INQUIRING ABOUT STUDENT WORK IN A PROFESSIONAL DEVELOPMENT SCHOOL CONTEXT: A CASE OF CROSS-ROLE TRIADS

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by
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This study is a case of cross-role triads - mentor teacher, intern, and supervisor - engaged in looking at student work in elementary mathematics over time in an elementary professional development school (PDS) setting. This study represents a significant effort to identify factors that impact teachers’ inquiry process of planning, implementing, collecting, and analyzing student work. By recognizing and understanding these factors, we gain new insights into fostering the development of effective PDS triad relationships.

This qualitative research study used case study methodology as an investigative tool to analyze the talk in a series of PDS triad conversations. The primary source of data collection was a series of audio-recorded triad meetings. Other data sources included student learning data (student work) and the researcher’s reflexive journal. The data suggested that when the understanding of student learning data was foregrounded as the primary task of all three triad members, advances in student learning across the study cycles were more clearly visible in the student work. The findings also indicated that the quantity and substance of intern participation in the inquiry process varied across the triads. And finally, the data supported the notion that the triads differed substantially in their conversations in regards to how clearly they connected place value concepts expressed in the student work to the Common Core State Standards for that grade level.

This research has implications for teacher educators and school district leaders responsible for developing meaningful professional development opportunities that involve collaborative groups of preservice and inservice teachers engaged in an inquiry process to examine student work. (271 words)
Keywords: inquiry-oriented talk, looking at student work, professional development schools, collaborative inquiry groups, professional development school triads, elementary mathematics education
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CHAPTER I: INTRODUCTION TO THE PROBLEM

If teachers are to be effective, they must work in settings where they can use what they know—where, for example, they can come to know students and families well; work with other teachers to provide a coherent, well-grounded curriculum; evaluate and guide student progress using information-rich assessments; and use texts and materials that support thoughtful learning. (Bransford, Darling-Hammond, & LePage, 2005, p. 4)

These are ambitious and noble goals for teacher educators and school administrators responsible for preparing teachers to work in schools today in the United States. Unfortunately, given the current demands placed upon teachers, providing supportive work environments for teachers has become tremendously challenging. In the current era of accountability and increased pressure to raise student achievement scores, teachers find themselves struggling to find the energy, motivation, and time to be reflective practitioners. Given the task of addressing district requirements, state standards, and Common Core State Standards (June, 2010), many teachers feel that there is little time left to practice being “life-long learners, raising questions and researching their practice across the professional career” (Cochran-Smith, M., Barnatt, Friedman, & Pine, 2009, p. 1). Now more than ever, it is important to consider ways in which teachers can be encouraged to come together in collaborative settings to reflect on their teaching in meaningful ways and make important decisions about their practice.
Looking at student work (LASW) is one vehicle through which teachers can enhance collaboration and improve student learning. “Professional development practices such as LASW engage teachers in data-based inquiry and analysis of their own work and practice, simultaneously promote inquiry and reflection and are deeply rooted in action-oriented exploration of professional practice” (Easton, 2004, p. 163). This study used the practice of examining student work as the focus of the analysis of the PDS triad conversations.

Chapter 1 begins by describing the topic and purpose of the study. A discussion of the mathematics that was at the center of the professional development school (PDS) triads’ work is presented and ways in which this research fills a critical gap in the literature is shared. Next, the task assigned to the PDS triads is outlined, with a detailed description of the study cycle. The chapter ends by presenting the research questions and the definitions of terms germane to the study.

Topic and Purpose

This study was conceived in part by the research of Nelson, Slavit, and Deuel (2012) who examined the inquiry orientations displayed by secondary mathematics and science teacher teams engaged in the process of examining student work over a period of seven years. The present study examined similar patterns of behavior displayed by three K-4 professional development school triads - mentor teacher, intern, and supervisor - over the course of one fall semester. This study has implications for professional development school triads and other collaborative groups comprised of participants in diverse roles e.g., school data teams, IST support teams, parent/teacher/student conference groups. The study looked at how the
participants interacted with each other, how they supported and learned with each other, and how they dealt with struggles and successes of fostering an authentic collaborative context in which all voices, no matter what the level of experience of expertise, were heard and respected. Hence, this study contributes to the literature by providing new research about how rich conversations of PDS triads in practice can provide fresh insights into the work of collaborative inquiry groups in which the members hold multiple levels of expertise and experience.

Each PDS triad engaged in an inquiry process of planning, implementing, collecting, and analyzing data about students’ understanding of grade level place value concepts. The dialogue of the inquiry process was explored across four focus areas: the substance of the conversations, the mathematics in the student learning data, the orientation toward inquiry, and the role identification of the triad members. (See Figure 1.1)

![Conceptual framework overview](image_url)

Figure 1.1. Conceptual framework overview.
Number and operation: place value. According to the Principles and Standards for School Mathematics (National Council of Teachers of Mathematics, 2000), “Foundational ideas like place value…should have a prominent place in the mathematics curriculum because they enable students to understand other mathematical ideas and connect ideas across different areas of mathematics” (p. 15).

The elementary classrooms in which this research study was situated were required by the school district curriculum office to address the Common Core State Standards for mathematics (National Governors Association Center for Best Practices, 2010). Understanding place value is an objective statement for the Standard: Number and Operations in Base Ten in the Common Core State Standards. The goals for understanding place value are described in the following manner for the three grade levels represented in this study.

- Kindergarten: Work with numbers 11-19 to gain foundations for place value.
- Grade 2: Understand place value; use place value understanding and properties of operations to add and subtract.
- Grade 4: Generalize place value understanding for multi-digit whole numbers; use place value understanding and properties of operations to perform multi-digit arithmetic

“The evidence indicates that U.S. children do not learn place-value concepts or multi-digit addition and subtraction adequately and even many children who calculate correctly show little understanding of the procedures they are using” (Fuson, 1990, p. 273). The current research examined both how the teachers’ understanding
of place value concepts impacted their instructional planning and how students
demonstrated their understanding of place value in their work.

Participants were provided with background information and standards
expectations of grade level place value concepts K-5. Thus, place value provided the
thread of foundational mathematics that spanned the grade levels in the study.
Although support for understanding place value expectations at each grade level was
provided, this research uncovered unexpected challenges for some triad members in
understanding the instructional role that place value played in the teaching of
mathematics at their grade level.

Study Description – The Task

In the fall of 2013, there were 48 interns in this particular professional
development school partnership. All 48 PDS interns completed one cycle of the
project study cycle with their mentors to meet the requirements of an assignment for
their elementary mathematics methods course, A6 - Student Assessment Project. (See
Appendix A) Three of the 48 interns, along with their mentors and supervisors,
formed the three PDS triads who voluntarily agreed to participate in the current
research study. These three triads completed two additional study cycles, or a total of
three study cycles.

This study examined the conversations of the three PDS triads - mentor
teacher, intern, and supervisor – mentioned above, who looked at student work in
elementary mathematics (place value concepts), determined what the student
understood, and made decisions about future instructional practice based on curricular
goals. The conversations focused on a “puzzling” student in the triad’s classroom. A
“puzzling” student was a student whose understanding of place value concepts caused wonderings by his/her teacher(s) in terms of how to plan future instruction. The primary source of data was audio-recorded conversations of the three PDS triads over the course of three study cycles during the fall semester of 2013. The mentor teacher was asked to take the lead in organizing the triad meetings for each study cycle. The intern took responsibility for gathering and/or administering the student work and sharing it at the triad meetings. The supervisor was invited to participate in the monthly triad meeting conversations.

