s the other one we talked about which was #13 on page 303 because it also has the instructions above it. “Shade to show halves two different ways.” I think if we use those three tasks...they’re all procedures without connections.

As Sara works on her computer to capture images of the tasks, Olivia confirms the purpose of the task activity with the team, “when we’re talking about those tasks, we are going to try to draw [the interns’] attention back to that list of concepts that they talked about when the coach was there and try to focus [the interns] on, ‘Are these tasks challenging students to make connections to those concepts?’ Is that what we’re doing?” Sara and Ainsley affirm Olivia. Colleen silently reviews the tasks and notices that the teacher’s manual gives the definition of an array, “Putting things in rows or columns,” for the Fruit Array task, which interns might think is helping students to build an understanding of multiplication, but she questions the value of merely stating the definition to students rather than using it as a teacher to inform ways to help the students better understand the mathematical concepts. Olivia says they will need to talk about it with the interns.
Olivia asks the team if they would like to discuss the three selected tasks with the DD interns as a whole class or if there is a preferred way to enact the activity. Sara EG suggests that the interns should work in pairs or small groups first: “I think maybe they could have small conversations about it first. Otherwise our non-talkers aren’t going to really participate in the conversation.” Olivia asks if they can give the interns slips of paper that have bullets with attributes of high-level and low-level tasks to mark off what applies to each task. She explains that although providing the bulleted list might make the activity “too traditional” or “too structured,” she suggests that “part of what’s happening is the interns are not really engaging with this list [the levels of cognitive demand].” Sara indicates that providing the slips of paper is not too traditional. The team agrees.

Figure 4-2: Fruit array task solution as copied into field notes.
Ainsley remarks about how much time the team’s classification of the three tasks has taken. Sara expresses that she thinks the bulleted lists will help the interns to be more engaged in the conversation. Colleen likes that interns will be required to look at the list and classify tasks based on the attributes in the list. Colleen wraps up this part of the meeting by recapping the plan, “So...it will be 15 minutes for them [interns] to talk. Work and talk on the task, and then maybe 10-15 minutes to talk then as a whole group.”

Vignette B

Vignette B describes the co-planning meeting that took place on October 15, 2015 to prepare for Week 10 of the methods course. Vignette B depicts the team co-planning for a class meeting that took place one week before an embedded week (see Chapter 3). Additionally, as with Vignette A, the team worked to plan how best to incorporate the time with the district instructional coaches as well as provide the interns with continued opportunities to explore “selecting and adapting mathematical tasks.”

Another domain of the methods course curriculum was “mathematical discourse.” During this meeting, Colleen suggested making connections between the discourse domain and “selecting and adapting mathematical tasks.” The team used Math Talk Moves (Chapin, O’Connor, & Anderson, 2013) as the guiding framework for that part of the curriculum. Table 4-2 shows an overview of the final plans for week 10 of the methods course. The highlighted sections indicate the plans developed during the October 15, 2015 co-planning meeting and illustrated in Vignette B.

Table 4-2: Overview of week 10 methods course plans in the shared planning file.
The co-planning session starts as Olivia shares her concern that with the EG embedded week approaching, this is the TEs’ last opportunity to address tasks with the interns. Olivia expresses hesitation to focus less on tasks because even though there was a good discussion last class, she fears that the interns are struggling with re-writing low-level tasks as high-level tasks, and that even after the interns make adaptations the tasks are still low-level. The class period for which the team is planning has 45 minutes available for instruction - 30 minutes before a visit from the district instructional coaches (1:00-1:30) and 15 minutes after that visit (2:15-2:30).

Olivia wants the team to build on something they already have rather than starting from scratch. She offers two ideas: (1) To use tasks interns had adapted for

<table>
<thead>
<tr>
<th>Time in Class</th>
<th>Content for Class Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:45-1:00</td>
<td>Focus on Math Talk</td>
</tr>
</tbody>
</table>
| 1:00-1:30     | Sorting of the six K tasks - print copies  
                 Highlight in two colors - low or high  
                 Make chart on board. each group marks whether they think the task is low  
                 or high (if table is undecided, mark both)  
                 We discuss the messy ones. |
| 1:30-2:00     | Mathematical Tasks Discussion |
| 1:30-2:15     | with Coaches - kindergarten District Textbook lesson |
| 2:15-2:30     | Given one low level task from the K tasks, interns will adapt the task to make it high level and then interns will have the opportunity to share their adapted tasks |
| 2:30-2:45     | Discuss A3 Math Talk      |
homework the preceding week, or (2) To use kindergarten tasks from the district textbook the team used the previous year. Sara asks Ainsley and Colleen for their thoughts. Ainsley is unsure how the interns will respond, “I don't know if the interns will think...we're using the homework too much or if they're thinking we're repeating what they already did last week...I know some of the interns that I looked at had some really good problems and in their discussion if it was a lower-level task they were able to adapt it to a higher level just by talking to their partner.” Colleen offers that sorting the kindergarten math tasks could be a good way to check for understanding of applying the cognitive demand framework and wonders if they could also incorporate Math Talk moves. Sara responds, “I think to follow up with the coaches, it's best to keep the tasks in the forefront.” Ainsley and Olivia quickly agree. Sara expands on her reasoning:

I feel like what the coaches do is extremely valuable, don't get me wrong, but I feel like it's really important for us, too, after they're done to really kind of grab it back together and say, “There's some really important math stuff going on here.”

To keep the tasks in the forefront, Sara suggests sorting tasks from the district textbook lesson. Ainsley wonders about the time limitations, “Now, is 15 minutes enough time for them to go through those tasks and sort them? And have a valuable discussion about it?” Olivia responds, “No.” Ainsley then suggests splitting up the activity into two parts where the interns spend the 30 minutes before the coaches’ visit sorting the kindergarten tasks, and afterwards they all come back together for discussion. Olivia likes this idea because sorting tasks will
serve as a warm up to interns’ work with the coaches. She says that it is still not decided what will happen during the 15 minutes after the coaches.

Sara asks if they can look at the kindergarten tasks together. Olivia has the 10 tasks from last year in a shared file on Google Drive. As they each open the file, Ainsley asks, “Are we just going to ask [the interns] to sort them by high and low? Or do we want them to sort [the tasks] specifically to the four categories [of the cognitive demand framework]?” In response, Olivia wonders if they can use the notes from the previous class session when the interns simplified the language of the framework to generalize high and low tasks. Ainsley agrees with the idea.

Olivia starts to write directions for the interns in the planning document. She wants the instructors to give each intern a task and to ask them to decide what level task they have, then find a partner with the opposite level task for discussion, so that each pair of interns has a high- and low-level task. Sara is unsure that the interns will be able to complete Olivia’s proposed activity, “I don't think they can do that.” When Olivia asks, “Why?” Sara responds, “There will be some of them that won't know how to do that. I'm afraid that it's going to take up too much time.” Building on Olivia’s idea, Colleen and Ainsley suggest similar ideas to ask the interns physically split up in the classroom by low-level or high-level tasks to facilitate finding a partner for discussion. Olivia offers, “If the point is to have them really recognize high and low, maybe since we have limited time, what if we asked them to get out two colored markers, or two different colored
highlighters, and with one color highlight things in tasks that match those characteristics of low-level tasks that we made in the notes on the board?” She also suggests cutting down the number of tasks for the sake of time and complexity. Sara wonders if they can make a chart on the board (see Figure 4-3).

<table>
<thead>
<tr>
<th>Low-level</th>
<th>High-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>[interns fill in task #]</td>
<td>[interns fill in task #]</td>
</tr>
</tbody>
</table>

Figure 4-3: Task sorting chart suggested by Sara.

Ainsley proposes combining the two ideas, “what if we...have them highlight [the DD tasks for characteristics of cognitive demand] and then categorize high or low EG [level of cognitive demand], and then with partners or table groups they could write the numbers in the charts so we could all see it visibly?” Olivia responds, “And then we talk through the ones that are messy [i.e., where there is disagreement].” She wonders aloud to the group about the purpose, “So what's our purpose here? What are we trying to do?” Colleen replies that before the interns are asked to adapt tasks, “I think they need more practice with identifying high and low level tasks.” Olivia summarizes the goal, “to give them more practice and make sure that they are really understanding...these characteristics of low and high level.” She asks the team to look at the tasks because she does not remember if there are any high-level tasks, and to remove a couple tasks to make the activity proceed more quickly.
Olivia identifies one task as high level, “Maybe this one is [high-level] because it says, ‘On a blank paper, draw 5 in as many different ways as you can.’” Colleen wants to eliminate one low-level task because the interns “should all get that one now. It's telling you what to do and it's telling you how to do it. Done.” Colleen says about another low-level task, “I think ‘Plus Task’ they might get. It's just a simple question.” Sara and Ainsley agree:

SARA: Yeah, yeah. They should be able to because there’s just one question.

AINSLEY: And that's something you memorize.

SARA: Yeah.

AINSLEY: You memorize that that symbol is a plus.

As they are looking through the tasks, Olivia comments, “I'm actually starting to think the ones with the asterisks are the ones that I changed [last year when she created this set of tasks]. I think maybe all of these are from the [district textbook] lesson and I may have edited the asterisk ones. I don't know. These all seem pretty low-level to me.” She then asks the team again, “Can we look at these? Are any of these high-level?”

COLLEEN: I think the ‘Imagining Five.’

OLIVIA: Is that the only one?

COLLEEN: And maybe “Bears in Their Beds.”

SARA: I thought “Bears in Their Beds” maybe.

COLLEEN: “Think of as many different combinations as you can.”
OLIVIA: Oh.

COLLEEN: And “How many are red and how many are blue? How many could be red? How many could be blue?”

OLIVIA: Okay, so now I think the asterisk means I changed it [from the original task] because that's like an Investigations problem.

SARA: Yeah, it is.

OLIVIA: And that's what I had in mind when I wrote that, I remember that one. I don't think that's in the lesson.

COLLEEN: See “The Bears in the Beds” is different than “The Lunch Table” cause “The Lunch Table” is five children, three join, how many are sitting, draw a picture. Whereas...“The Bears in their Beds” is looking at multiple combinations.

OLIVIA: So the idea was to maybe get rid of a couple to make this go a little faster. Was that right?

9 Sara asks if the interns will be sorting based on the framework. Ainsley says they will sort the tasks by high and low levels of cognitive demand based on simplified notes they had constructed in the previous class about the MTF. The team eliminates two low-level tasks that they decide are Memorization tasks.

Colleen asks if interns can go back to the low-level tasks and re-write one (or more) of them as a class. The team members express that they love the idea, but later decide not to use it because of time constraints.

10 Ainsley directs the conversation back to the details of the activity by asking, “So
they're just going to highlight what makes it high and low in the tasks, and then as table groups or partners they're going to go up to the board and put each number underneath high or low?” Olivia indicates that she likes the table idea but prefers for the table to be organized slightly differently (see Figure 4-4).

<table>
<thead>
<tr>
<th>Task</th>
<th>Low-level</th>
<th>High-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4-4: Task sorting chart modified by Olivia.

11 Colleen agrees that this table makes it more organized and requests that if the DD interns, when working in small groups, are split on their decision, they should be allowed to mark both low and high. The team agrees and Olivia moves the conversation to timing, wondering if 30 minutes is enough time. Sara suggests stopping whenever they need to. Olivia responds, “Once there's one that's messy, we stop and talk about that?” In the final planning document the team noted, “We discuss the messy ones,” to indicate that if a task was marked as both low- and high-level, the instructors would discuss the task with the interns. The discussion begins to shift to addressing Math Talk with the interns and Olivia shares, “I'm scared to move away from the tasks yet.” Returning to tasks, Ainsley suggests cutting down the list to 6 tasks because that will be more manageable. The TEs look at the remaining 8 tasks and remove two tasks they consider low-level
memorization because they feel the interns would be able to quickly classify them.

Vignette C

Two of the five major methods assignments for interns were the Mathematical Discourse Project and the Mathematical Tasks Project. To complete the Mathematical Discourse Project, which attended to another domain of the course framework, the interns prepared and conducted mathematical discussions with small groups of students in their K-4 classrooms. The Mathematical Tasks Project required the interns to select and adapt two mathematical tasks from their classroom textbooks. Vignette C portrays the co-planning meeting that took place on November 5, 2015 during which the team intended to help interns make connections between the two projects. Ultimately the team devised an activity to allow the interns to reflect upon the course curriculum from the entire semester. Table 4-3 shows the final plans that emerged from the team co-planning meeting for week 14 of the methods course and appeared in the shared planning file. The highlighted section includes details for the activity, further described in Vignette C.
Table 4-3: Overview of week 14 methods course plans in the shared planning file.