Nelson, Slavit, and Deuel (2012) conducted research that investigated how educators work together using “evidence-based decision making as a means for improving teaching and learning” (p. 3). They looked at “groups of teachers in reflective inquiry about student learning data, instructional practices, and curricular goals” (p. 3). These researchers developed two frameworks that represent two dimensions of an inquiry stance demonstrated by collaborative teacher groups while examining student learning data. One framework described the dimension of an epistemological stance; the other framework described the nature of the dialogue. To match the unique characteristics of the current study, an inquiry-oriented talk framework was developed by making adaptations to the Nelson et al. (2012) nature of the dialogue framework. (See Appendix B)

**The study cycle.** The study cycle (See Figure 1.2) began with each triad convening to identify a “puzzling” student, determine his/her needs, and decide on 2-3 samples of student work that the intern would collect or administer. The intern was responsible for administering the student work and bringing the results to the second
meeting of the study cycle. At the second meeting, the triad reviewed the results, discussed interpretations, and determined a future instructional plan. The triad repeated the study cycle two additional times, continuing to focus on the same student during each cycle. All triad meetings were audio recorded and transcribed. These audio recordings represented the primary source of data for the study.

Figure 1.2. The study cycle.

**Research Questions**

“The function of your research questions is to explain specifically what your study is intended to learn or understand” (Maxwell, 2013, p. 75). It is important to constantly revisit the research questions to make sure the focus remains constant and to provide guidance for the way in which the study is conducted. Mason (2002) suggests that if one thinks of your study in terms of a puzzle, “it will be a relatively easy task to formulate a set of research questions” (p. 19). Rather than testing a hypothesis in a quantitative study, qualitative research explores and develops ideas. Wonderings are pondered; stories are told. The research question helps to frame the
essence of the exploration and guides the process of the study. Glesne (2006) summarizes the process in this way, "Thinking about what you do not know, as well as what kind of light you hope to shed, is useful for giving direction to your research endeavor" (p. 29). From these roots, the research question is born.

Central to this research study was the search for evidence of factors in practice that impacted an inquiry process in the triad conversations. First, the substance of the triad dialogues was examined for evidence of talk about student understanding (SU), instructional practices (IP), and student learning behaviors (SLB). Next, the level of interpretation and applicability of the mathematical concept (place value) by the triad was explored in each study cycle. Then, the conversations were analyzed for evidence of an orientation toward inquiry by using an inquiry-oriented talk framework. Further, evidence of the roles played by each triad member was identified, discussed, and compared across triads. Finally, based on these factors, the dynamics of each PDS triad was characterized holistically; and similarities and differences across the three triads were investigated.

The main question of the present research study was:

How do PDS triads inquire into and talk about student work in elementary mathematics over time? What are the factors that impact the outcomes of an inquiry process?

- How do the conversations differ across triads?
- How do the conversations differ across time?

Four sub-questions were:

1. What is the substance, or the focus of the conversations? (student understanding
[SU], instructional practices [IP], student learning behaviors [SLB])?

• How does the substance of the conversations differ across triads?
• How does the substance of the conversations differ across time?

2. How do members of the triad connect place value concepts expressed in student work to the Common Core State Standards?

• How does this connection differ across triads?
• How does this connection differ across time?

3. To what extent do the triad conversations illustrate inquiry-oriented talk?

• How does the inquiry-oriented talk differ across triads?
• How does the inquiry-oriented talk differ across time?

4. How do the roles played by triad members influence the nature of the conversations?

• How do the roles differ across triads?
• How do the roles differ across time?

Summary

This study represented a significant effort to understand the factors that impact the inquiry process of three PDS triads while examining student work in elementary mathematics. Further, it pondered how these factors impacted individual triad members’ patterns of participation and in the triad as a whole. By recognizing and understanding these factors, new insights were gained into fostering the development of effective PDS triad relationships.
Definitions

AIMSweb Test of Early Numeracy (TEN): a research-based assessment used to identify kindergarten and early grade 1 students who may be at risk and to monitor their progress in acquiring early numeracy skills.

Collaborative inquiry group: a group of teachers who collaboratively meet and discuss teaching and learning practices.

Hybrid educators: those educators who cross or span institutional boundaries in their work.

Inquiry-oriented behavior: observable behaviors that define an inquiry process and represent a posturing toward an inquiry stance to teaching. These are behaviors that, over time, may develop into a disposition toward inquiry, or an inquiry stance.

Inquiry process: inquiry as a cyclic process of planning, implementing, collecting, and analyzing data (Nelson et al., 2012).

Inquiry stance: “The term inquiry as stance describes the positions teachers and others who work together in inquiry communities take toward knowledge and its relationships to practice” (Cochran-Smith, Marilyn & Lytle, 2009, p. 120). Often described as a disposition, an inquiry stance is multi-faceted and can be identified by observing inquiry-oriented behavior over time.

Intern: a senior university K–4 education student taking part in a full-year professional development school (PDS) field experience in which the university calendar is abandoned and the district school calendar is followed.
Measures of Academic Progress (MAP): a personalized assessment adapted to each student’s learning level developed by NWEA (Northwest Evaluation Association) a company that develops and markets research-based assessments.

Mentor teacher: the classroom teacher assigned to a university professional development school intern for a full-year field experience.

Place value: In our decimal number system, the value of a digit depends on its place, or position, in the number. Each place has a value of 10 times the place to its right.

Professional development associate (PDA): a university or school-based hybrid educator who can be either university faculty or a graduate student, or reassigned classroom or mentor teacher (Burns, 2012). The PDA is assigned to mentor/intern partners to create a collaborative triad during the full-year field experience. The PDA is referred to in this study as the “supervisor”.

Professional development school (PDS): a specific form of a district-school(s) – university partnership wherein the participants share a commitment (and a responsibility) to improve the education of students in the public schools by simultaneously renewing the lifelong education of teachers and the institutions responsible for that education (Snyder, 1999, p. 136).

Response to Instruction and Intervention (RTII): a multi-tier instructional approach to the early identification and support of students with learning and behavior needs.

Student work / student learning data: data collected on student thinking and learning (Lewis, C., Perry, Friedkin, & Roth, 2012). These two terms are used interchangeably in this study.
Talk categories: categories used to identify types of inquiry-oriented talk found in the dialogue of professional development school (PDS) triads, adapted from the work of Nelson, Slavit, and Deuel (2012).

Triad: the mentor teacher, the intern, and the supervisor (professional development associate - PDA) in a professional development school setting.

Chapter Summary and Preview

Chapter 1 began with a description of the topic and purpose of the current research study. The elementary mathematics that was the focus of the study - grade level place value concepts - was described. Next, the task of the study was detailed, including an explanation of the study cycle that was followed by the participants. The main research question and four sub-questions were outlined. The chapter ended with a list of definitions that explained and clarified terms used in the study.

Chapter 2 will describe the scholarly literature that informed the present research study. Connections to three major bodies of literature will be examined: 1. inquiry in the practice of teaching, 2. teacher groups looking at student work and 3. professional development schools. These areas of research provided the theoretical underpinnings for the current research.
CHAPTER 2: A REVIEW OF THE LITERATURE

A conceptual framework is a skeletal structure of justification, based on previous research and literature. It must be timely and should reflect the current state-of-affairs regarding a research problem.