<table>
<thead>
<tr>
<th>Time in Class</th>
<th>Content for Class Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:45-12:30</td>
<td>A2 Data</td>
</tr>
<tr>
<td>12:30-1:30</td>
<td>Chart Talk Project 8 questions, have them make the two grids and record the questions at the start. Give directions, each takes a marker. Spend about 30 minutes in this part. About 15 minutes for them to write at least 2 ideas from the charts, then about 15 minutes for a group discussion.</td>
</tr>
<tr>
<td></td>
<td>1. What are some surprising things about children’s thinking that emerged in your math talks?</td>
</tr>
<tr>
<td></td>
<td>2. What did you learn about children’s number and operation sense from leading your math talks?</td>
</tr>
<tr>
<td></td>
<td>3. Consider this low-level task. When might a teacher choose to use this task? How might it be used? Paco had 15 cookies. He ate 7 of them. How many cookies does Paco have left?¹</td>
</tr>
<tr>
<td></td>
<td>4. Consider this high-level task. What kinds of questions might a teacher ask when using this task in the classroom? You add two numbers that are almost 30 apart. The answer is almost 90. What might the numbers be?²</td>
</tr>
<tr>
<td></td>
<td>5. How does productive struggle³ relate to math talk?</td>
</tr>
<tr>
<td></td>
<td>6. How do you look at teaching mathematics differently after completing A3 (math talk) and A4 (math tasks)?</td>
</tr>
<tr>
<td></td>
<td>7. What qualities should a task have when being considered for use in a math talk?</td>
</tr>
<tr>
<td></td>
<td>8. Why is it important for math tasks and math talks to focus on more than just the answer?</td>
</tr>
<tr>
<td>1:30-2:45</td>
<td>Time to work on A5 (children’s mathematical thinking) in grade level groups</td>
</tr>
</tbody>
</table>

¹ This problem comes from Children’s Mathematics: Cognitively Guided Instruction (Carpenter, Fennema, Franke, Levi, & Empson, 2015) used to address Domain 4 of the course curriculum.
² One task from the Math Talk Assignment
³ Interns read about this in Principles to Actions: Ensuring Mathematical Success for All (National Council of Teachers of Mathematics, 2014)
Ainsley initiates the co-planning on November 5, 2015 by asking Olivia about her plans to have the interns discuss class projects. Olivia asks the team to devise a creative opportunity for the interns to share about and make connections between the Mathematical Discourse Project and the Mathematical Tasks Project. Colleen suggests asking the interns to look at tasks and generate questions a teacher could ask students “as a way of forcing the issue of when you have really low-level tasks you ask really low-level questions.” Olivia listens to Colleen and asks, “Does this match what you’re saying?” She describes that interns have been asking in class if high-level tasks are the only type of task they should use in the classroom. She wonders if interns could do a Gallery Walk, an activity where the interns rotate in small groups around the room answering questions and reflecting on the responses of others written on hanging posters. Interns could ponder questions such as “When are low-level tasks appropriate?” Colleen says she loves the idea.

Furthering the discussion, Olivia suggests making two questions about math tasks and two questions about Math Talk. Colleen notes that with more questions, they could have fewer interns at each poster. Olivia asks the team to start recording question ideas within the instructors’ planning Google Doc. As the questions are recorded, Colleen suggests one aloud, “Consider this low-level task. What kinds of question might a teacher ask about it?” Olivia asks Colleen what kinds of responses she expects from the interns. Colleen pauses. She then asks the team to consider a Math Mountain, or fact family (see Figure 4-5), with a 9, a 5, and a
circle. She says a teacher might ask, “What goes in there [the empty circle]?” Sara quickly follows up with an alternate perspective on how interns might respond to the question:

I'm thinking when I have a low-level task, that’s when I really try to unpack it and make it more meaningful. When you have a high-level task that's already kind of making you think just by the nature of the task, then it's almost not as necessary to ask the question.

![Math Mountain diagram](image)

Figure 4-5: Example of a Math Mountain copied into field notes.

During this brief exchange between Sara and Colleen, Olivia looks through DD materials within their shared folder. She reminds the group that they have a framework guiding the course that includes 12 essential questions, and that the final assignment for the interns asks them to revisit those questions. The team opens the shared document to review the framework and essential questions (see Chapter 3).
Olivia says that she thinks the essential questions are too complex for this activity, but if simplified could give the interns the opportunity to connect everything they have done over the course of the semester. She suggests the team develop questions that represent each of the four domains of the framework. Ainsley asks for clarification about the scope of the activity. Are they focusing on the Math Talk and math tasks assignments or trying to make it broader? Olivia responds, “I think that's a good question, I don't know, maybe both.” Colleen chimes in that she would like to tie in “productive struggle,” which the interns just read about in Principles to Actions because she thinks “productive struggle is something that most interns are allergic to because if the student doesn't know it they should just tell them.” As the purpose of the questions starts to become less clear, Olivia asks:

Can we all just sit here and everybody write down 3 questions? Just right now just add 3 questions. It can be as broad or as specific as you want. Just add anything and then we'll have a whole bunch of questions and we can think about it.

For the next 7 minutes the team members type in the Google Doc to add to the questions already written. The team drafts a total of 36 questions. Conversation resumes when Sara says, “This would be a great exercise for them to start thinking about their final reflection…Is there a way that they can respond to a whole lot of things? What do we have? Like 20-some [questions]?” Ainsley reminds Sara some questions might overlap since they worked independently.
Olivia and Sara move away from the conversation about the questions and start discussing how the interns will engage with the questions, each suggesting ideas. Regardless of the activity, they want the interns to have a record of it. Sara proposes contributing to a Google Doc, but Olivia and Ainsley say they believe the interns will never look again at an electronic document. Colleen asks if they want the interns to respond to one question or all of them. And Olivia wonders aloud if verbal responses will be as meaningful to the interns as having add a note on a poster. Olivia and Ainsley recall an activity, Chalk Talk, where they, as participants, walked around a room for a set time silently responding to questions. All members support the idea, and decide to call it “Chart Talk.” The team agrees to use eight questions written on posters for interns to respond to because six would be too few and twelve would be too many given the number of interns. Olivia requests that they eliminate overlapping questions from their list of 36 and look for questions that have connections between two domains of the framework.

After some brief work the following discussion emerges:

**SARA:** I make a motion that we accept these 8 questions onto our chart paper.

**OLIVIA:** I accept that.

**AINSLEY:** I second that.

**SARA:** Okay, motion moved and passed or however you do that parliamentary procedure. Okay, we have 8 questions for our Chart Talk.
Once the questions are accepted, the team returns to the issue of wanting the interns to take what is written on the posters and have a record in their math journals. But asking the interns to write the questions and their responses in their journals generates a disagreement among the team. Sara is firmly against requiring the interns to write all 8 questions in their math journals because she feels it would be too much writing for the class period. Olivia replies, “People learn by writing things.” The other team members disagree with Sara but agree with each other and advocate requiring the interns to handwrite the questions in their math journals. They finally end the discussion as follows:

**AINSLEY:** Sara, what’s the point you’re making?

**SARA:** It’s a lot of writing.

**OLIVIA:** What if we project the questions [on the classroom screen] and they can think about them as they write them down...what are you going to contribute to the Chart Talk? So write your questions down but also be thinking about what are your ideas?

**SARA:** I like that. And the reason why it makes a huge difference is because...all the writing is not happening at one time.

The team wraps up discussion about the activity with agreement that they will spend 30 minutes with the interns rotating around the room writing their responses to the questions, 15 minutes writing down at least 2 ideas from each chart, and then 15 minutes discussing as a class.
Co-planning Activities

Throughout the co-planning meetings, the MPCoP engaged in three general types of activities: (1) establishing goals, (2) general brainstorming, and (3) determining instructional details. As described in Chapter 3, the general co-planning activities are the result of a domain analysis (Spradley, 1979) of the MPCoP’s co-planning meetings. These general co-planning activities of the MPCoP make up the joint enterprise and shared repertoire that define the community of practice. Table 4-4 provides a concise summary of each of the co-planning activities (CPAs) and occurrences of the activity within the team co-planning meetings. Each occurrence has the appropriate reference to its description within the vignettes. In the following sections, I describe each activity with supporting examples from the three vignettes presented.
Table 4-4: Occurrences of co-planning activities.

<table>
<thead>
<tr>
<th>Co-planning Activity</th>
<th>Occurrences</th>
</tr>
</thead>
</table>
| Establishing Goals [EG]               | • Following up a coach visit (Vignettes A.1, A.3, B.1, B.2, B.3)  
  • Purpose of task activity (A.9)  
  • Responding to interns not engaging with the MTF (Vignette A.10)  
  • Final opportunity to address tasks with interns (Vignette B.1)  
  • Responding to interns struggling with adapting tasks (Vignette B.1)  
  • Wanting to give interns more practice with classifying tasks (Vignette B.6)  
  • How to give interns a chance to connect and reflect on tasks in relation to all four domains (Vignettes C.1, C.4)  
  • Responding to interns’ confusion about only using high-level tasks (Vignette C.1) |
| General Brainstorming [GB]            | • Using tasks from the district textbook (Vignette A.2)  
  • Classifying tasks based on concepts (Vignette A.2)  
  • Comparing tasks from the district textbook to other tasks (Vignette A.2)  
  • Classifying tasks instead of adapting (Vignette A.3)  
  • Building on material the team already has (Vignette B.2)  
  • Using Kindergarten Tasks from previous year (Vignette B.2)  
  • Connecting math talk and math tasks by asking interns to analyze tasks and generate discussion questions (Vignette C.1)  
  • Gallery Walk with questions about when to use high- and low-level tasks for interns to reflect upon (Vignette C.1) |
| Determining Instructional Details [DD] | • Using tasks from within the district textbook lesson (Vignette A.3-4)  
  • Selecting and sorting tasks from district textbook (Vignette A.5-7, A.9, B.6-8, B.11)  
  • Instructions for task sorting (Vignette A.8)  
  • Tasks to use for sorting (Vignette A.9)  
  • How to enact task sorting and discussion (Vignette A.10-11, B.4-6, B.10-11)  
  • Time constraints (Vignette B.3)  
  • Generating reflective questions for Chart Talk activity (Vignette C.2-5)  
  • How interns will engage with the reflective questions (Vignette C.6, C.8)  
  • How will interns take home a record of the Chart Talk (Vignette C.7, C.8)  
  • Potential responses to reflective questions (Vignette C.2) |
Establishing Goals

The team typically engaged in the activity of establishing goals as an initial step of co-planning. The CPA included verbally stating a purpose or goal for the co-planning. For example, in their first co-planning meeting, described in Vignette A, the team needed to decide what interns would do in a class following an activity with some visiting instructional coaches (Vignette A.1):

**OLIVIA:** You were starting to say what the coaches are going to do for the curriculum discussion next week.

**SARA:** Yeah, can I just describe that?

**OLIVIA:** Yeah.

**SARA:** And then we can know where to go from there. (Co-planning A, 10/1/15)

Sara and Olivia initiated the meeting with attention to what the coaches planned to do so that the team would have a basis for planning the remainder of the methods class period.

Another example occurs in the third co-planning meeting, described in the opening of Vignette C. Olivia expressed her desire to develop a culminating, reflective course experience for the interns:

**AINSLEY:** Olivia, you have for that week of the 17th and 18th -- when their assignments are due -- [in the planning document] you have time allotted for them to share about A3 [Mathematical Discourse Project] and/or A4 [Mathematical Tasks Project].

**OLIVIA:** Right.

**AINSLEY:** So, what were you thinking?

**OLIVIA:** I was thinking we would come here and plan that together...I was wondering if there was some creative way to give [interns] a chance to share things about A3 and A4 that maybe weren't written in the assignments. (Co-planning C, 11/5/15)
Ainsley commented that prior to the start of the meeting Olivia had noted in the planning document about offering an opportunity in class for the interns to share about their projects, and she asked Olivia to tell the team her thoughts. Olivia established the goal to create a methods course experience that would allow the interns to share about the two projects. This established goal set the focus for the team’s subsequent co-planning during that meeting.

As the team worked, they stated new goals as their plans developed and they made decisions moving toward a final instructional plan. Vignette C exemplifies the refinement of the established goal. As stated above, the team initially wanted to develop a methods course experience that would connect the interns’ Mathematical Discourse Project and the Mathematical Tasks Project (Vignette C.1). Throughout the planning meeting, the goal was refined to create an opportunity for the interns to make connections across and reflect upon the four domains of the course curriculum framework (Vignette C.4). Another example of this refinement is described in Vignette A.10. Originally, the team established the goal of deciding how to follow up a visit from the instructional coaches (Vignette A.1, A.3), but as the team developed a plan, the goal became more specific. The focus shifted from simply following up the curriculum discussion with the coaches to addressing the concern that Olivia pointed out -- that the interns were not engaging fully with the list of characteristics for categorizing tasks by level of cognitive demand (Vignette A.10).

At times, team members referred back to a goal during other CPAs -- general brainstorming and determining instructional details, both of which are described below. In the first co-planning meeting (Vignette A), after Olivia voiced the established goal to
create a methods course experience to follow a visit from the instructional coaches, the
team promptly started to look at the mathematical tasks within the district textbook lesson
(Vignette A.2). As presented in Vignette A.3, Olivia restated the established goal to move
forward with the planning process, “My thought was this week, in this little tiny half hour
that we have after the lesson, we could do something with... these tasks from this lesson”
(Co-planning A, 10/1/15). In another instance, depicted in Vignette B.6, Olivia asked the
team “What’s our purpose here? What are we trying to do?” (Co-planning #2, 10/15/15).
Ainsley commented on this remark in an interview, “[Olivia] knows there has to be a
purpose to the activities that we do and that we need to know exactly what we want the
interns to do so that we can make sure the activity gets them to that goal” (Interview #2,
10/22/15). Olivia confirmed in her interview, “I’m big picture. What are we doing? Why
are we doing this? Let’s make sure with our purpose...did what we decide match?”
(Interview #2, 10/20/15).

**General Brainstorming**

After the team established a goal, they typically engaged in general
brainstorming. During this activity, the team shared ideas to respond to the established
goal. Vignette B.2 depicts the general brainstorming activity in response to an established
goal. The TEs believed the interns needed more practice with sorting tasks according to
the levels of cognitive demand and with adapting low-level tasks to a higher level
(Vignette B.1). Olivia suggested using homework from a previous week or using an
activity from the previous year: sorting kindergarten tasks from the district textbook
according to the levels of cognitive demand (Vignette B.2). Olivia acknowledged this
brainstorming when describing the team co-planning in an interview, “our planning
involves constantly revisiting things we’ve done in the past and thinking about what happened” (Background Interview, 9/21/15).

General brainstorming also included opportunities for the team to share ideas about how to respond to the specific needs of the interns. Ainsley commented in an interview, “we just kind of throw out ideas...just think through what’s best for the preservice teachers to learn” (Background Interview, 9/23/15). As shared in Vignette C.1, Olivia noted that the interns were questioning when to use high- and low-level tasks. She said, “One of the things that has come up a little bit this week is...are we saying that you guys should always teach with high-level tasks -- that's what all the tasks you use in the classroom should be?” The team then brainstormed ways to respond to this issue. Colleen first suggested asking the interns to develop questions that could be asked when using specific high- and low-level tasks (Vignette C.1). Olivia responded to Colleen’s suggestion by asking if they could do a Gallery Walk (Vignette C.1).