A conceptual framework helps determine what is relevant to study and why. It often has several sources upon which it draws to make an argument. “The goal of a conceptual framework is to categorize and describe concepts relevant to the study and map relationships among them” (Rocco & Plakhotnik, 2009, p. 122). The framework for this study (See Figure 2.1) was conceptualized by reviewing three major bodies of relevant literature: (1) inquiry in the practice of teaching, (2) teacher groups looking at student work, and (3) professional development schools.
Figure 2.1. Conceptual framework overview.

Much has been written about inquiry in the practice of teaching (Cochran-Smith, Marilyn & Lytle, 1993, 1999, 2009; Dana, 2009; Jaworski, 2006; Nelson et al., 2012; Wells, 2000; Wolkenhauer, Boynton, & Dana, 2011), teacher groups looking at student work (Ball & Cohen, 1999; Langer, Colton, & Goff, 2003; Lewis, C., 2009; Patrizio, 2009; Pugalee, 2001; Slavit, Nelson, & Deuel, 2012), and professional development schools (Abdal-Haqq, 1998; Badiali, 2011; Burton, 2007; Maier & Bump, 2011; Nolan et al., 2009; Patrizio, 2009; Robinson & Darling-Hammond, 1994; Rutter, 2011; Snyder, 1999; Teitel, 2011; Trachtman, 2007). This study is situated at the intersection of these three research arenas. Within the context of a professional development school, each triad - mentor teacher, intern, and supervisor - looked at student work following an inquiry process and explored a student’s
understanding of place value at one of three grade levels - kindergarten, 2\textsuperscript{nd} grade, and 4\textsuperscript{th} grade.

First, the literature on the subject of inquiry in the practice of teaching is reviewed and compared among several experts in the field. This body of literature provided the underpinnings on which this study was conceptualized. Next, the chapter describes the research about how looking at student work (LASW) allows teachers to use authentic evidence to support their understanding of what students know and provides data on which to develop future instructional plans. A history of the origins of LASW and the role it has played since its inception is shared. The last section of this chapter describes the ways in which a professional development school partnership encourages collaboration within the PDS community and sets the stage for preservice and inservice teachers to explore inquiry as a way to view the practice of teaching.

**Inquiry in the Practice of Teaching**

A hallmark of the professional teacher is that he or she is knowledgeable about not only content and pedagogy, but also how to learn from teaching in an ongoing way, how to pose and address new problems and challenges that do not have existing answers (Darling-Hammond & Bransford, 2005) and how to integrate and link different kinds of knowledge to the complex problems of schools and classrooms. (Hammerness, 2006)

Over the last several decades, there has been a dramatic shift in how educators perceive their role in the classroom. In the early 70’s, teachers routinely closed their
doors and worked in isolation. Asking to borrow an idea from another teacher was often frowned upon; teachers were expected to compliment each other’s work but not “copy” it. Fortunately, that is no longer the profession into which preservice teachers are inducted (Professional Standards for Teaching Mathematics, 1991). A professional teacher is still expected to know content and teaching strategies, but is also encouraged to be a life-long learner who works collaboratively with her colleagues and asks tough questions about new and effective ways to teach. Life-long learning comes with a commitment to explore the complexities of the classroom, and a willingness to welcome each new class of students with a fresh perspective.

In the present study, data were collected that impacted the success and productivity of an inquiry process. In order to conceptualize an inquiry process, it was important and necessary to research how others define an inquiry stance and to understand the course of its evolution.

Trachtman (2007) wrote,

Inquiry in teaching and learning may be as complex as a sophisticated action research project that draws on multiple methods and far-reaching dissemination strategies or as simple as a group of teachers and teacher candidates sitting around a conference table debating the merits of student work and the ways in which they might change their practices to enhance students’ performance. (p. 199)

Being a reflective practitioner, as defined by Donald Schon (1987), is an essential condition to accomplish this work. Wolkenhauer, Boynton, and Dana (2011) assert, “Inquiring professionals seek out change by reflecting on their practice”
Although being a reflective practitioner is a fundamental requirement for a teacher possessing an inquiry stance, it is not the only qualifying trait. There is a learning process at the core of developing an inquiry stance that is built on knowledge extracted from daily practice and thoughtfully combined with educational theory. The manner in which this knowledge is processed and used to inform and improve future practice is a key to developing an inquiry stance toward teaching.

**Understanding an inquiry stance.** The term “stance” can be defined as an attitude or mental posturing. It results from a habit of mind that becomes a routine way of thinking and acting and can often be recognized in a public way. Inquiry denotes a quest for knowledge. It is also defined as a close examination of something in a search for the truth. The literature characterizes an inquiry stance toward teaching and learning in a plethora of ways. In fact, the terms used to label this notion often vary from author to author. Because it is a complex idea, it is more useful to *describe* what it means to possess an inquiry stance than to simply offer an explicit definition.

Dana and Yendol-Hoppey (2009) connect the cycles of action research to teacher inquiry. They explain this process as problematizing one’s practice, encouraging teachers to question, try new ideas, systematically analyze evidence related to practice, and share widely. This describes how a teacher might conceptualize an inquiry process and the consequential actions they may take. From this practice, an inquiry stance may emerge, providing “a constant within the ever-changing world of school reform and competing political forces” (Wolkenhauer et al., 2011, p. 402).
Adaptive expertise is another descriptive term in the literature related to teacher inquiry. Hammerness et al. (2005) define this notion as the development of teachers as lifelong learners. The requirements include thinking about teaching differently than how you were taught, being able to think like a teacher, and having the ability to deal with the complexities of teaching. These beliefs and principles begin to provide foundational ideas on which the characterization of an inquiry stance may be understood. It describes not only what teachers do, but also how they think.

Cochran-Smith and Lytle first coined the term “inquiry stance” in the late 1990’s. They viewed this idea as “grounded theory in action” (Cochran-Smith, Marilyn & Lytle, 2009, p. 119). An inquiry stance placed teachers at the center of questioning their own practice and resulted in the metamorphosis of teaching and learning.

In the discourse of qualitative research, “stance” is used to make visible and problematic the various perspectives through which researchers frame their questions, observations, and interpretations of data. In our work, we offer the term inquiry as stance to describe the positions teachers and others who work together in inquiry communities take toward knowledge and its relationships to practice. (p. 288)

In Cochran-Smith and Lytle’s (1993) book, Inside/Outside, the authors explore a “redefinition of the notion of a knowledge base for teaching” (p. 43). As teachers are encouraged to come together to talk about their practice and learn from
each other, they “build knowledge collaboratively” (p. 45). This may be referred to as “local knowledge in and for their own communities” (p. 52).

As teachers engage in reflective thinking about their practice, they are acquiring knowledge about teaching and learning. Cochran-Smith and Lytle (1999) proposed three significantly different conceptions of “teacher learning based on an understanding of the relationship of knowledge and practice” (p. 253). It is useful to consider the following three conceptions when examining the components of teacher learning: knowledge for practice, knowledge in practice, and knowledge of practice. An inquiry stance is the keystone for the thoughtful interweaving of these conceptions of knowledge and practice.