The team shared ideas with one another until agreement among some or all of the TEs was reached. Ainsley described the team’s collaborative work:

I think we do a good job at giving input when we feel like we have something to say. I feel like we’re all really good at listening to each other’s ideas and really piggybacking off of each other’s ideas. And it seems like most of the time we’re okay if we choose to table something for another time for further discussion. (Background Interview, 9/23/15)

General brainstorming ended when the team moved forward with an idea and shifted to the CPA determining instructional details. An example of this shift is described in Vignette A.3. Olivia originally suggested that the interns should classify and adapt tasks from the district textbook lesson, but after some discussion revised her suggestion to
focus only on classifying the tasks. With Sara’s affirmation of this suggestion, the team moved on to determining instructional details.

**Determining Instructional Details**

After a general idea had been agreed upon, either explicitly or implicitly, the team discussed how the activity would play out in the classroom. The team determined instructional details such as which teaching strategies would be used, how to engage the interns, how much time would be devoted to the methods course experience, where it fell within the class period, and what instructions the interns would receive for it. In an interview, Sara acknowledged this focus on logistics during co-planning when she mentioned questions they thought about, “what is this going to look like when we actually do it? And is it going to take too long? Are [the interns] not going to understand the directions?” (Interview #2, 10/21/15). Olivia also described the work during co-planning, “We try to work out the nitty-gritty details. How are we going to do it?” (Interview #2, 10/20/15).

Vignette B.9-11 illustrates the TEs’ activity of determining instructional details. In this example, the team discussed how the interns would sort tasks, using the framework or their simplified notes. At this point in the co-planning meeting, the team had agreed upon some of the tasks for a sorting experience but needed to discuss how the interns would record their task sorting on the board to facilitate class discussion. Olivia revised the organization of a previously suggested table (Vignette B.5) to capture the interns’ work (Vignette B.10).

As previously described, Vignette A.3 portrays the shift from general brainstorming to determining details. The team moved forward with determining the
instructional details when Olivia asked the team to pick out problems from the district textbook lesson. The team then went through the process of selecting tasks for a sorting experience (Vignette A. 4-7) and deciding how the interns will participate in the task sorting experience (Vignette A.10).

At times during the co-planning meetings the team engaged with potential methods course experiences as they worked through the instructional details, specifically when selecting tasks for the interns to examine during class and classifying the tasks according to the levels of cognitive demand within the Mathematical Tasks Framework (MTF). The team engaged in the sorting as a means to both select the tasks for use by the interns in class and to come to a consensus as instructors about how to classify the tasks. For example, Vignette A. 4-7 depicts this activity as the team discussed whether or not the level of cognitive demand of the task changes when the task requires students to show their work in two ways. The team continued to engage with the potential course experience as they discussed how a student could shade to show halves and whether or not the authors of the task would accept an unconventional response (Vignette A.7).

Ainsley summarized the team’s work with tasks during co-planning, “Our conversation is just focused around determining the [methods course experience] and the best way for the interns to determine the cognitive level of the tasks” (Interview #2, 10/22/15).

As the team determined the instructional details of the methods course experience, they engaged with potential experiences, which included discussion of how the interns might respond to a particular methods course experience. For example, when the team developed reflective questions for the interns, described in Vignette C.2, Olivia asked Colleen how she anticipated the interns would respond to the question “Consider this
low-level task. What kinds of questions might a teacher ask about it?” Colleen and Sara both shared their ideas of how the interns might respond to the prompt (Vignette C. 2). In the same co-planning meeting, the team engaged with a potential methods course experience when they discussed how the interns would record responses to the reflective questions (Vignette C.7). Sara voiced her concern that the interns would not respond well to writing the eight questions and responses in their math journals because it would be too much writing for them at one time. Sara and the other team members considered how the interns would respond to the methods course experience they were developing.

**Patterns in Co-Planning Activities**

As illustrated in the vignettes, the MPCoP worked through the three CPAs to arrive at final plans for the methods course experiences to prepare the interns to select and adapt mathematical tasks. Figure 4-6 shows the team’s progression through these activities. In each co-planning meeting, the MPCoP began with the activity of establishing goals (EG), and then moved to general brainstorming (GB). This is represented by the arrow originating at EG going to GB in the figure. From general brainstorming, the group either moved on to determining instructional details (DD) or returned to the original goal. The group moved back and forth between determining instructional details and establishing goals before finalizing their plans.
The vignettes provide a cohesive picture of the co-planning meetings and a depiction of the nature of those meetings. The timelines below (Figure 4-7) represent how the CPAs progressed over time within the meetings, providing information that is not visible within the vignettes. Whereas the vignettes help the reader to understand the content of the co-planning meetings and the nature of the CPAs, they are not accurate representations of time nor the amount of time spent on each CPA. For example, although as shown in Figure 4-7, the TEs spent 56% of their co-planning meeting time depicted in Vignette A on determining instructional details, that time may not be represented by 56% of the text of the vignette. A different view of the co-planning meetings in the form of the timelines allows for additional patterns in the CPAs to emerge. In the following sections, I discuss patterns related to the time distribution of CPAs and the initiation of CPAs by the various team members.
Figure 4-7: Timeline of co-planning activities.
**Time Distribution of CPAs**

The team spent more than 50% of its time in each meeting determining the instructional details of the methods course experiences for the interns in the methods course. The amount of time devoted to determining the details of the methods course experiences is consistent with the team members’ perceptions of their co-planning.

Colleen described the team co-planning in her initial interview as “collaboratively trying to wrestle with what we want this hour [of the methods class session] to look like” (Background Interview/Interview #1, 10/7/15). Sara explained the purpose of their co-planning meeting as: “We meet to plan together. But it’s as we need to meet, when it’s time to get ready for the next class or two that’s coming up, then we meet together physically” (Background Interview, 9/30/15). The larger purpose of the co-planning meetings was to plan the details of the methods course experiences for a specific portion of the methods class which may explain why the team spent more than 50% of their time on this co-planning activity.

As evidenced by the conversations in the co-planning meetings described in the vignettes, and supported by interviews, the team arrived at the co-planning meetings with ideas about the methods course experiences. Sara explained in an interview, “We do some planning prior to [the co-planning meetings]. We have [shared files and folders] that we often come to a [co-]planning meeting with ideas ready to discuss. We don't necessarily start from scratch when we get together physically together” (Background Interview, 9/30/15). Olivia supports the comments made by Sara in her interview, “Our planning involves sort of constantly revisiting things that we’ve done in the past and thinking about what happened and what we want to do this time and talking about why
and talking through all the details” (Background Interview, 9/21/15). The MPCoP worked together in co-planning to develop course experiences.

The exception to this practice is depicted in Vignette C and reflected in the timeline as the team spent 85% of their time determining the details of the course experience. Prior to meeting for the co-planning depicted in Vignette C, Olivia wrote a brief outline of the methods class meeting in the shared planning file that Ainsley asked about at the start of the co-planning meeting (Vignette C.1) For the co-planning meetings depicted in Vignettes A and B, tentative plans for the class session were in the shared planning document prior to the meeting. In this co-planning meeting (Vignette C), the only plans initially shared were time allocated for a methods course experience that would connect two major projects for the interns. The team started from scratch on developing the methods course experience and spent 85% of their time engaged in determining the instructional details.

**Participation in the MPCoP**

Both Sara and Olivia held more permanent roles within the MPCoP with their respective roles as PDS Coordinator and tenured faculty member, whereas Colleen and Ainsley were in transitory positions. In the year following the study, Colleen would be leaving the team to return to her classroom after three years of service in the PDS. Ainsley, a graduate student, held different roles for her assistantship, which varied year-to-year, offering a lack of permanency. Compared to Sara and Olivia, Colleen and Ainsley were “just visiting” (Fenton-O’Creevey, Brigham, Jones, & Smith, 2015) the MPCoP, which may account at least in part for differences in participation among the team members. Table 4-5 depicts the number of times each team member initiated one of
the CPAs in the three co-planning meetings. Even though not all team members initiated each type of CPA, they each contributed to the co-planning meetings overall.

Table 4-5: CPA initiation by team member.

<table>
<thead>
<tr>
<th></th>
<th>EG</th>
<th>GB</th>
<th>DD</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olivia</td>
<td>12</td>
<td>5</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Sara</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Colleen</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Ainsley</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>18</td>
<td>6</td>
<td>14</td>
<td>38</td>
</tr>
</tbody>
</table>

In addition to their trajectory out of the MPCoP, fewer occurrences of initiation by Colleen and Ainsley may also be accounted for by their perception of their respective roles within the co-planning activities. Colleen, a returning member of the team, explained, “I'm doing better this year of suggesting things or I continue to ask questions, because that's partially how I operate, and I feel more like we are creating a lot of the ideas together” (Background Interview, 10/7/15). Ainsley, the newest team member, described her role in the co-planning meetings: “I feel like I’m just kind of listening to [the other TEs] talk about what they did in the past and how they could tweak it to now...I just try to put in any input that I can” (Background Interview, 9/23/15). It seems that Colleen and Ainsley were comfortable with listening to others, asking questions, or offering suggestions when they could, rather than taking the lead in initiating planning.

Olivia initiated the CPAs more than the other three team members combined. Sara follows Olivia in her initiation of the CPAs with a total of 9 times throughout the three meetings. When asked to describe her role in the co-planning meetings, Sara responded:

My role is probably to keep the conversation going...I'm typically the person that might take what one person says and what another person says
and then make that statement like, “It sounds like we're trying to go here.”
And sometimes, it moves the planning forward. (Background Interview,
9/30/15)
Sara saw her role as one that synthesized the contributions of team members to progress in getting plans made.

The team engaged in the CPA establishing goals 18 times over the three co-planning meetings. Of those 18 times, 12 of them were initiated by Olivia. She self-identified in an interview as focusing on the purpose of the co-planning, “I'm big picture: What are we doing? Why are we doing this? Let's make sure what we decide matches with our purpose” (Interview #2, 10/20/15). Olivia explained in her initial interview:

I spend a lot of time on planning for the class. I feel very responsible for making sure the class gets planned...I don’t feel like I’m the leader of the team, but I sometimes feel like I do a lot of the planning...I feel like part of my role in the planning is to try to make sure that all of us have a role in it even when that means that I have to invite people to participate in the planning (Background Interview, 9/21/15).

Olivia wanted to share decision-making out of respect for what others could contribute:

I’m influenced by [my] lack of elementary school teaching experience in the sense that I really want people on the team who have that to bring that to the planning. Because I think that’s where this co-planning and co-teaching makes a better class than if I was just doing this by myself...I think other members bring a lot of experience with their own use of math textbooks and curriculum materials...and children from their classrooms and how those children engaged with tasks and textbooks. (Background Interview, 9/21/15)

Olivia’s position and participation within the MPCoP appears to be that of a boundary broker (Wenger, 1998). As indicated above, she wanted to invite other team members to participate in the activities of co-planning because she valued their diverse expertise. The work of a boundary broker is complex as the position requires knowledge of the
landscapes of practice of each team member within the MPCoP and a legitimacy to be able to navigate the boundaries between them.

The other three team members seem to support Olivia’s position as a boundary broker when they describe her work in the MPCoP. Ainsley articulated:

I would have to say that Olivia takes on a majority of the planning for the course and we meet bi-weekly to...discuss the plans for a class and we each give our feedback and input into whatever Olivia has come up with and Sara seems to put in a lot of input, too, before... our planning meetings. And we just kind of throw out ideas, just think through what’s best for the preservice teachers to learn. (Background Interview, 9/23/15)

Colleen offered a similar perception of Olivia’s role when she reflected:

[Olivia] definitely had a roadmap in mind for this semester’s class and not that she decided everything on her own but she would say “I'm thinking we should do this” and as a group of people, we tend to all say, “Oh, okay, well let's try that.” (Interview #4, 12/9/15)

Finally, when examining a transcript from Co-Planning A, Sara pointed to Olivia’s suggestion to use slips of paper with bullet points of task characteristics that can be circled or crossed off (Vignette A.10) and explained, “Olivia obviously had an idea here [looking at a piece of transcript from co-planning A]. She wanted to make sure that she was checking in with us and trying to get some ideas” (Interview #1, 10/7/15). These descriptions, along with Olivia’s own understanding of her role in the MPCoP seem to indicate that she was acting as a boundary broker.

Summary

The vignettes and co-planning activities presented in this chapter served to establish the group’s work as a community of practice through team members’ mutual engagement, joint enterprise, and shared repertoire. The MPCoP engaged in three general co-planning activities: (1) establishing goals, (2) general brainstorming, and (3)
determining instructional details. More than 50% of the MPCoP’s work focused on
determining the instructional details for the methods course experiences. As the MPCoP
progressed through the co-planning activities, members of the community of practice had
differing degrees of participation.

The patterns that emerged from the vignettes and the timelines of the co-planning
meetings raise questions about how the team navigated the diverse communities of
practice within the work of the MPCoP. What areas of professional expertise does the
MPCoP use while engaging in the general co-planning activities established in this
chapter? In the next chapter I explore these questions as I examine the expertise that
came into play in the MPCoP.
Chapter 5

Areas of Professional Expertise

In Chapter 4, I established the three types of co-planning activities that the Methods Planning Community of Practice (MPCoP) engaged in during their meetings: (1) establishing goals, (2) general brainstorming, and (3) determining instructional details. In this chapter, I focus on how the MPCoP navigated the multimembership in diverse communities of practice held by the various team members when engaging in its joint enterprise of co-planning by responding to the questions: What areas of professional expertise do members of a MPCoP use while engaging in general co-planning activities for preparing beginning teachers to select and adapt mathematical tasks? How are the areas of professional expertise used by a MPCoP?