**Knowledge for practice.** The first conception is described as knowledge for practice, sometimes referred to as “the knowledge base” (Cochran-Smith, Marilyn & Lytle, 1999, p. 253). This usually refers to content or subject matter knowledge, but may also include ideas such as knowledge about pedagogy, classroom organization, assessment, or teaching as a profession (p. 254). For example, a district might bring in an outside expert on designing rubrics. Teachers are asked to bring samples of their students’ work to the session. The expert guides the teachers in applying the principles of rubric development to their students’ work. School district administrators frequently try to develop this type of knowledge for practice in professional development offerings. These offerings are often mandated for all teachers and are not necessarily catered to individual students or classrooms. Knowledge for practice might also be acquired from reading a professional journal, listening to a webinar online, or drawing on ideas from college coursework. Teachers
acquire knowledge for practice from outside the classroom and apply it to their practice inside the classroom. When knowledge for practice is privileged, knowledge that is developed by practitioners themselves within their daily practice is less rigorous and therefore less valuable in making instructional decisions.

**Knowledge in practice.** The second conception is called knowledge in practice. Cochran-Smith and Lytle (1999) believe that this type of knowledge is developed in or through practice by capitalizing on rich learning opportunities in context, allowing teachers to “deepen their own knowledge and expertise as makers of wise judgments and designers of rich learning interactions in the classroom” (p. 250). This type of knowledge is acquired through deliberate reflection about or inquiry into experience. Teachers reflect on previous situations and make “sense of new situations by connecting them to previous ones” (p. 263). Implicit in this belief that knowledge in practice is the most important type of teacher knowledge, is that knowledge inside the classroom is disconnected from knowledge outside of the classroom. In other words, teachers may demonstrate that knowledge for practice is not as highly valued as knowledge in practice when making instructional decisions. Decision-making is constructed organically from knowledge within the classroom through thoughtful reflection on practice. Zeichner and Liston (2010) presume that reflective teaching involves “a commitment by teachers to internalize the disposition and skills to study their teaching and become better at teaching over time, a commitment to take responsibility for their own professional development” (p. 6).

**Knowledge of practice.** The third conception is more complex. Knowledge of practice is generated when collaborative groups of teachers come together to
investigate and improve their practice, taking both theory and practical experiences into account. Cochran-Smith and Lytle contend that this type of knowledge is the stepping-stone toward the development of an inquiry stance. According to Cochran-Smith and Lytle (1999), in this conceptualization there is no longer a distinction between formal (for) and practical (in) knowledge; there is no distinction between expert and novice teachers. Both knowledge for practice and knowledge in practice are viewed as valuable and important through this lens. All players examine all types of knowledge and “through inquiry… make problematic their own knowledge and practice as well as the knowledge and practice of others and stand in a different relationship to knowledge” (p. 273). In this phase, it is the thinking, acting on, interpreting, and interrogating that transforms knowledge for practice and knowledge in practice into knowledge of practice. There are many activities, formal and informal, in which knowledge of practice may develop, e.g., from co-teaching or peer teaching, participating in Critical Friends Groups, or looking at student work in collaborative inquiry groups. In contrast to knowledge for practice and knowledge in practice, which tend to be linear in nature, knowledge of practice is a cyclical process in which all types of knowledge are consistently interrogated and refined.

**Knowledge of practice and inquiry stance.** Knowledge of practice and an inquiry stance are similar in that in both conceptualizations, the lines between theory (for) and practice (in) are blurred. There is no longer a distinction between the two; both theory and practice are considered equally important concepts to inquire into and question. Knowledge of practice and an inquiry stance also share the assumption that “beginning and experienced teachers need to engage in similar intellectual work”
(Cochran-Smith, Marilyn & Lytle, 1999, p. 293). The belief is that there is not a hierarchy in which the beginning teacher strives to become like the experienced teacher.

On the other hand, there are differences between knowledge of practice and inquiry stance. Knowledge of practice is a product (teacher knowledge) that is generated from inquiry in action. In contrast, inquiry stance is a disposition; it is sometimes described as a habit of mind or a prevailing tendency. It is the mindset that drives the inquiry process leading to the development of knowledge of practice. Cochran-Smith and Lytle (1999) use the term stance to make the point that an inquiry stance is “intended to capture the ways we stand, the ways we see and the lenses we see through” (p. 288). It evolves over time, building on consistent and routine instances of knowledge of practice. In their words, “Teachers and student teachers who take an inquiry stance work within inquiry communities to generate local knowledge, envision and theorize their practice (knowledge in practice), and interpret and interrogate the theory and research of others (knowledge for practice)” (p. 289).

**Understanding an inquiry process.** These three conceptions of knowledge have connections to how other researchers conceptualize reflection, inquiry, and the possession of an inquiry stance. For example, Wells (2000) believes that a stance toward inquiry is not a “once in a while project” or a method that is implemented from a preformulated script. Wells (2000) argues, “On the contrary, it is the stance that pervades all aspects of the life of a classroom community” (p. 12). The strategy of teaching from a preformulated script could be considered knowledge for practice. It is an idea that is taken from a knowledge base and applied to a classroom.
Furthermore, a “once in a while project” could be defined as knowledge in practice. It might be a project from which teacher learning is constructed by examining the results in practice. Wells might suggest that knowledge is developed by “the teacher researcher who not only reflects on his or her practice but also systematically makes changes and collects and critically evaluates evidence about the consequences” (p. 12).

Wells argues that these ideas alone, however, do not necessarily constitute an inquiry stance. He believes, as others do, that it is much more. “Knowledge is created and recreated between people, as they bring their personal experience (knowledge in practice) and information derived from other sources (knowledge for practice) to bear on solving some particular problem” (Wells, 2000, p. 13). When all these components of knowledge and practice (for, in, and of) intermingle in thoughtful reflection on a regular basis, action is taken and a stance, or way of being, may begin to emerge.

Jaworski (2006) also distinguishes between three forms of inquiry practice that parallel those of Cochran-Smith and Lytle (1999). These three forms are (1) inquiry in content (knowledge for), (2) inquiry in teaching (knowledge in) and (3) in the development of teaching (knowledge of). She argues that “theories (knowledge for practice) help us to analyze, or explain but they do not provide recipes for action; rarely do they provide direct guidance for practice” (p. 188).

Jaworski sees teaching as a social practice in which teachers are practitioners. Simply put, they are doing the work of being a teacher in the classroom. Similar to Cochran-Smith and Lytle’s knowledge in practice, Jaworski (2006) defines the notion
of teaching as learning in practice. As theories (for practice) are merged with
learning in practice, Jaworski advocates that a shift occurs from learning within a
community of practice to forming a community of inquiry where all participants are
learners (knowledge of practice).

Jaworski (2006) believes that this shift to a community of inquiry takes place
over time as members who are “in reflective development of practice” (p. 204) look
critically and seek to modify their practice through “their own learning–in-practice”
(p. 204), or what Cochran-Smith and Lytle would call knowledge in practice. This
reflexive stance creates a cyclical relationship between reflection and practice. As
these communities of inquiry engage in rich discussions of issues and tensions, there
is not necessarily a promise that solutions will be discovered. Instead, as Jaworski
(2006) argues, the power is in being open-minded and sharing a sense of purpose to
recognize the issues and to work collaboratively to address them. When this becomes
a habitual, or routine, way of thinking and acting, an inquiry stance may eventually
evolve.