Areas of Professional Expertise

Each member of the MPCoP brought a unique background to the team co-planning, and therefore, multimembership in other communities of practice (Wenger, 1998). There are many potential areas of professional expertise that could have been drawn upon by the MPCoP during their co-planning work. Figure 5-1 represents the areas of professional expertise that emerged in this study and that guided the joint enterprise of the MPCoP.
Four primary areas of professional expertise guided the MPCoP’s joint enterprise: context, course curriculum, Mathematical Tasks Framework, and strategies for effective teaching. These four main areas of professional expertise acted as boundary objects (Star, 1989; Wenger, 1989) within the MPCoP because they carried different meanings for different members of the group, yet each TE understood and engaged with these areas to some extent. Boundary objects allow for interaction across communities of practice. The areas of professional expertise that emerged as boundary objects within the MPCoP did so because they held at least some common meanings to all members of the group. As detailed in Chapter 3, these boundary objects are named using terms that carried meaning.
for members of the group. These four areas of professional expertise, the boundary objects, were the primary areas influencing the team’s co-planning activities (CPAs) established in Chapter 4. Outside the MPCoP in Figure 5-2 are two areas of professional expertise that held meaning for some but not all members. These areas of expertise are non-boundary objects because they did not appear to influence the MPCoP’s engagement in the joint enterprise in a unified way.

The context and course curriculum are pre-existing boundary objects for the work of the MPCoP. The very existence of the group depends on the context of the PDS, which allowed for the TEs with diverse backgrounds to come together to co-plan and co-teach the elementary mathematics methods course. Olivia designed the course curriculum framework prior to the start of the course, and other team members were able to describe the framework in interviews. As the MPCoP prepared interns to select and adapt mathematical tasks, they also drew on their expertise about the Mathematical Tasks Framework and strategies for effective teaching. Connected to both the expertise about Mathematical Tasks Framework and strategies for effective teaching are other related areas of professional expertise that members of the MPCoP drew upon during co-planning, however, these areas were subsumed by the larger categories.

In the following sections, I describe the areas of professional expertise that acted as boundary objects and influenced the MPCoP’s joint enterprise. I then describe the non-boundary objects that seemed individually influential to the MPCoP’s co-planning.

Course Curriculum

The elementary mathematics methods course curriculum was developed in greater detail by Olivia, the university mathematics education faculty member, in a guiding
framework (see Figure 5-2; the course curriculum is described in more detail in Chapter 3). The focus of this study is the team’s work addressing Domain 2: Selecting and Adapting Mathematical Tasks.

Figure 5-2: Visual representation of the guiding framework for the methods course.

The course curriculum was a pre-existing boundary object developed by Olivia prior to the start of the semester. Each TE explained her respective understanding of Domain 2: Selecting and Adapting Mathematical Tasks during initial background interviews. While Ainsley seemed hesitant in her response, she was ultimately able to articulate the main ideas about this piece of the course curriculum:

Domain 2 is really looking at mathematical tasks and analyzing their cognitive level. And deciding whether or not the goals for those
mathematical tasks are achieved. No wait. Hold on. Looking at those mathematical tasks to see if the mathematical knowledge you want the kids to achieve will be...what’s the word I’m looking for...achieved through those tasks...Sorry. And the adapting piece which we haven’t gotten to yet with the preservice teachers is taking mathematical tasks that are a lower cognitive level and adapting them to be a higher-level task, if that’s the goal for the mathematical thinking that you want. (Background Interview, 9/23/15)

Colleen offered a less-detailed response than the other TEs, but emphasized her belief in the importance of preparing beginning teachers to select and adapt mathematical tasks, “That to me is huge...You can have the most pathetic resource in the world if you understand how and why you should be changing mathematical tasks to make them more engaging, more building understanding” (Background & Interview #1, 10/7/15). Sara’s description echoes Colleen’s feelings about the importance of this domain:

We really started talking about Domain 2 last year more. We didn't have this [course curriculum] framework but we really hit on Domain 2 last year and realized how powerful that was...[The Mathematical Tasks Framework] really gives interns a way to talk about [math tasks] that's clear...Some interns or teachers have been successful teaching and learning math in another way and so it's really hard to break through that barrier. But when you really look at the tasks in a critical way, some things start to become apparent that aren’t black and white...It's not like you're being judgmental but it's a way to look at tasks, see what they are...You can select tasks but you don't have to necessarily teach them the way they're presented to you. If you understand how to look at a math task, any task could be a good one. (Background Interview, 9/30/15)

Sara seemed to find value in this part of the course curriculum framework that focused on mathematical tasks.

Olivia offered an overview of the domain that indicated the potential influence of the course curriculum on the work of the MPCoP:

We have placed a strong emphasis in our methods class on working with interns on thinking about the nature of mathematical tasks and how the nature of tasks impacts children’s opportunities for learning. So we do
certain things in class to try to draw their attention to tasks. We read
certain things. They have certain assignments. That’s where we bring in
the instructional coaches into class to work with us on looking at the
curriculum program that’s used in the school district here. (Background
Interview, 9/21/15)

In addition to explaining the domain, Olivia later acknowledged the influence of the
course curriculum on her work in co-planning.

While reviewing a section of the transcript from the first co-planning meeting in
which the team discussed a task sorting methods course experience (Vignette A.9), Olivia
commented, “I feel like I am heavily, heavily driven by my knowledge of the goals of our
class...in this first statement I really am thinking what are we trying to do?...I even said,
‘Is that what we're doing?’” (Interview #1, 10/8/15). In reviewing the same transcript,
Ainsley also recognized the influence of the course curriculum on the MPCoP’s work:

We're discussing the tasks and connecting the tasks to the task framework
because we think that preservice teachers should know how to analyze
math problems for cognitive levels [of demand]...That's the whole purpose
of this conversation. Obviously, we have to have some knowledge of the
fact that we think preservice teachers need to know how to analyze tasks.
(Interview #1, 10/6/15)

The course curriculum was a pre-existing boundary object for the group. As Ainsley
pointed out, without this focus, they would not be engaging in discussions about how to
prepare beginning teachers to select and adapt mathematical tasks.

Expertise about the course curriculum includes an understanding of the other
domains. Depicted in Vignette B.2, Colleen suggested “I’m wondering if we could do [a
task sorting experience] in a way that would uses Math Talk from the instructors, and
then stop and unpack what the instructors did” (Co-planning #2, 10/15/15). Colleen’s
idea connects selecting and adapting mathematical tasks (Domain 2) with planning and
facilitating mathematical discourse (Domain 3). The team also drew on their expertise about the methods course curriculum when they planned a culminating activity to allow the interns to reflect upon the interconnectedness of the four domains through the Chart Talk activity (Vignette C.4). Olivia commented during co-planning:

The assignments we give them guide them through all of these processes. Like here's how we're going to do this Math Talk, follow these steps. Here's how we're going to analyze these math tasks and adapt them, follow these steps. So now I feel like these questions [for reflection] should be one step removed from that. We're giving them a chance to connect it all.
(Con-planning C, 11/5/15)

Knowledge of the methods course curriculum allowed the MPCoP to understand how selecting and adapting mathematical tasks fit into the framework for the whole course. In her final interview, Olivia reflected:

A lot of our planning has to do with scaffolding [the interns’] experiences and engagement with the [district resource], helping them to develop knowledge about how to read tasks and interpret tasks, and adapt tasks for specific children’s learning. We thought about that a lot as we sequenced, structured, and developed different task-related [methods course experiences] over the course of the semester. Then, at the end, when we had the reflective experience, we really wanted them to be able to connect across different domains of our course (Interview #4, 12/9/15)

The MPCoP attended to Domain 2: Selecting and Adapting Mathematical Tasks from the course curriculum during their planning. In all three co-planning meetings, the team worked to develop methods course experiences that would prepare PSTs to select and adapt mathematical tasks according to the Mathematical Tasks Framework.

Context

In this study, the MPCoP worked to plan methods course experiences for preservice teachers in a year-long Professional Development School internship, which is the context for teaching. When asked in an interview to consider the extent to which the
team drew on expertise about the context for teaching, Sara mused, “The context...I mean I think that goes without saying that we just do, who wouldn't? Hopefully there isn't anybody that teaches that doesn't consider the context...I recognize how important it is and it played a key, key role” (Interview #4, 12/17/15). Olivia described many aspects of the context that are unique to the PDS setting:

The PDS context is one in which all of the [preservice teachers] in our methods class are in internships in classrooms across the elementary schools of the same school district. So they have certain common experiences like the curriculum resources are common across those classrooms. The teachers are given the same professional development opportunities. The interns are treated as beginning teachers in the district so the interns are also given opportunities to participate in the same professional development opportunities as each other, and as their mentor teachers. Part of the context is that these [interns] had made a choice to do a yearlong internship rather than the August to May senior year that other comparable students at [the university] are doing. So I think that the students are part of the context because they are people who have made a choice to do more than what they had to do.

There's a physical part of the context which is that we teach in an elementary school in an elementary classroom where we have access to children and we see children. Children walk by our classroom going out to the playground, we see them out the window, but we also have the opportunity to do things with the children in that school. Some of the interns in our class are placed in that particular elementary school so for some of them, they're very much at home in that building. We as instructors are- I mean we each have a different role or relationship with the school district but we all have a school district ID and we all try to know the teachers in the school and you know for example we can go sit in the lunchroom before or after class and interact with staff and teachers in the school, so we are also part of the context.

I think another specific part of the context is the [university] program that we're satisfying the requirements of and the [state] Department of Education requirements that we have to meet for them to get their teaching credentials...I think there are so many parts of the context and I'm sure I've missed some. (Interview #4, 12/9/15)
As Olivia pointed out, there are many aspects that are specific to this context that affect what can be done in the methods course. While not all of these aspects appeared to be influential in this study, they are potential factors that could impact co-planning of the MPCoP.

Interns’ use of common mathematics resources is a unique aspect of the methods course context for this study. Colleen commented on this piece of the context:

We have an opportunity to do a lot of work with that particular resource to help [the interns] see that you don't have to teach your resource as it is written so that they can then go out, whether it's this year or next year, and be thoughtful providers of mathematics, thoughtful teachers of mathematics. (Interview #4, 12/9/15)

To support district teachers in their use of the textbook, the district maintains a team of instructional coaches. As described at the beginning of both Vignettes A and B, the team planned sections of class related to selecting and adapting mathematical tasks around visits from district instructional coaches. The team invited the instructional coaches from the district to work with the interns on understanding and using the district mathematics textbook. Sara met with the various coaches to help them plan a thirty-minute session with the interns and then shared that plan with the team:

OLIVIA: You were starting to say what the coaches are going to do for the curriculum discussion next week.

SARA: Yeah, can I just describe that?

OLIVIA: Yeah.

SARA: And then we can know kind of where to go from there. (Co-planning A, 10/1/15)
The MPCoP made use of this unique aspect as a starting point for creating methods course experiences for the interns. Sara commented on the importance of connecting the participation of the instructional coaches with the focus of the course:

I feel like what the coaches do is extremely valuable, don't get me wrong, but I feel like it's really important for us, too, after they're done to really kind of grab it back together and say, there's some really important math stuff going on here. (Co-planning #2, 10/15/15)

Inviting the coaches into the methods classroom draws on expertise about the district resources, and the TEs found it important to make sure the coaches’ activities were not disconnected from the work that the team did with the interns. They used the coaches’ plans to guide their own plans for the interns to provide a more cohesive lesson for the interns rather than disjointed activities.

In co-planning, the MPCoP discussed the use of the district mathematics curriculum program (Vignettes A.2, B.2). Paragraph A.2 describes the team’s use of the district textbook as a source of mathematical tasks, Colleen suggested, “I wonder if there’s a way to use a couple of the tasks in the [district textbook] lesson and then a couple of tasks that we know tend to be more connected and have them compare them” (Co-planning A, 10/1/15). While the team used tasks from the district mathematics resource for their task sorting, they had reservations about the quality of the resource, as voiced by Colleen during an interview, “One of my concerns has been using this particular resource, do [the interns] really get what it's leaving out?” (Interview #1, 10/7/15). These reservations explain the desire to compare district textbook lesson tasks with other, higher-level tasks.
In addition to knowledge of district resources, expertise about the context included knowledge of the class logistics such as the physical layout of the classroom, the number of interns in each section, the time constraints of the class period, and the schedule for the semester. The methods course had embedded weeks. The interns spent three weeks in their methods classes and then one embedded week full-time in their classroom placements. The timeline of the semester was a topic of discussion during co-planning. Olivia highlighted one impact of the embedded weeks on the course:

[The interns] have the embedded week then we see them twice before the day that they have to turn in Assignment 4 [the Mathematical Tasks Project]. So, my question - we don't have to figure it out right now - but my question was, since they have the embedded week, then we see them twice before they turn it in, are we going to do anything more with tasks in that period as they're working on [Assignment 4]? And I guess I'm not really asking the question honestly because I think we should do something. I feel like we should do something with their work in progress on Assignment 4 when they come back from the embedded week. (Co-planning B, 10/15/15)

The embedded week limited the amount of time the team had available to continuing work on selecting and adapting mathematical tasks with the interns. This concern shared by Olivia initiated the work of the MPCoP described in Vignette B.

The MPCoP was aware of the constraints within which they had to teach and their plans reflected this knowledge. The TEs drew on their expertise about the context in their co-planning as the MPCoP decided how the interns would engage with questions posted on chart paper for a final reflective activity (Vignette C.6). Sara asked, “Do we want all 28 interns to individually go to each chart?” (Co-planning C, 11/5/15). In this comment, Sara is attending to the format of enacting the methods course experience; the team was
limited in the physical space of the classroom and had to determine how to facilitate the methods course experience.

In another example, the team discussed how to put the interns into pairs for a task sorting methods course experience (Vignette B.5). Olivia suggested asking the interns individually to classify a task, and then find a partner with the opposite cognitive level task so that each pair had a high- and low-level task. Sara voiced her concern about the amount of time it would take for interns, “I'm afraid that it's going to take up too much time” (Co-planning B, 10/15/15). Olivia noted that in this moment, “[Sara]'s worried about time which is our context” (Interview #2, 10/20/15). The MPCoP adjusted other plans based on the time constraints as well (Vignette B.3):

**AINSLEY:** Now, is 15 minutes enough time for them to go through those tasks and sort them? And have a valuable discussion about it?

**OLIVIA:** No. (Co-planning B, 10/15/15)

After that exchange between Ainsley and Olivia the team decreased the number of tasks that the interns would examine from 10 to 6. The MPCoP was aware of time allotted for facilitating this methods course experience, and the final plans reflected use of this expertise.

**Mathematical Tasks Framework**

Expertise about the Mathematical Tasks Framework (MTF) is another boundary object for the MPCoP. The MPCoP used the MTF as an instrument to attend to Domain 2: Selecting and Adapting Mathematical Tasks as discussed in the previous section. Expertise about the Mathematical Tasks Framework (MTF) is the knowledge of and experience with Stein and Smith’s (1998) framework for evaluating mathematical tasks.
The framework allows for the categorization of tasks as either low-level of cognitive demand (memorization or procedures without connections) or high-level of cognitive demand (procedures with connections or doing mathematics). Within their team co-planning meetings, the members of the MPCoP used their individual expertise about the MTF to discuss the methods course experiences they designed for the interns. Team members held a shared understanding that this framework would be used, and as such the MPCoP structured the methods course experiences around helping the interns to understand and use the MTF. All of their discussions about the class periods related to selecting and adapting mathematical tasks involved the MTF in some capacity.

In the first co-planning meeting (Vignette A), the MPCoP developed a course experience for interns to classify three tasks from the district textbook as procedures without connections (low-level) or procedures with connections (high-level) using a bulleted list of attributes from the levels of cognitive demand of the MTF (Vignette A.10). Ainsley confirmed the MPCoP’s use of expertise about the MTF in an interview reflecting on the planning of this methods course experience:

We need to have knowledge of the task framework otherwise we wouldn't be having this conversation. Because we also reference putting bullets directly from the task framework into the activity that we were going to have the preservice teachers do. And if we weren't familiar with this framework, there would be no reason for us to be having this conversation because we wouldn't know how difficult it would have been for the preservice teachers in adapting our task for them. (Interview #1, 10/6/15)

Without expertise about the MTF, the team co-planning about preparing PSTs to select and adapt mathematical tasks according to the framework would not be possible.

The MPCoP drew on their own experiences and knowledge of the MTF in determining the details for task sorting course experiences for the interns. Sorting the
tasks can be a challenge and there is not always one clear category for a given task. The MPCoP wanted to create a space for the interns to discuss disagreements in classifications. For example, in the co-planning meeting described in Vignette B.11, the team decided to allow interns working together at one table to indicate disagreement on the board for the class to discuss:

**COLLEEN:** The only issue then we might have to address is if the table is split [in agreement about whether a task presents a low or high level of cognitive demand], I think they should be able to put up both numbers.

**OLIVIA:** They can mark high and low.

**SARA:** Mhm.

**COLLEEN:** Because that's where we want to talk about it. If one person is high and the rest are low, they can go with low, but if they're split then they can put both. (Co-planning #2, 10/15/15)

Based on expertise about the MTF, the MPCoP created an opportunity for discussion of disagreements within the activity.

During a semi-structured group interview, the MPCoP reflected upon course experiences they had developed throughout the semester related to Domain 2. In response to a methods course experience about the characteristics of tasks (see Figure 5-3), each TE had the opportunity to explain how she saw expertise about the MTF used in the development of the course experience (see Figure 5-4). All members of the MPCoP commented on the influence of expertise about MTF on the development of this course experience.
Characteristics of Tasks

12:30-1:20
Adapting tasks --- For HW, interns rewrote one of the tasks from the lesson last week.

Get with your appointment. Share the task you rewrote with your partner. Check that you think your partner’s new task is high level. Refine your tasks. (15 min)

(20 min) Two pairs will join up to discuss these three questions. Make notes (bulleted list in math journal):

1. What are some characteristics of low level tasks?
2. What are some characteristics of high level tasks?
3. What are some strategies for adapting a low level task into a high level task?

Share your revised tasks as you respond to these questions.
(15 min) Three questions on the board - discuss whole class

Figure 5-3: Plan for methods course experience in slam book.
Knowledge of Math Task Framework

Our knowledge of the MTF was needed to plan this. How follow up. We needed to know the MTF and be able to classify tasks ourselves in order to appreciate the importance of this kind of curriculum work and to set up an experience for interns. We had to know that there are high and low level tasks.

Throughout the semester it became apparent that we could use the MTF to help students understand the importance of the task itself and how that connected to math tasks, differentiation, etc.

- We knew the complexity of the framework and how difficult it can be sometimes to classify tasks, we planned this assignment to try to simplify identification for the interns.

Figure 5-4: Responses to how knowledge of the MTF influenced the co-planning of the methods course experience.
Further evidence for the MPCoP’s use of expertise about the MTF emerged in co-
planning when the TEs discussed the specific mathematical tasks they wanted interns to
sort based on the levels of cognitive demand (Vignette A.5, Vignette B.7-8). Depicted in
Vignette A, Olivia invited Sara and Ainsley to share their understandings of the levels of
cognitive demand when there was disagreement about how to classify tasks (paragraph
A.5). In the follow discussion, Olivia challenged Sara’s suggestion that when the task
prompts elementary students to show a solution in two ways, the level of cognitive
demand is increased:

**OLIVIA:** Are you saying that’s *procedures with connections* because they
have to do it two different ways?

**SARA:** I’d have to look at the list [referring to the characteristics for
levels of cognitive demand].

**OLIVIA:** Without looking at the list. What’s your gut?...What do you
think, Ainsley?

**AINSLEY:** In response to what Sara’s saying?

**OLIVIA:** Yeah, that one that’s “Shade to show halves two different ways.
Measure in centimeters. Draw rows and columns.”

**SARA:** Okay, that’s all lower-level, right? Because you’re telling them
what to do. You’re looking for halves. You’re drawing. You’re doing this.

**OLIVIA:** What were you saying isn’t lower-level?

**SARA:** The fact that they have to show more than one way.

**OLIVIA:** That makes it higher-level?

**SARA:** A little, tiny bit. I mean there isn’t one right way.

**AINSLEY:** I don’t know if that makes it higher-level.

**SARA:** Maybe it’s *procedures without connections*.

**OLIVIA:** It’s low-level.
SARA: Yeah. But it’s more than just being told exactly what to do. (Co-planning A, 10/1/15)

This exchange highlights a difference in familiarity and comfort with using the MTF to categorize mathematical tasks. While the MPCoP engaged with expertise about the MTF during co-planning, Olivia remarked in her final interview, “I think we have people on the team who have maybe less familiarity and experience with the Math Task Framework. Maybe I think there's a way of experiencing the Math Task Framework with less confidence or maybe even superficially” (Interview #4, 12/9/15). Sara’s self-reflection in her final interview supports Olivia’s comments, “Although I love [the MTF], I wish that I had more time to get familiar with it. I think it’s a great resource. But I feel like I need to do more work with that” (Interview #4, 12/17/15). Colleen offered a similar reflection:

I've learned a lot about the Math Task Framework but that's something that I feel like I need to keep working on….I plan on photocopying that table [levels of cognitive demand], laminating it, and sticking it in my planning book and on my desk. (Interview #4, 12/9/15)

Both Sara and Colleen expressed a desire for experience with practically applying the MTF to mathematical tasks for elementary students. Although some TEs had more experience with the MTF and were more confident using it than others, the MTF operated as a boundary object for the group, organizing the work of the MPCoP around the use of the MTF to prepare interns to select and adapt mathematical tasks.

Mathematics. A related area of professional expertise that was subsumed by the expertise about the MTF is expertise about mathematics. As Ainsley remarked in an interview, “In order to use the Math Task Framework, you have to have a good solid knowledge of the mathematics that you're looking at within the tasks” (Interview #2,
10/22/15). The team examined mathematical tasks in the first two co-planning meetings (Vignettes A and B). In preparation for a district instructional coach visit, described in Vignette A, the team considered how they could use tasks from the district textbook in their instruction. In the following exchange (described in Vignette A.9) the team discovered in a district textbook lesson that arrays, which could be used to support the development and understanding of multiplication, were used instead to emphasize fractions. The team used their knowledge of mathematics to recognize this difference, and in fact, one team member initially incorrectly assumed the lesson presented arrays as related to multiplication.

SARA: There is no purpose in this teacher’s manual for these arrays to build on multiplication at all. It builds to fractions.

OLIVIA: We have talked about three tasks. We have talked about this one which has addition and multiplication on page 301, we’ve talked about-

SARA: Wait, go back to the one on page 301, it has what?

OLIVIA: Page 301. It has addition and multiplication.

SARA: Where’s the multiplication?

OLIVIA: Well...oh.

SARA: It could be adapted to look at multiplication but it does not have anything about multiplication.

OLIVIA: I was totally…I didn’t read what the equations were written down there.

SARA: And even in the teacher’s manual part of it, it doesn’t have any. (Co-planning A, 10/1/15)

Ainsley confirmed the use of expertise about mathematics while discussing this particular task, “As far as talking about the array itself and the problems, we need to have
knowledge of math problems themselves...and...knowledge of the mathematics that are within those math problems” (Interview #1, 10/6/15). The MPCoP drew on expertise about mathematics to identify mathematical concepts that were addressed within the task in order to classify tasks according to the MTF.

**Strategies for Effective Teaching**

*Strategies for effective teaching* is the fourth boundary object for the MPCoP. Expertise about effective teaching operates at two levels within this study. There is effective teaching as it relates to teaching preservice teachers, and as it relates to teaching K-4 students. In each case, expertise about strategies for effective teaching includes knowledge of the students. As the MPCoP co-planned, they drew on this area of professional expertise as it related to each of the different audiences. This expertise as it relates to either type of student, could come from experience as teacher educators, elementary teachers, or being students themselves. Sara explained drawing on this expertise, “as teacher educators you're talking about how you're going to deal with [the interns] in this particular context, but you're drawing on what you know about your experience and what effective teaching you know from that experience (Interview #2, 10/21/15). For some members of the MPCoP, strategies for effective teaching is general teaching expertise and not particular to teaching mathematics.

This boundary object carries a nebulous definition for participants, which was never clearly defined in interviews. For example, when reviewing a transcript for Co-Planning B, Ainsley speculated that Sara was drawing on her experience as a teacher educator and her knowledge of effective teaching:
Sara’s contribution about having them create the table and marking the tasks as high or low and then looking at how the class as a whole rated them to have a discussion about just the ones that were messy in the interns' minds I think comes from experience as teacher educators and knowledge of effective teaching. Because it's not worthwhile to talk about problems that they all rated high or all rated low so she's thinking about effective teaching strategies. And how to make the activity better. (Interview #2, 10/22/15).

In this case, it seems that strategies for effective teaching are used to make a course experience “better,” but without specifying how to know the plan is improved. In the first semi-structured group interview, Sara explained her thoughts when reviewing Assignment #4: Mathematical Tasks Project, the culminating project for Domain 2:

I thought about [knowledge of effective teaching] as having taught long enough to know that you have to be clear about instructions and you have to have [the interns] engage in something that is going to help them learn what you want to have them learn…we collectively, maybe, decided that these were strategies that would accomplish what we wanted to have accomplished. (Group Interview #1, 10/15/15)

Sara appears to be drawing on her experience as a teacher to support her expertise about strategies for effective teaching.

**Teacher education.** As the team drew on their expertise about effective teaching, they drew on their experiences as teacher educators. Sara, Olivia, and Colleen had worked together for three years prior to this study and Ainsley had worked with preservice teachers outside of this specific context. During team co-planning, the TEs recalled their previous work outside of the semester of this study, as well as enacted lessons that had occurred during the semester. They also discussed their knowledge of the interns.

When examining the work of the MPCoP to determine the details for the task sorting experience described in Vignette B, Ainsley commented, “We're all still just
contributing ideas of how to conduct the [course experience] with the interns. I think that stems from just previous knowledge of working as a teacher educator. And it stems from knowing effective teaching strategies, too” (Interview #2, 10/22/15). A more specific example of drawing on these experiences arose during the second co-planning meeting.

Olivia drew on her experience as a teacher educator when she suggested using kindergarten tasks for the interns to sort (Vignette B.2):

I remembered that last year when we did this kindergarten lesson that [the math coaches] are going to be doing with us, that was the first lesson we did last year. That was our first [district textbook] lesson and I had pulled out these tasks. These are tasks from the kindergarten lesson and some of these I wrote. They were made up tasks based on tasks in the lesson. And those were the first sorting. That was the first sorting we did last year. (Co-planning B, 10/15/15)

This suggestion from Olivia exemplifies her expertise by her recalling a previous experience in teacher education. While examining the second co-planning session (Vignette B), Colleen reflected on the team’s discussion:

I feel like a lot of this [discussion] is on the effective teaching and experience as teacher educators - trying to figure out what we want to do that's going to help [the interns] further their thinking about high- and low-level tasks and then how do we get them to do that in a way that will help them. (interview #2, 11/2/15)

The MPCoP also considered strategies for effective teaching when planning how the interns would sort and discuss mathematical tasks (Vignette A.10). During planning, the team had the following exchange:

**OLIVIA:** So is that going to be a whole class discussion? How are we going to do that?

**COLLEEN:** You mean after they’ve identified the tasks?

**OLIVIA:** We’re going to pass these three tasks out.
SARA: I think we should have them either talk in a pair or get with an appointment or do a desk set, two or three of you in each desk set. I think maybe they could have small conversations about it first. Otherwise our non-talkers aren’t going to really participate in the conversation.