Nelson, Slavit, and Deuel (2012) “use stance in relation to the habits of mind
or ways of being that underpin teachers’ group processes” (p. 10). Nelson et al. draw
upon Jaworski (2006) to define the term inquiry stance as a way of being, situated
within the context of the collaborative group. They describe two key components or
influences on an inquiry stance: (1) the epistemological stance that the group takes
toward looking at student learning data and (2) the nature of teachers’ dialogic
interactions as they engage in phases of the data process. In their framework,
knowledge for practice is found at one extreme of a continuum. This is characterized
by traditionally held beliefs and values of the group that inform and influence the majority of decisions made about student understanding and future instructional practices. Situated in the middle of the continuum, groups begin to broaden their vision as they consider classroom experiences that may affect their decision-making. This might be referred to as knowledge in practice. Finally, when an inquiry approach to teaching is taken (the other extreme of their continuum), there is reflective dialogue that includes both knowledge for and knowledge in practice, or what Cochran-Smith and Lytle call knowledge of practice. Nelson et al. describe these interactions as an inquiry process. They would argue that an inquiry process is different from an inquiry stance. An inquiry process is the action that can be identified and described; an inquiry stance is a disposition. This disposition is a “way of being” that evolves from the enactment (or the inquiry process).

**Researching an inquiry process.** Although the present study looked at PDS triad conversations over several project study cycles, the time span of the study was inadequate to make claims about the existence of an inquiry stance. An inquiry stance, or a disposition toward inquiry, in some cases may take several years to evolve and develop. This study did, however, examine how the triad members began to build knowledge about what a student understands and what instructional strategies seemed to be most successful by engaging in an inquiry process. In other words, the PDS triads constructed knowledge about a particular student by looking at student work and discussing the relationship of that knowledge with ideas for instructional practice. Similar to what Cochran-Smith and Lytle (1999) refer to as knowledge of practice, this inquiry process of knowledge building was the focus of the present
Whereas there is much written in the literature about an inquiry stance, there is less written specifically about what the behaviors of an inquiry process look like in practice. Hence, this research makes an important contribution to the literature about the evolution of an inquiry stance by examining an inquiry process in practice.

**Looking at Student Work in Collaborative Groups**

In recent years, organizations engaged in professional development and school reform have begun bringing teachers together to do collectively what they generally do alone: that is, look at student work and think about students’ performance in the classroom. In addition to evaluating a teacher’s instructional relationships with individual students, the purpose of these collaborative efforts is to foster teacher learning, support for professional community, and the pursuit of school reform. (Little, Gearhart, Curry, & Kafka, 2003, p. 185)

In this section, “student work” is defined in the context of collaborative inquiry group (CIG) conversations. Next, two of the more commonly used conversation protocols used to guide the examination of student work are described. Finally, four models or theories that are employed to structure the process of looking at student work as professional development are explained, compared, and contrasted.

Traditionally, teachers have looked at student work in isolation; they review, correct, or evaluate homework, quizzes, tests, projects, and other types of assignments produced in and outside the classroom regularly throughout the school year. They discuss the work with the individual student or perhaps with a parent, but rarely with
colleagues. Typically, they are interested in determining whether the student has learned the content, understands the concepts, or can apply the knowledge to other contexts. Teachers look at student work to determine whether additional instruction is needed or if students are ready to move on to the next unit of study. In recent years, however, there has been significant attention to looking at student work (LASW) in other ways that might produce benefits for teaching and learning (Langer et al., 2003; Pugalee, 2001; Slavit et al., 2012).

In most cases, Critical Friends Groups, or CFGs, is used as a general term to describe a group of teachers who collaboratively meet and discuss teaching and learning practices. Some authors do not use the term, CFG. Other terms such as teacher group, collaborative group, study group, professional learning community or simply group are used in the literature. Acknowledging that the definition of each type of group is slightly different, the terms are used in a similar manner in this chapter. Additionally, “student work” is also referred to as “student learning data” in the literature. The two terms will be used interchangeably in this section of the literature review.

Types of student work. When collaborative inquiry groups, commonly known as CFGs, look at student work (student learning data), they are often looking for evidence to address specific wonderings. The type of student work brought to the group for this purpose can be quite diverse. For example, it might be one, or several pieces of work from one student, the work of several students representing contrasting ability levels, or a class set of student work. Langer, Colton, and Goff (2003) define student work as “any data or evidence teachers collect that reveals
information about student learning, e.g., standardized test data, classroom assessments, writing samples, projects, oral reports, videotapes, pictures or student observation data” (p. 4).

The forms of student work from which to choose are nearly inexhaustible. CFGs use “samples of work students produce or create in the classroom (usually), most commonly in response to an assignment or a task provided by their teacher” (Allen & Blythe, 2004, p. 4). This type of student work usually comes in a physical form. There are many types of artifacts in this format, such as quiz and test data, student assessments, running records or other reading inventories, student writing, group projects, problem solving, visual products, classwork, homework, laboratory reports. For some groups, however, such as a CASL group (Collaborative Analysis of Student Learning), a specific type of data is selected. In the case of a CASL group, one of the goals is “to document students’ progress toward local learning standards” (Langer et al., 2003, p. 11), in which case, assessment data provides the best source.

Ball and Cohen (1999) used a video recording to demonstrate how teacher learning can develop from the examination of student work. By examining a video recording of a third grade math class discussion, teachers discovered that although the students thought that 4/4 and 5/5 were both equal to one, they did not understand that 4/4 and 5/5 were equal to each other. Teachers uncovered the misconception some students held that the pieces in 4/4 were less than the pieces in 5/5 because there were fewer pieces. From this exercise of looking at student work through video analysis, teachers were “disturbed by the children’s misconceptions, enchanted by their imagination, worried about the students’ potential confusions, and concerned over the
teachers’ role” (Ball & Cohen, 1999, p. 15). By examining student work, in this case a video recording, a wealth of teacher learning had the potential to emerge through discussions about the student thinking that was represented.

Slavit and Nelson (2010) write, “Our examination of mathematics teachers’ interactions is framed by their engagement in a collaborative inquiry cycle that focuses on the examination of students’ mathematical work” (p. 202). Sometimes researchers are interested in studying teacher groups who look at student work to determine the effectiveness and usefulness of their work, both in the original context and in application to other situations. The researcher investigates what teachers learn from examining the student work; that is, what is learned about the student, and what is learned about the teaching practices. In other cases, the researcher is interested in the process of examining the student work. Are there specific ways in which the work is examined and discussed that are more useful or productive than others?

For example, Kazemi and Franke (2004) were interested in finding out how teachers can develop a deeper understanding of their students’ mathematical thinking. They collected artifacts of students’ mathematical thinking from the teachers’ own classrooms. “Thus each teacher could speak to how the work was generated and had opportunities to return to their classrooms to clarify their understanding of student thinking or to extend it” (p. 230). The math problems solved by the students were selected for the group by the researchers ahead of time based on the content currently being taught in the classroom. Teachers were encouraged to adapt the problems to be appropriate for their students, however, they were asked to keep the problem structure the same. This provided a common thread in the student work that would drive the
Nelson et al. (2012) claim, “Teacher interactions around student learning data are often fundamental in establishing and refining direction, dialogic tendencies, and overall group perspectives about teaching and learning” (p. 8). The student work, or student learning data, selected by collaborative inquiry groups set the stage for teachers’ dialogue. It played a significant role in shaping the direction in which conversations develop.