OLIVIA: What would you think of - this sounds super traditional - What if on that page where the three tasks will be - what if I put these bullets [referring to characteristics of the levels of cognitive demand]? What if I made a copy of the middle two categories? And we actually ask them to circle or cross off the bullets that seem to apply to that problem. I feel like part of what’s happening is they’re not really engaging with this list [of task characteristics]. (Co-planning A, 10/1/15)

The MPCoP drew on their expertise about strategies for effective teaching in the determining the details for how the interns were going to engage with the material: whole class discussion, partner work, etc. Olivia confirmed her thoughts about drawing upon her knowledge of the interns and of effective teaching in a follow up interview, “When I suggest putting the bullets on the paper...I'm drawing on experience with [the interns] struggling with [classifying tasks using the MTF] so I'm trying to create some kind of scaffold for them” (interview #1, 10/8/15).

The MPCoP’s co-planning of methods course experiences was influenced by what happened during previous class sessions with the interns -- the enacted lessons. Olivia shared her knowledge of enacted lessons during the third co-planning meeting described in Vignette C.1, “So one of the things that has come up a little bit this week is, ‘So wait, are we saying that you guys should always teach with high-level tasks? That's what all the tasks you use in the classroom should be?’” (Co-planning C, 11/5/15). This comment led the group to discuss posing reflective questions to the interns including, “Consider this low-level task. When might a teacher choose to use this task? How might it be used?” (Planning Document). The work of the MPCoP described in Vignette A
demonstrates similar evidence of knowledge of enacted lessons. Depicted in paragraph A.2, Olivia and Colleen discussed interns’ understanding of procedures and concepts in mathematics, which is something that had previously emerged as problematic in class.

As described in Vignette A.10, Olivia shared her knowledge of the interns while discussing a task classifying course experience, “Part of what’s happening is the interns are not really engaging with this list [the levels of cognitive demand]” (Co-planning A, 10/1/15). She recognized that the interns did not connect with the characteristics in the Math Task Framework and, therefore, wanted an activity to address the issue. Vignette B also illustrated Olivia’s knowledge of interns as she shared her concern in the second co-planning meeting that the interns struggled to adapt low-level tasks to higher-level tasks (paragraph B.1). Sara voiced her concern that the interns would not be able to sort themselves by high- and low-tasks in a short period of time (Vignette B.5).

Responding to a course experience from earlier in the semester for which interns sorted third grade tasks from the district textbook, the MPCoP reflected upon the influence of their expertise about strategies for effective teaching and their experience as teacher educators in designing the task sorting (see Figure 5-5). In this course experience, the TEs exposed the interns to tasks they would be using the following week during a visit from an instructional coach and it was the interns’ first encounter with the MTF.
The reflective comments from the MPCoP indicate that the TEs were aware of the complexity of categorizing tasks according to the MTF as well as the need to provide interns opportunities to engage with tasks early on in the semester. Further, they were preparing for a visit from the instructional coaches by familiarizing the interns with the tasks from the district resource.

**Elementary teaching.** As MPCoP drew on expertise about strategies for effective teaching, some TEs drew upon their elementary teaching experiences. Figure 5-6 shows Sara’s reflection about using “Appointments,” a strategy to group students in pairs, came from her experience as an elementary teacher.

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1 In the first methods class meeting, interns scheduled fictitious “appointments” with each other at specific times and filled out an appointment sheet, which could be consulted in subsequent classes. For example, a TE might say, “Get with your 2 o’clock appointment,” and interns would find their predetermined partner.
Colleen and Sara, both of whom had extensive experience as classroom teachers, voiced their disagreement with aspects of the district textbook lesson based on their experiences working with elementary students (Vignette A):

**COLLEEN:** Part of what bothers me about this entire lesson is you want kids “to attend to precision” is one of their phrases, and yet, you are asking them to use rulers and draw straight lines and make equal-sized boxes.

**SARA:** Oh, I hate that whole part of the lesson. That’s ridiculous.

**COLLEEN:** Ever work with a second grader? It doesn’t work. Why don’t they just use tiles? (Co-planning A, 10/1/15)

Colleen expressed frustration that she felt the lesson was developmentally inappropriate to ask second grade students to use rulers to draw straight lines and equal-sized boxes.

Colleen’s comment, “Ever work with a second grader? It doesn’t work.” (Co-planning A, 10/1/15) demonstrates her knowledge of what students are capable of at different grades as well as knowledge of what was effective for teaching elementary mathematics at that grade-level. She reflected on her comment during an interview, “I'm even thinking... going back to teaching arrays as a second grade teacher, the lesson that was in there, I would never have done like that. Ever” (Interview #1, 10/7/15). Team members’ elementary teaching experience influenced how they viewed tasks within the district’s curriculum program.

Figure 5-6: Sara’s reflection on using the “Appointments” strategy.
Ainsley had 10 years of elementary teaching experience prior to her graduate work at the university, yet she expressed feeling that this area of professional expertise did not influence the MPCoP:

The majority of my career is elementary teaching experience. Spending 10 years doing that, I feel like that is an area of expertise for me. But I don't know how much I used what I know about teaching mathematics to children in our actual planning conversations. (Interview #4, 12/15/15)

Ainsley continued to reflect on the work of the MPCoP suggesting that the group’s work focused more on the details of how to engage the interns with the various domains of the course curriculum rather than what happens in a classroom:

I feel like majority of [the co-planning] was more based on...talking about how we're going to discuss with [the interns] math talk moves, and how are we going to present to them the task framework? How are we going to use the task framework with them? What are we going to expect them to do with it? Things like that, more so than about how talk moves are used in the classroom. (Interview #4, 12/15/15)

Though she identified as an elementary teacher, for Ainsley it seems that the nature of the work of the MPCoP did allow for her to share or draw upon this area of professional expertise.

Strategies for effective teaching encompass both experiences in teacher education and elementary teaching, which allows for this area of professional expertise to be a boundary object even though the members of the MPCoP had varying degrees of experience with both teacher education and elementary teaching. The TEs still understood and drew upon strategies for effective teaching, regardless of their origin.

Non-Boundary Objects

The non-boundary objects in this study are represented in Figure 5-2 as the circles outside of the MPCoP, specifically research and teaching mathematics conceptually.
These areas of professional expertise emerged during the study as expertise that was drawn upon by some members of the MPCoP. However, these areas did not unify the organization of the MPCoP because not all members of the group discussed these areas as individually influential, perhaps suggesting that they did not carry significant meaning for all members of the group.

**Expertise about research.** Research appears in Figure 5-1 outside of the work of the MPCoP. Expertise about research refers to knowledge of literature regarding any of the following: mathematical tasks, elementary mathematics, and preservice teachers as well as experience conducting research in education. Though the MTF is research-based and could fall into this category, expertise about the framework itself, not the related research, acted as a boundary object in the work of the MPCoP, as previously discussed.

I found no explicit evidence of the role of expertise about research during the MPCoP’s co-planning meetings. When asked to review the interns’ final project for Domain 2 in a group interview, Sara, Ainsley, and Colleen all marked the overview of the project (see Figure 5-7) as having been influenced by research knowledge. However, they do not elaborate on what research knowledge was used or how the research knowledge influenced the development of the project. They shared their thoughts with the group:
SARA: We had research knowledge and experience, or some of us did, that helped us come up with those ideas.

AINSLEY: I marked those [experience as teacher educators] and [research knowledge and experience] as well. More specifically, I marked the first box [research knowledge and experience] and I marked the second gray box [experience as teacher educators]. But that's where I also included [knowledge of effective teaching] and [knowledge of the specific context for teaching]. I don't know. Not sure if it should be [knowledge of effective teaching] and [knowledge of the specific context for teaching] because of the teaching piece.

COLLEEN: I have [experience as teacher educators], [research knowledge and experience], [knowledge of the specific context for teaching], and [knowledge of MTF]…The whole assignment really to me has a lot of the 8 [areas of expertise] in it but I kept coming back to what the interns need, which is [experience as teacher educators], [research knowledge and experience], and [knowledge of the specific context for teaching]. (Group Interview #1, 10/15/15)

Ainsley agreed with Sara, but did not elaborate on how research knowledge to create this assignment. Colleen appears to view the expertise in a different way as she discussed research knowledge and experience as something the interns need, and not as something

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2 Portions of the assignment have been blacked out for confidentiality.
that influenced the MPCoP. The development of this assignment occurred outside of the co-planning meetings, initially drafted by Olivia, but all TEs were invited to offer suggestions and revisions.

The lack of explicit use of research knowledge within the co-planning meetings is consistent with reflections in a final interview with participants. Colleen commented, “I don't know that we used a whole lot of research knowledge and experience. That doesn't mean we didn't” (Interview #4, 12/9/15). Ainsley echoed Colleen’s comment, “I don't know exactly how much specific research came into our conversations” (Interview #4, 12/15/15). However, during an interview, Olivia shared:

I think one of the reasons that I feel like [selecting and adapting mathematical tasks] is a really important part of a methods class comes from my background doing research about teachers’ use of curriculum. I feel like a central part of designing and implementing math instruction is thinking about how are you going to use the curriculum program. So I’m really influenced by my research experience and my knowledge of the research in that area. (Background Interview, 9/22/15)

It seems that this area of professional expertise may have influenced the team’s co-planning, but perhaps was more implicit in the MPCoP’s interactions. Ainsley reflected:

I think for me it was more of an internal thing. I knew...what the research said about the importance of adapting tasks and the ways this framework has been used. I think that helped me to know why what we were doing with the interns was important. (Interview #4, 12/15/15)

Ainsley had been previously exposed to research relating to the MTF in her graduate courses and in her work with a summer institute for teachers at the university, however, as she indicated, she did not explicitly share this expertise. Sara summarized her perception of each team member’s expertise about research, “Colleen, I don't think has much experience with research knowledge and experience, but Ainsley is starting to learn
Olivia indicated that she drew upon her knowledge of research in co-planning. While analyzing transcripts in Interview #1 and #2, she identified two contributions where she drew upon such expertise, but the other team members did not recognize her contributions as indicative of that expertise. For example, in Interview #1 Olivia examined her comment as part of the discussion depicted in Vignette A.9, “But the array is made for them...we’re going to have to talk about it” (Co-planning A, 10/1/15). She explained:

> When I said that I'm concerned that “the array is made for them,” I'm interpreting the task using my knowledge of classifying tasks. It's also in the back of my mind that I know what happens when teachers try to teach with a low-level cognitive demand task because I've read so many articles about how difficult it is to raise the level of demand in a classroom, and how easy it is to bring down the level of demand. I am influenced by my knowledge of research when I express concerns like that. (Interview #1, 10/8/15)

Although Olivia discloses that this expertise influences her comments, her research experience was not shared aloud. Conversely, in an interview, Ainsley reflected on her comments about task sorting (Vignette A.11):

> I say, “Look at how long it took the four of us to try and decide where those tasks were classified.” That's me drawing on our own experience categorizing math tasks using that task framework. And, I think I draw on my own experience with teaching undergraduates because I'm thinking of where they're at, what we've done with them so far, and where we need to take them. (Interview #1, 10/6/15)

It seems that Ainsley attributes her own knowledge of task sorting to experience with the Mathematical Tasks Framework and experience as a teacher educator. This is an instance where both Olivia and Ainsley understand task sorting to be a complex experience,
however, where they may have obtained this knowledge differs. This is an example of when the MTF and strategies for effective teaching are boundary objects, but would be an opportunity for Olivia to introduce her expertise. However, perhaps she chose not to offer her expertise because there was already a shared understanding that task sorting is complex, and no further understanding seemed necessary to move the planning forward. Olivia, acting as a boundary broker, may have hedged her expertise about research given that it would not have resonated with all members of the MPCoP.

Though Ainsley and Sara had some experience conducting research and engaging with academic literature, neither self-identified as specifically drawing upon that expertise when analyzing transcripts of co-planning meetings. Nor did they identify research as an area of professional expertise when asked to consider what they drew upon in co-planning during background interviews. Ainsley reflected:

I think I did learn a lot about teaching undergraduate students last year when I taught the [early elementary field experience] course, so I have a bit of experience knowing what we did in that class to get feedback from the students or strategies to use with the [undergraduate] students...And, I think just my knowledge of teaching elementary school in general and kind of what these preservice teachers should know, but should know for teaching elementary mathematics. (Background Interview, 9/23/15)

Sara similarly focused on previous experiences as a teacher in her reflection about the expertise she drew on:

I think that my primary experience that I draw upon is the three-year [Mathematics Teacher Learning Project]. I remember clearly when I was teaching during that project. I remember specific math classes when I put myself in an uncomfortable position just to try out what they were trying to make me do, even reluctantly. And I remember specifically realizing by doing that...I really changed my practice...And so when I’m planning for [the methods course], I think about that all the time...I’ve taught from kindergarten to sixth grade, every grade level. So I’ve experienced that kind of math and I know how to play with that, and so that probably is the
second thing that is useful for me when I’m planning. (Background Interview, 9/30/15).

Each member of the MPCoP rated herself on a Likert scale to indicate her own level of expertise for each of the areas of professional expertise. Figure 5-8 shows the results of the ratings for research knowledge and experience.

![Figure 5-8: Likert scale responses for research knowledge and experience.](image)

After the low Likert scale rating, when asked in which area did she wish she had more expertise, Colleen reflected, “I would like to say research knowledge and experience, but that's just not something that is really high on my list” (Interview #4, 12/9/15). The varying degree of expertise about research may explain why it was not explicitly shared during the MPCoP’s co-planning.

**Teaching mathematics conceptually.** Teaching mathematics conceptually also appears outside of the work of the MPCoP. Sara in particular referred to drawing on expertise about teaching mathematics conceptually in co-planning. She connected
strongly with this area of professional expertise. She discussed her own expertise in contrast with Olivia’s:

My expertise is how to teach elementary math conceptually...and the experience that I've had doing that. Sometimes I sense things that I can bring to the table but...[Olivia] might not have thought about that. Or I can take an idea that she has from her point of view and I can kind of see how that might play out in an elementary setting...She brings research knowledge. She brings a broad range of knowledge of mathematics. She knows about curriculum. She's this top part “experience as teacher educators” [referring to an index card with “experience as teacher educators”]. I feel like she knows more about that than I do. So she's this part up here and I'm this part down here [referring to an index card with “elementary teaching experience”]. (Interview #3, 11/18/15)

Sara’s description of her expertise may support a membership in communities of practice related to elementary teaching.

By contrast, Olivia has a differing view of teaching mathematics conceptually that may be rooted in her membership in academic communities of practice. Olivia elaborated on her understanding of teaching mathematics conceptually as an area of professional expertise:

This one [teaching mathematics conceptually] doesn't resonate with me. I feel like 15 years ago this was such a big thing and teaching math conceptually meant something to some people. Now it just feels like it's a phrase that people use and I'm not sure how meaningful it is. (Interview #4, 12/9/15)

This area of professional expertise did not seem to influence the work of the MPCoP, and therefore, is not considered a boundary object. It is an area of professional expertise that holds meaning for some, but not all members, as indicated by Olivia’s reflection above. Given that the focus of the methods course was not to teach the interns mathematics, but rather to teach them how to teach mathematics in the elementary schools, it may be unsurprising that this area of professional expertise did not emerge as a significant
influence. The MPCoP focused on fostering an appreciation for and knowledge of how to teach mathematics conceptually in the interns through the judicious use of mathematical tasks, which is distinct from the way in which the expertise might be used when planning mathematics lessons for elementary students.

The Role of Expertise in the Methods Planning Community of Practice

Areas of professional expertise acted as boundary objects, or non-boundary objects, for the MPCoP. The work of the MPCoP was complex. Individual teacher educators comprised the group and each one brought her own experiences and membership in other communities of practice. During the general activities of co-planning, the MPCoP made decisions about methods course experiences based on the shared areas of professional expertise that acted as boundary objects.

The non-boundary objects in the MPCoP, research and teaching mathematics conceptually, may have influenced individual contributions, but were not salient areas of professional expertise for all team members. Olivia’s role as a boundary broker may have had a surprising effect on the presence of her expertise in the co-planning meetings. Olivia had certain expertise, e.g., research, that appears to influence the product, but was not made explicit in co-planning conversations. Rather than introducing her expertise as a boundary object, it remained outside the MPCoP. It seems that the group did not often find the need to justify their rationale for decisions, which perhaps would have created opportunities for Olivia to share this expertise. Sara’s role as the coordinator for the PDS and a recent Ph.D. graduate of the university, also positioned her with potential to act as a boundary broker, however, she connected with boundary objects that overlapped more with elementary school teaching communities of practice. While these areas of
professional expertise did not operate as boundary objects within this community of practice, they are likely to be central components of other communities of practice.

In this chapter, I have established four areas of professional expertise that the MPCoP explicitly used while engaging in general co-planning activities to prepare beginning teachers to select and adapt mathematical tasks: (1) course curriculum, (2) context, (3) Mathematical Tasks Framework, and (4) strategies for effective teaching. These four areas of professional expertise acted as boundary objects and unified the joint enterprise of the MPCoP. Expertise about research and teaching mathematics conceptually did not function as boundary objects in this study, though some members of the MPCoP considered them to be influential in designing course experiences for preservice teachers.
Chapter 6

Discussion, Implications, and Reflections

In this study, I examined the collaborative work of a Methods Planning Community of Practice (MPCoP), comprised of four hybrid teacher educators, as it developed methods course experiences intended to prepare preservice teachers to select and adapt mathematical tasks. This study responds to calls for research that examines hybrid spaces in teacher education (e.g., Zeichner, 2010; Zeichner, Payne, & Brayko, 2015). Martin, Snow, and Franklin Torrez (2011) reported on the complexities and challenges of the work of hybrid teacher educators within a school-university partnership. This study extends that work by offering new insights into the interactions among the hybrid teacher educators and the sharing of expertise in a community of practice.

In Chapter 4, I presented three vignettes to depict the nature of the work of the MPCoP. The team of hybrid teacher educators formed a community of practice because they exhibited the three characteristics as defined by Wenger (1998): mutual engagement, joint enterprise, and shared repertoire. I identified the general co-planning activities (CPAs) the MPCoP engaged in while creating methods course experiences to prepare beginning teachers to select and adapt mathematical tasks and discussed participation of the individual members within the MPCoP. Previous research about co-planning is limited to collaboration among preservice teachers (e.g., Bartell, 2013; Sims & Walsh, 2009), inservice teachers (e.g., Boylan, 2010; Lewis, Perry, & Hurd, 2009; Murata, Bofferding, Pothen, Taylor, & Wischnia, 2012), between preservice and inservice teachers (e.g., Van Zoest & Bohl, 2002), or between researchers and inservice teachers.
with a focus on professional development for the teachers (e.g., Jung & Brady, 2016; Roth McDuffie & Mather, 2009). This study examined the co-planning of hybrid teacher educators for an elementary mathematics methods course. In most studies, co-planning has typically been embedded within a larger context, such as lesson study (e.g., Fernandez, 2010; Wake, Swan, & Foster, 2016) and is not the main focus. The present study extends this body of research by focusing on identifying the primary activities that make up the collaborative work of teacher educators. In this study, the MPCoP engaged in three co-planning activities (CPAs): *establishing goals, general brainstorming*, and *determining instructional details*.

In Chapter 5, I used the construct of boundary objects (Star, 1989; Star, 2010; Wenger 1998) to identify and examine areas of professional expertise that the MPCoP drew upon during co-planning. The boundary objects in this study are expertise about the course curriculum, the context, the Mathematical Tasks Framework (MTF), and strategies for effective teaching. The boundary objects that emerged in this study were consistent with overlapping areas of professional expertise among the diverse participants. In contrast, areas of professional expertise that were influential for select individuals (i.e., research or teaching mathematics conceptually) were not explicitly shared during the MPCoP’s co-planning work. These findings contribute new understandings to previous claims about the value of integrating academic and practitioner knowledge (Lampert et. al., 2013; Spillane & Hopkins, 2013; Wood & Turner, 2015; Zeichner, 2010; Zeichner, Payne, & Brayko, 2015) because they provide a specific illustration of how hybrid teacher educators’ expertise interacts to influence the
work of a community of practice focused on planning elementary mathematics methods course experiences.

**Co-Planning Activities**

Contrary to collaborative planning within lesson study (e.g., Lampert et al., 2013; Suh & Seshaiyer, 2015), the MPCoP did not have an imposed protocol to guide its collaborative planning. For this reason, it was necessary to investigate the particular activities of this team. Whereas all three of the general CPAs (establishing goals, general brainstorming, and determining instructional details) appeared to be essential components of the MPCoP’s planning process, the MPCoP spent the majority of its time on the co-planning activity *determining instructional details*.

Given that the MPCoP co-taught the methods, all members of the MPCoP were responsible for knowing and being able to enact the plans for the methods course experiences that were developed during the co-planning meetings. The MPCoP deprivatized the work of the teacher educators (TEs) and removed sole ownership of the planned course experiences from one individual TE and placed the ownership on the group thereby removing the personal attachment educators can have towards their work (Boylan, 2010). Collaboration of this kind supports a collective attitude during the planning process and gives educators an incentive to be invested in the final product (Sims & Walsh, 2009). Perhaps due to the nature of team teaching, the MPCoP spent considerable time on determining the instructional details as each individual would be held responsible for the methods course experience.

It is possible that the MPCoP’s lesser time spent on the other two co-planning activities (*establishing goals* and *general brainstorming*) may have related to the TEs’
memberships in other communities of practice. As relatively novice teacher educators, it is possible that Ainsley, Colleen, and Sara had less experience in teacher education communities of practice, and therefore, might not have had as many ideas for contributions to establishing goals and general brainstorming activities as did Olivia. The opportunities for their contributions to these activities may have been limited by the type of co-planning the team engaged in. The first two co-planning meetings (Vignettes A and B) can be characterized as unilateral co-planning as introduced in Chapter 2; Olivia wrote plans for the class session in the shared planning document prior to the co-planning meeting. Ainsley, Colleen, and Sara may have defaulted to Olivia for her academic expertise given that the course is for university credit and she represented the university in setting the course curriculum.

**Implications**

While I identified three general CPAs for this specific team, they are likely to appear in the co-planning of other teams. Furthermore, other teams, or even this one, might have additional CPAs and patterns. Perhaps within this MPCoP there might be other CPAs and patterns for planning other domains of the course curriculum framework. CPAs may or may not remain stable across the co-planning for the four domains of the mathematics methods course. To extend this study, it might be worthwhile to look at the MPCoP’s co-planning across the four domains to confirm or expand the CPAs. Given the complex work of hybrid teacher educators (Martin, Snow, & Franklin Torrez, 2011; Williams, 2014), future research should examine the activities of other communities of practice composed of hybrid teacher educators. Another area to consider for further
research is the differences between the organic co-planning activities of this group with those of communities of practice that use a guiding protocol.

**Areas of Expertise as Boundary Objects**

Boundary objects (Star, 1989; Star, 2010; Wenger, 1998) offered a lens to understand which areas of professional expertise were influential in the observed work of the MPCoP. The areas of professional expertise that overlapped among the TEs impacted the group’s decision-making most explicitly. Other studies in mathematics education have focused on artifacts, such as lesson plans or learning trajectories, as boundary objects (e.g., Sztajn, Wilson, Edington, & Myers, 2014; Wake, Swan, & Foster, 2016). In this study, I considered the shared areas of professional expertise, rather than tangible items, to be the boundary objects of the MPCoP. Boundary objects are necessary to organize the collective work of individuals from different communities of practice (Sztajn et al., 2014; Wenger, 1998). The affordances of considering expertise in this way not only honored the diverse expertise that individual TEs held, but also the collective use of this expertise in the MPCoP’s work. Further, the construct of boundary objects maintains that these objects can carry different meanings for different individuals, however, they must carry some meaning for all involved. This facet of boundary objects accounts for the TEs’ varying depths of knowledge and understanding regarding the areas of professional expertise.

The boundary objects in this study emerged from the TEs’ descriptions of their work. The course curriculum and context seemed to be prescribed areas of professional expertise that guided the work of the MPCoP. However, the boundary objects for the MPCoP might be influenced by the domain of the course curriculum for which it was
planning methods course experiences. This study focused on Domain 2: Selecting and Adapting Mathematical Tasks. While expertise about the Mathematical Tasks Framework was a boundary object in this study, it may not be present in co-planning for other domains. However, strategies for effective teaching may still surface as a boundary object because it is less specific to this domain.

The use of the MTF was limited to the practical applications of the levels of cognitive demand, and as a basis for discussion among interns. Conversely, this perceived limitation may have unintentionally supported the MTF as a boundary object. For a successful partnership among university and schools, researchers have found that teachers need to see the practical applications of the research-based materials (Jung & Brady, 2016; Sztajn et al., 2014). Colleen commented in her final interview that she would be taking the framework back into her classroom when she transitioned out of her role as school-based TE, which highlights the pragmatic aspects of the MTF, and confirms Arbaugh and Brown’s (2005) findings that practical tools, such as the MTF, can help teachers examine their own practice in a non-threatening manner.

The MPCoP used the Mathematical Tasks Framework to address Domain 2: Selecting and Adapting Mathematical Tasks without seeming to question it. However, some of the TEs might not have encountered this framework were it not for teaching the methods course. The co-planning meetings centered on the details of the course experiences, based on the assumption that the MTF would be used with the interns as a lens for examining curricular materials. It seems that over time the MTF became part of the context, and I entered into the context after that had been established. The MTF seemed to be synonymous with selecting and adapting mathematical tasks and there was
no visible consideration of other ways to analyze tasks or to prepare the interns to select and adapt mathematical tasks (see e.g., Lloyd & Pitts Bannister, 2011). It seems that this may have been a missed opportunity for other boundary objects to be introduced.

**Implications**

This study focused on a portion of the work of these teacher educators during one semester. If this community of practice continued its work, would the boundary objects shift over time, or would new boundary objects be introduced and others fall away? I wonder if the MPCoP had jointly pursued an endeavor to extend the TEs’ knowledge about the MTF if other boundary objects such as research might have played a more prominent role. In addition to considering how boundary objects can change depending on the content focus of the planning, it would also be interesting to consider how changes in boundary objects might impact the resulting course experiences designed by the MPCoP.

While they are specific to this MPCoP, the boundary objects in this study relate to other researchers’ frameworks. Had the focus of the group’s work been on teaching mathematics to the preservice teachers, we may have seen an emergence of the categories of knowledge in Zopf’s (2010) Mathematical Knowledge for Teaching Teachers as boundary objects. Kennedy’s (2002) framework for teacher knowledge focused on tracing the origin of the knowledge to craft, prescriptive, and systematic sources. This framework offers a lens for acknowledging both practitioner and academic expertise, and may be helpful in reflecting upon shared knowledge as a group. Chauvot’s (2009) knowledge map includes *subject matter content knowledge, pedagogical content knowledge, curricular knowledge, knowledge of context, and research knowledge*. While
her map examined the influence of her career path on her individual work as a mathematics teacher educator-research, I created shared categories of expertise from a particular team of people doing particular work. Although there are overlaps in the categories, such as curricular knowledge, knowledge of the context, and research knowledge, Chauvot’s categories were specific to her expertise and the categories developed in this study were specific to the MPCoP. However, there may be value in constructing individual, perhaps simplified maps, to create opportunities for discussion among TEs within a community of practice.

**Non-Boundary Objects and Boundary Brokers**

The non-boundary objects in this study did not influence the MPCoP in ways that were accessible in the group’s work, although some individual members identified them as influencing their contributions to the co-planning. I accounted for those areas of professional expertise that were deemed influential and important for individuals but did not affect the entire group in a noticeable way by discussing them as non-boundary objects. Teaching mathematics conceptually is an area of professional expertise that seemed to underlie the MPCoP’s work, but was not explicitly discussed. Perhaps this lack of presence is unsurprising given the focus of this study was on the team’s planning to prepare preservice teachers to select and adapt mathematical tasks. During the observed portions of the meeting that comprise part of my data, the MPCoP planned course experiences for the interns to become familiar and proficient with applying the levels of cognitive demand of the Mathematical Tasks Framework (Stein & Smith, 1998) to
analyze mathematical tasks, rather than focusing on teaching the interns mathematics content\textsuperscript{1}.