**Protocols.** Collaborative inquiry groups, Critical Friends Groups, (CFG), professional learning communities (PLC), and other similarly organized groups often structure their work sessions by choosing a protocol such as those found at the National School Reform Faculty website, [http://www.nsfharmony.org](http://www.nsfharmony.org).

Professional Learning Communities meet on a regular basis and their time together is often structured by the use of a protocol to ensure focused, deliberate conversation and dialogue by teachers about student work and student learning. Protocols for educators provide a script or series of timed steps for how a conversation among teachers on a chosen topic will develop. (Dana, 2009, p. 13).

In a professional context, the word “protocol” has evolved over time to describe a particular kind of group interaction. It is believed by some that when used with fidelity, conversations guided by a protocol will empower educators to learn more deeply about teaching and learning. There are protocols that are written specifically to guide discussion of student work and others to explicitly address
teaching practice and teacher thinking. A typical protocol will address the role of the context, whether participants are observing, interpreting or evaluating and what the focus question will be (Allen & Blythe, 2004). Two protocols that are often used by collaborative groups looking at student work are the tuning protocol and the collaborative assessment conference.

The tuning protocol. The tuning protocol originated from the needs of a group of high schools in the Coalition of Essential School’s Exhibitions Project whose goal was to redesign their student assessment systems (McDonald & Allen, n.d., para 1). This protocol affords teachers an opportunity to examine the results of their own teaching in order to “fine-tune” or improve their teaching practice. When using the tuning protocol, the presenter brings student work and begins the session by asking a focus question. Next, the other participants take time to review the student work and ask clarifying questions. Following this section, feedback is offered while the presenter remains silent. The presenter is then invited to reflect on the feedback without interruption. The session ends with a time for debriefing. Each of the sections is timed; the facilitator is responsible for keeping the group on track with both the timing and the structure of the protocol.

The tuning protocol has been used with teacher groups in a variety of contexts (Little et al., 2003; Nolan & Hoover, 2008; Patrizio, 2009). For example, Patrizio (2009) felt this protocol “worked best for using student work to promote consideration of curriculum design” (p. 169). In Patrizio’s study, a university methods course was redesigned based in part on the results of studying the interactions of preservice teachers using the tuning protocol while looking at student
work (LASW). Results from the study indicated that “LASW provided a structure for collaborative inquiry in which (preservice teachers) could question and make meaning of the intersection of theory and practice” (p. 175). No matter the context, the tuning protocol provides a venue for group reflection. In many cases, strong relationships are formed among group members and a common language builds, developing a sense of trust. This experience often fosters meaningful change, resulting in improved teaching and learning. Little et al. (2003) write about the benefits of using protocols such as the tuning protocol, “(Structuring conversations) was meant to afford certain opportunities for teacher learning, the creation of a professional community, and the pursuit of school reform” (p. 187).

The collaborative assessment conference. Steve Seidel and his colleagues developed the collaborative assessment conference in 1988 as part of Project Zero, an educational research group at Harvard University that examined the development of learning processing in children, adults, and organizations. The protocol was designed to help educators discover greater depth of information about a student, such as intellectual interests, strengths, and struggles (Blythe, Allen, & Powell, n.d., para 1). This protocol encourages the suspension of judgment and the perspective of others to help the presenter consider new perspectives. Nolan and Hoover (2008) write, “Typically, the presenter is confused, frustrated, or stymied by the work and hopes that examination of the work by others will provide new insights and perspectives that will enable the presenter to help the student more effectively” (p. 158).

In contrast to the tuning protocol, the collaborative assessment conference begins without an introduction by the presenter. The group examines the work, takes
notes if needed, and begins a discussion among themselves about aspects of teaching and learning reflected in the student work. They describe what they see, raise questions, and talk about what the student seems to be thinking and understanding. Next, the presenter enters the conversation, shares her perspective, and addresses questions raised by the group. Finally the entire group discusses overall implications for teaching and learning and reflects on the entire process (Blythe et al., n.d., p. 3-4).

When using the **collaborative assessment conference**, participants are able to approach the discussion with an open mind and are not influenced by anyone else’s ideas or opinions about the work. This protocol affords the group a fresh perspective and offers the opportunity to spark useful thinking about teaching and learning that can be applied to other classroom contexts (Allen & Blythe, 2004).

The **tuning protocol** and the **collaborative assessment conference** are only two of more than 250 files that can be accessed on the [nsfharmony.org](http://nsfharmony.org) site by choosing “Protocols and other resources.” This website provides a vast number of protocols for collaborative inquiry groups who are looking for ways to provide structure to their conversations as they examine their practice and explore the work of their students. Following the steps of a protocol can create a balance in the conversation, allow space for all participants to engage in the discussion, and create opportunity for teacher learning (Little et al., 2003). Although groups are encouraged to use the protocols with fidelity, they can also be adapted to meet the specific needs of the group.

**Models and theories.** Slavit et al. (2012) claim, “‘Looking at student work’ has recently emerged as an important process in teacher professional development.
The activity usually occurs during some form of collaborative inquiry, such as a professional learning community or lesson study group” (p. 8). This practice “requires collecting, analyzing, and presenting real data from student work and teacher practice” (Easton, 2004, p. 3). It is an innovative approach to professional development practices that has its roots in the work of writers and scholars from the 90’s.

**Background.** In 1996, Kathleen Cushman, a writer/editor for the Coalition of Essential Schools introduced the process of “looking at student work” to her readers of the *Horace Newsletter*. She shared the story of how 23 heart surgeons in several New England states agreed to observe each other while performing surgeries and then share the strategies they used in their practice. In the two years following this nine-month project, their patient death rate fell by 25%. In the article, Cushman compared teachers to the heart surgeons, as professionals who historically have worked alone. If heart patients could enjoy such remarkable survival rates as a result of collaboration among their surgeons, why couldn’t students similarly improve their achievement rates as a result of the teamwork of classroom teachers?

In October, 1998, the Chicago Learning Collaborative and the Annenberg Institute for School Reform hosted a meeting in Chicago entitled, “Examining Student Work and School Change.” Following this meeting, a number of teachers, administrators, staff developers, and others came together to form an association called *Looking at Student Work* - LASW. They designed a website, [www.lasw.org](http://www.lasw.org), that is committed to sharing ideas and resources to support the practice of “looking at student work.” Their goals included using LASW as professional development, for
accountability, to set standards and to reflect on student learning and development (Seidel, 2013).

Since these beginnings, others have started to explore the merits of looking at student work in collaborative groups. They have discovered that there is not one correct way to structure their time together. However, the lasw.org group believes that, whatever the goals, it is useful for professionals to share resources and ideas to help each other determine the best methods for engaging in the process of challenging their own practice and looking at student work in their own local schools. Those interested in either sharing or accessing ideas and resources are encouraged to visit www.lasw.org.