The non-boundary objects in this study illustrate how an area of expertise can be brought to the table by a team member yet may or may not become a boundary object, an area that is explicitly shared and accessible to the team. Non-boundary objects have the potential to be boundary objects, however, they need a boundary broker to share them with others in a way that connects to the overlaps among communities of practice. For example, Olivia’s research expertise (e.g., knowledge of studies such as Drake, Land, & Tyminski, 2014; Stein et al., 2009) seemed to act as a non-boundary object. Drawing on her research knowledge and experience, as reported in an interview, Olivia developed the framework for the methods course curriculum, which included a domain about selecting and adapting mathematical tasks, the focus of this study. Yet, Olivia did not explicitly share this research expertise in co-planning meetings, nor did team members ask her to.

Olivia expressed in an interview that she valued the expertise of her fellow team members. It is possible that she was trying to honor practitioner expertise but did so at the expense of sharing academic expertise that only she held. Martin, Snow, and Franklin Torrez (2011) report on the challenges of working with mentor teachers in a third space where their relationship with these teachers depended on the mentor teachers’ perceptions of them. Olivia may have intentionally minimized her academic expertise to maintain stable relationships with other teacher educators within the MPCoP.

\textsuperscript{1} This was part of Domain 1: Doing and Learning Meaningful Mathematics, a domain of the course curriculum that was not included in this study.
Perhaps the other TEs did not ask Olivia to share her research expertise because of a lack of membership in academic communities of practice for which research expertise is a boundary object. Labaree (2003) contends “to move from being a teacher to being a researcher...constitutes a major change in occupational role and requires an accompanying change in professional priorities” (p. 18-19). The other team members may not have undergone this change and may have, perhaps unintentionally, distanced themselves from communities of practice that value the development of research expertise by focusing on developing practitioner knowledge. Although Sara and Ainsley had experiences with research, they each had far greater experience with elementary teaching – a highly valued experience in the PDS community.

Sara and Colleen seemed to be able to capitalize on their membership within communities of practice for elementary school teaching. In contrast, Ainsley may have experienced a marginalization of her expertise as an elementary teacher. E. Wenger-Trayner and B. Wenger-Trayner (2015) describe this marginalization in their work that crosses boundaries between consulting and the academy, “Often our identification with being both theorists and practitioners is not fully expressible in either a consulting assignment or in an academic discussion” (p. 25). It may be that Ainsley found it difficult to express the expertise she held about teaching mathematics to children in the context of this study. Her expertise in about elementary school teaching may have emerged in co-planning for a different domain of the methods course curriculum.

It is possible that Olivia’s role of a boundary broker was less important for the MPCoP to function than it might have been in other communities of practice because Ainsley, Colleen, and Sara expressed an overlap between their experiences in teaching
elementary school and their work in co-teaching the methods course. Perhaps because of this overlap, the team did not seem to justify decisions apart from small disagreements about sorting tasks by level of cognitive demand (e.g., Vignette A.5) and instructional details (e.g., Vignette C.7). By contrast, Bleiler (2015) examined the collaborative work of a mathematics teacher educator and a mathematician and Bleiler reports:

The actual act of team-teaching, and having to negotiate instructional decisions, caused [the mathematics teacher educator] to reflect even further on the need to articulate her rationale for professional practice. [The mathematics teacher educator] felt she needed to develop a rationale that not only would be supported from within her community, but that also would be accepted by her co-instructor whose instructional goals were often more strongly tied to “content coverage.” (2015, p. 239-240)

It seems that the MPCoP could function without the kind of rationale described by Bleiler, however, it is possible that not everyone understood the work at the same level. This reliance on overlapping expertise among members of the MPCoP may have limited the TEs’ exposure to academic or theoretical expertise.

**Implications**

While Olivia’s academic expertise influenced her co-planning, it remained tacit to the MPCoP. In some ways, Olivia possessing and privately using this expertise to guide her planning may be analogous to how textbook writers’ design may be research- or theory-driven but their decisions are often hidden from the teachers implementing the curriculum (Remillard, 2000; Stein & Kim, 2009). Research suggests that teachers can learn from curriculum materials (Collopy, 2003; Remillard, 2000; Roth McDuffie & Mather, 2009). Kauffman et al. (2002) note that new teachers need support in learning to teach and that “the curriculum and its associated materials are potential sources of this support, and they play important roles in teacher development” (p. 274). In this study,
Ainsley in particular, but also Colleen and Sara were novice teacher educators, and perhaps could have benefitted from an explicit sharing of the reasoning behind Olivia’s decision-making.

Presumably, we need individuals to foster productive collaboration through boundary spanning roles in order to share expertise as boundary objects within any new community of practice. Who can we expect to serve as boundary brokers within third spaces? What supports are needed for a TE such as Sara to assume a boundary-spanning role (Martin, Snow, & Franklin Torrez, 2011) as coordinator between the school district and the university? In the case of Olivia, whose academic expertise was marginalized within the MPCoP, it would be important to consider how to support her boundary-spanning work that navigates potentially delicate relationships between the school and the university.

Labaree (2003) points out, “The problem is that research is defined as a central part of the professor’s job but not the teacher’s” (p. 18). Research seems to have a higher status; while insights from and the value of practitioner expertise are not to be ignored, researchers are considered to be positioned better to evaluate and situate this expertise within a broader context (Labaree, 2003). Boundary spanning roles are complex and require careful navigation of the multitude of relationships (Martin, Snow, & Franklin Torrez, 2011). Boundary brokers (Wenger, 1998) wrestle with the tension of sharing expertise with others who do not belong to the same communities of practice as themselves. However, boundary brokers are necessary for the exchange of information across communities (Sztajn et al., 2014; Wenger, 1998). This exemplifies the complexity of integrating academic and practitioner expertise.
Communities of Practice for Developing as a Teacher Educator

Research shows that it takes time to develop as a teacher educator (Dinkelman, Margolis, & Sikkenga, 2006; Murray & Male, 2005). Although the larger PDS may have provided an additional community of practice that supported the development of teachers becoming teacher educators, the MPCoP in this study may not have necessarily been an environment to support that development. The PDS setting for this study rotated the school-based TEs out of their positions as co-planners and co-teachers of the methods courses within three years, and graduate students, by the nature of their program, may not work in the same position year-to-year. Within the MPCoP, Sara and Olivia were the more permanent TEs assigned to the group and had the most experience in teacher education, but they did not participate in the MPCoP in the same way.

There are various paths to becoming a teacher educator (Berry & Van Driel, 2012). Ainsley, Sara, and Colleen drew primarily on their practitioner expertise as elementary mathematics teachers as they engaged in offering strategies for effective teaching. Their work in the schools emerged as influencing the ideas that they shared and the decisions that they made within the MPCoP. Colleen and Sara both seemed to embrace and depend on their membership in communities of practice related to elementary schools. This is perhaps unsurprising for Colleen as she was a tourist in the MPCoP (Fenton-O’Creevy, Brigham, Jones, & Smith, 2015); she moved from a classroom teaching position to work as a mathematics teacher educator alongside the others for a limited period before moving back into her classroom the year after this study. Similar to undergraduate students progressing through their programs of study at the university, Colleen was “just visiting” (Fenton-O’Creevey et al., 2015) the MPCoP;
her trajectory through the group had an endpoint returning to the classroom. Sara, on the other hand, possesses some academic expertise and occupies a role that seems to warrant facilitating boundary spanning as the coordinator between the university and the school, yet the expertise she shared with and drew upon in the MPCoP was largely practitioner in nature.

Berry and Van Driel (2012) report on the impact of varied entries into the role of teacher educator on the type of expertise shared among teacher educators. These researchers suggested, “TEs with a long history as a schoolteacher and little or no research experience usually displayed a more pragmatic type of expertise” (p. 125). This is consistent with the results of this study in which the co-planning was dominated by the pragmatic work of determining instructional details, guided by practitioner-orientated areas of expertise. Martin, Snow, and Franklin Torrez (2011) detail the complex, boundary-spanning work of teacher educators in a PDS. This study extends the work of these researchers by examining teacher educators with diverse entry paths into the profession as they work in a boundary-spanning third space. Assigning a teacher to co-teach a mathematics methods course does not necessarily mean that she will become a mathematics teacher educator. Similarly, the presence of a university researcher is not a sufficient condition for research to become a boundary object in a community of practice.

Implications

In the findings, I suggested that three members of the MPCoP participated in the group’s work while relying on memberships in other communities of practice, particularly elementary teaching. As discussed in Chapter 2, Labaree (2003) points out differences between teachers and university faculty:
Teachers and researchers not only find themselves in two very different institutional contexts—the public school and the university—but they also frequently ‘frequently carry with them sharply contrasting worldviews that arise from the distinctive problems of practice they encounter in their respective roles (p. 16)

Ainsley, Colleen, and Sara spent the majority of their careers up to the time of this study in elementary school teaching positions. While the work of the MPCoP may have offered new problems of practice, it seems that these TEs were satisfied to draw upon their experiences as elementary teachers to solve them. Successfully drawing upon this knowledge may have limited the appeal of extending existing expertise through engagement with theory. This raises the question, what would it take for the TEs to embrace exposure to new communities of practice in their professional work?

The MPCoP focused on cultivating in the interns a critical eye for examining curricular resources for teaching mathematics to elementary students through the application of the MTF. In their own work developing methods course experiences, what would have happened if the MPCoP examined their own resources with such a critical eye? If the TEs had engaged with readings and other TEs’ plans for preparing preservice teachers to select and adapt mathematical tasks, perhaps they would have generated other ideas for their own methods course experiences, and this might have been a new opportunity for learning within the MPCoP. Further, it seems that new areas of expertise as boundary objects might have emerged as the entire team gained access to the potentially new information.

In Chapter 5, I presented a diagram of the areas of professional expertise that seemed to be influential in the MPCoP’s co-planning of methods course experiences for preparing preservice teachers to select and adapt mathematical tasks. As previously
discussed, I identified these areas as boundary or non-boundary objects. This MPCoP 
experienced the marginalization of some areas of professional expertise. I wonder if a 
group of TEs could construct a diagram similar to the one I shared in Figure 5-1 of 
Chapter 5 as a way to consider what knowledge is most drawn upon in their community 
of practice, and what knowledge remains outside of the group’s work. For example, see 
Appendix B for a research informed protocol to guide co-planning. This may be a way to 
facilitate dialogue in a non-threatening way that might allow for boundary brokers to 
contribute other areas of professional expertise or to introduce new boundary objects.

Reflections and Future Work

As discussed, the boundary-spanning work of hybrid teacher educators is 
complex. This study examined a specific portion of the co-planning of hybrid teacher 
educators. In this chapter I have offered implications for future research and teacher 
education. As I reflect on my own study, I recognize that there are areas that I could have 
further explored to gain more depth. For example, when I developed the slam books for 
collective reflection on developing methods course experiences, I could have focused on 
the course experiences that were planned during the meetings I recorded. At the time, I 
was attempting to access planning that had occurred outside of the group meetings. 
Another way to gain further insights would be to follow up with more interviews with 
participants, and even to examine collaborative work of the individual TEs in other 
settings, for example, following Colleen into her communities of practice for elementary 
teaching as she transitioned back into her position as a classroom teacher. Finally, I could 
have broadened the study to include the co-planning for all of the domains of the course
curriculum, which would have given me a deeper understanding of the collaborative work of the MPCoP overall.
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Appendix A

List of Acronyms and Members of the PDS

CoP – Community of Practice
CPA – Co-planning Activities
DD – Developing Instructional Details
EG – Establishing Goals
GB – General Brainstorming
MPCoP – Methods Planning Community of Practice
MTE – Mathematics Teacher Educator
MTF – Mathematical Tasks Framework
PDA – Professional Development Associate
PDS – Professional Development School
TAG – Task Analysis Guide
TE – Teacher Education

Interns – university undergraduates participating in full-year student teaching internship in the PDS
PDAs – reassigned or retired classroom teachers, graduate assistants, university faculty working in the PDS to teach and/or supervise interns
Instructional coaches – district employees assigned to provide instructional support implementing subject-specific curriculum (e.g., mathematics)
Appendix B

Research-Informed Protocol for Co-Planning

1. What are the goals for the co-planning session?

2. What initial ideas do I have for meeting these goals?

3. What expertise am I drawing upon in co-planning? What expertise do I have that I am NOT drawing upon in co-planning? [Fill in the circles in the diagram below with the areas of expertise you are drawing upon during your group’s work, and the areas of expertise you hold but are NOT drawing upon in co-planning.]

4. What could our group do to bring outside expertise into planning work?
VITA

Courtney Lynch

Education
Ph.D., Curriculum & Instruction [emphasis in Mathematics Education] (August 2017), The Pennsylvania State University, University Park, PA
M.S., Instructional Technology (September 2011), Saint Joseph’s University, Philadelphia, PA
B.A., Spanish (May 2008), Bucknell University, Lewisburg, PA

Award, Fellowships, & Scholarships
Graduate Student Recognition Award (2017), The Pennsylvania State University
Donald B. & Mary Louise Tait Scholarship in Mathematics Education (2014-2017), The Pennsylvania State University
Graduate Student Travel Grant (2014, 2015, 2016, 2017), The Pennsylvania State University
Susan Gay Conference Travel Scholarship (2014), Association of Mathematics Teacher Educators
Graham Endowed Fellowship (2012-2013), The Pennsylvania State University

Professional Experiences
Graduate Assistant (August 2012-May 2017), Department of Curriculum & Instruction, The Pennsylvania State University, University Park, PA
Teacher [various positions] (September 2010-June 2012, May-June 2014, May-June 2017), Strath Haven Middle School, Wallingford, PA
Gifted Education Instructor (September 2010-June 2011), Wallingford Elementary School, Wallingford, PA
Spanish Teacher (August 2008-June 2010), Oxford Area High School, Oxford, PA

Publications

Selected Presentations