**LASW as professional development.** Professional development for teachers often falls into one of three categories: 1. direct instruction, 2. mentoring/coaching, or 3. collegial conversation and reflection (Allen & Blythe, 2004, p. 25). In the past, professional development opportunities offered by school districts have often been referred to as “sit and git” or “spray and pray” sessions, falling into category one (direct instruction). In other words, administrators arrange for a guest speaker or a district representative to present a new initiative; and the teachers come and sit and listen. Everyone is expectant that useful learning will take place. In many cases, all district staff members are required to participate: classroom teachers, specialists, support staff, and others. Occasionally, an effort is made to “actively involve” the participants, but in most cases, the take-home message of the day has already been predetermined without their input.
In recent years, some districts have made a greater effort to offer professional development opportunities in which individual teachers’ needs and beliefs are taken into account. Patrizio (2009) argues, “Professional development practices that result in meaningful learning are an imperative for improving school renewal and student achievement” (p. 161). Lois Easton (2008) describes the need for professional learning as opposed to professional development or training. She believes that in today’s complex world, teachers need to do more than develop; they need to be learners, or self-developers. “Educators must be knowledgeable and wise” so meaningful change can take place to meet the demands of today’s society (p. 756).

Other researchers feel that it is important to provide opportunities for teachers to experience professional development situated in their own practice (Ball & Cohen, 1999). To address all of these demands, some districts are providing opportunities for teachers to come together in various forms of collaborative inquiry groups to examine their practice. It is becoming more common for these groups to organize their professional development sessions around looking at student work (LASW) (Kazemi & Franke, 2004).

**Critical Friends Groups.** “Critical Friends Groups, though a relatively recent invention, have grown dramatically” providing an innovative alternative to existing district professional development plans (Nolan & Hoover, 2008, p. 146). In 1994, The National School Reform Faculty of the Annenberg Institute explored the idea of teachers working collaboratively in their local schools to improve student learning and encourage teacher learning. The result was the establishment of guidelines for forming Critical Friends Groups, (CFG) in local schools. CFGs are usually made up
of 10-12 educators who voluntarily meet once a month. These groups are interested in challenging their own practice as they collaboratively look at student work. A trained coach guides the group through the use of conversation protocols. The protocols, such as the examples described above, are accessible for educational purposes at the National School Reform Faculty website, http://www.nsrfharmony.org.

Critical Friends Groups, encourage teachers to look at student work using a different lens. In addition to concern about student achievement and completion of assignments, a foundational belief of CFGs is that equally important is “the process that acknowledges the complexity of teaching and provides structures for teachers to improve their teaching by giving and receiving feedback” (Bambino, 2002, p. 25). In other words, the student work provides the focus for collaborative discussions among teachers. It gives them an opportunity to examine their own practice and make meaningful connections to the student work. Of particular note is that “critical”, in Critical Friends Groups, does not mean judgmental. It means important, essential, or urgent. CFGs provide the context in which teachers can come together to look critically and collaboratively at student work in a productive and meaningful way.

From another perspective, Borko, Whitcomb, and Byrnes (2008) write about Critical Friends Groups, as a way to support practitioner research. Practitioner researchers are individuals who work in the field while conducting research instead of being an academic researcher observing and collecting data from outside the context. Because collaboration is a key feature of this type of research, participation in CFGs provides a collaborative context in which teachers can interact. The researcher is able
to participate and contribute as a member of the group as she concurrently collects data for her research.

The goal of a CFG is to build collaboration and reflection among colleagues while looking at student work. It affords teachers the opportunity to critically examine their own practice through deep exploration of the work of their students. Critical Friends Groups, “can enhance the professional development and classroom practice of individual teachers and transform the culture of the school as a whole” (Nolan & Hoover, 2008).

**Collaborative analysis of student learning (CASL).** Langer, Colton, and Goff (2003) developed a method for studying student work that follows a systematic analysis cycle called Collaborative Analysis of Student Learning or CASL, pronounced “castle”. Similar to CFGs, the goal of CASLs is to help teachers understand how to link their instruction and their students’ learning. This is accomplished by developing a working culture of collaborative inquiry in which teachers become more reflective about their practice (Langer et al., 2003). Over the course of 15 years, the authors combined their expertise and training in Cognitive Coaching, peer coaching, and special education to develop the components of the CASL system (Costa & Garmston, 2002).

There are four major components of the CASL system. First, the framework is research and theory-based, and asks teachers to reflect on “what has happened, why it happened and what to do next” (Langer et al., 2003, p. 12). Second, the culture is one of collaborative inquiry. This component establishes the norms and expectations for open and trusting communication within the group. Third, there is a series of five
CASL phases. These broad goals structure the work of the CASL over the course of 3 – 7 months, beginning with a target learning area (phase 1), moving to the student work (phases 2 – 4), and reflecting and celebrating (phase 5). The final component is facilitation, leadership, and support. Identified leaders in the process are charged with “creating a vision, cultivating the culture of inquiry, fostering collective responsibility for student learning and empowering teachers to change” (p. 155).

Langer et al.’s (2003) “how to” book walks the reader through the steps in establishing a CASL group. It provides suggested resources, facilitator guides, and sample materials. The authors claim that the CASL staff development tool has been transformational to participants over the period of only a few months. The process “cultivates a culture for inquiry…fosters collective responsibility…and empowers teachers to change” (p. 155).

**Transformation of participation.** Kazemi and Franke (2004) used a different approach to examining student work in their study called *transformation of participation*. This approach builds on the work of Rogoff and Toma (1997) who were interested in the notion that “cognition involves a collaborative process as people engage in thinking together with others” (p. 471). These authors believe that both student and teacher learning takes place more productively through shared thinking. Their work contrasts *transformation of participation* with *transmit-and-test*, a dyadic relationship in which the teacher transmits information to the class and interactions take place between the teacher and one student, one at a time.

In Kazemi and Franke’s (2004) work, “analyses were guided by a situated view of learning” (p. 205). They looked at student understanding as it emerged in
activity. In this model, the focus was on the professional evolution and growth of the
teacher group. The individual and the larger context of the professional development
experience were kept in the background. “Analyzing teachers’ collective engagement
with student work, then, reveals not only their deeper knowledge about student
thinking and mathematics but also their developing professional identity as teachers”
(p. 206).

Similar to Critical Friends Groups, this process extends the focus beyond
simply evaluating student work. It supports discussion that fosters teachers’ growth
and professional development as a result of collaborative group interactions. There is
a facilitator present to guide the discussion and the protocols are unique to each
individual study. The focus, however, is on the participation patterns within the
group and how those patterns affect change in teacher practice. This sociocultural
theory of learning defines this change more explicitly as a transformation (Rogoff &
Toma, 1997). In essence, this theory is based on the belief that how you participate,
shapes who you become as an educator.

**Lesson study.** Lesson study is a form of professional development that
incorporates looking at student work into its process. Lewis, Perry, Friedkin, and
Roth (2012) write, “During the research lesson, team members gather data on student
thinking and learning, studying selected students to see how their thinking evolves,
and what aspects of the lesson design enhance or pose barriers to learning” (p. 368).
In this model, there is attention to teacher learning through collaborative lesson
planning, enactment, and observation of the research lesson and post-lesson
discussion. Originating in Japanese classrooms, lesson study groups are “based on a
long-term continuous improvement model” (Stigler & Hiebert, 1999, p. 121) and can be organized either at the local, regional, or national level. Watanabe (2003) describes lesson study in this way: “Lesson study is a shared professional culture, not just a professional development activity” (p. 36). By working in (lesson study) groups to improve instruction, teachers are able to develop a shared language for describing and analyzing classroom teaching, and to teach each other about teaching” (Stigler & Hiebert, 1999, p. 127).

Watanabe (2003) makes five recommendations for emulating the Japanese model of lesson study in U.S. schools. One recommendation that relates directly to student work is for lesson study groups to anticipate students’ thinking. In this component, (mathematics) teachers solve the problems themselves and also predict both correct and incorrect answers in the resulting student work. In the post-lesson discussion, the group unpacks the results from looking at the students’ work by sharing their reflections and observation notes from the research lesson.

In a study conducted within a partnership between a central New Jersey university and neighboring urban school district, lesson study was used to examine the development of algebraic ideas in grade 3-8. Over the course of 4 days of lesson observations, data were collected in multiple ways, one of which was students’ work from the implementation. The goal of the study was to examine “critical examples of the (teachers’) own actions and of their students’ thinking” (Alston, Pedrick, Morris, & Basu, 2011, p. 139). Before the implementation of the research lesson, there was extensive discussion about possible problem solutions. The members of the teacher group completed the student work themselves and also shared the problems with their
own students in order to gather preliminary evidence. It was only after extensive lesson planning that the research lesson was developed and organized for implementation and observation by the lesson study group. In the debriefing session that followed, members of the lesson study group shared their observations and were able to explore the students’ understandings based on the results of the student work.

Stigler and Hiebert (1999) write, “The premise behind lesson study is simple: If you want to improve teaching, the most effective place to do so is in the context of the classroom lesson” (p. 111). Student work is the classroom evidence collected during the implementation of the lesson study lesson. It provides the focus for analytical discussions that guide improvements that are made to the lesson. Marble (2006) claims, “With such strong endorsements, lesson study has gained a solid foothold in U.S. professional development circles” (p. 88). Lesson study can be a powerful strategy for improving teaching practice by collaboratively studying student work and teaching in context.

**Summary of models and theories.** Critical Friends Groups (CFG), collaborative analysis of student learning (CASL), transformation of participation (TP), and lesson study (LS) are four types of organizational structures used to understand student work. Not surprisingly, they have many features in common. All models/theories possess an overall goal to provide a meaningful professional development experience in which teachers critically examine their own practice. Collaboration, reflection, and inquiry are shared characteristics of these professional development experiences. They enhance classroom practice and student learning,
contribute to the knowledge base of individual teachers, and have the potential to transform the culture of the school as a whole.

“The value of looking at student work resides in its potential for bringing students more consistently and explicitly into deliberations among teachers” (Little et al., 2003, p. 192). Common to all models/theories described above is a shift away from looking at student work alone, allowing teachers to learn from each other. There was no literature found about what teachers learn when looking at student work alone. There is, however, much research on how collaborative groups acquire knowledge, learn from each other, and improve practice.

Group sizes vary depending on the model, but in each case, a facilitator directs the work. Some facilitators are selected from within the group, some from outside, some are trained, and others are simply selected subjectively based on their qualifications and experience. There is typically a plan or structure to the work. Some groups, such as CFGs, use protocols to set time frames for discussion and listening, allowing each member to have appropriate “air time”. Other groups configurations set their own norms for sessions, uniquely developed by the members. Perhaps most importantly, in all cases, there is a focus on student learning at the heart of the work.

Little et al. (2003) claim, “Looking at student work has the potential to expand teachers' opportunity to learn, to cultivate a professional community that is both willing and able to inquire into practice, and to focus school-based teacher conversations directly on the improvement of teaching and learning” (p. 192). In other words, providing the organizational structure for collaborative inquiry groups has broadened the playing field to explicitly address teaching practice and teacher thinking. It helps teachers “develop a critical
lens through which to view their practice” (Marble, 2006, p. 86). Perhaps Hargreaves (2003) said it best:

The time is ripe to rethink what teaching and learning for students and professional learners and support for teachers should look like for the new generation of educators who will shape the next three decades of public education. Educational reform can no longer be built on the backs of teachers. Improved learning must be achieved through methods that inspire good teaching and that retain good teachers. If schools are to become real knowledge communities for all students, then teaching must be made into a real learning profession for all teachers. (p. 161)

Looking at student work in this study. In this study, PDS triads looked at student work across three cycles of an inquiry process. They did not follow one particular model or theory for looking at student work. There were, however, elements of several models or theories that guided their work. For example, similar to transformation of participation, this study was interested in how the group acquired knowledge about student understanding and how those conversations resulted in growth within the teacher group. Moreover, as in transformation of participation, this study looked at participation patterns and how those patterns shaped the results of the discussions and ultimately the growth and development of the triad.

This study also shared components of lesson study. For example, in lesson study, instructional plans are developed based, in part, on the results of examining
student work. A lesson study group works together to make decisions about what types of work will best meet the needs of the students. Whereas lesson study usually concentrates on one lesson for a class of students, this study made decisions about various ways to challenge an individual student and improve learning over three cycles of evaluation. “The basic shared purpose of any lesson study effort is to improve instruction” (Lewis, C., 2009, p. 96). Similarly, a goal of this study was not only for the student to improve his learning, but the triad members to improve their practice. Lewis et al. (2006) assert, “The fact that each teacher in a lesson study group brings particular knowledge and personal characteristics to the table makes it challenging to document teachers’ learning from lesson study” (p. 4). Similarly, this study investigated the impact of various levels of expertise and experience within a professional development school (PDS) triad and the roles that each triad member played.

This study was different in several ways from the models and theories discussed above. For example, the triads met and discussed student work without a facilitator. In fact, there was not a specific protocol that the triads were asked to follow. They were given a study cycle framework and project requirements for the interns’ elementary mathematics methods course. The manner in which they actually discussed the student work, however, was not prescribed. This was different from collaborative analysis of student learning and Critical Friends Groups, which both use protocols to structure their conversations.

Participation in this study differed from CGFs in that it was not completely voluntary. As partners in the professional development school (PDS), the mentor and
PDA were expected to support the intern in methods course projects. The intern was required to complete one cycle of an inquiry process to complete a methods course project. This study, however, extended the project from one to three cycles, in which the participants were asked to voluntarily take part.

While previous research has investigated how to look at student work, the literature is limited in what the process actually looks like operationally. This study helps address the need for more evidence-based research that will help understand how teachers acquire knowledge from looking at student work in practice.

Professional Development School Partnerships

A PDS is a specific form of a district-school(s) - university partnership wherein the participants share a commitment (and a responsibility) to improve the education of students in the public schools by simultaneously renewing the lifelong education of teachers and the institutions responsible for that education. (Snyder, 1999, p. 136).

Partnership communities provide opportunities for all members to learn with the ultimate goal of improving the education of the students. The National Association of Professional Development Schools (2008) has as one of its nine essential goals, “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” (p. 5). This mission statement further exemplifies how the work of a professional development school partnership results in dedicated efforts to provide benefits for all partners. The broader community does not only include
mentor teachers, interns, and supervisors, but all members of both partners whose work may have some connection or relationship that intersects with the work of the PDS. “These (Holmes Group) principles will also only work when the new “place” is created in which the university and school come together, establishing a sense of reciprocity by each abandoning some of its established ways and relinquishing some of its power to this new idea” (Rutter, 2011, p. 299).

“Since the mid-1980’s, as part of the school reform movement, professional development schools (PDSs) have sought to revitalize teacher education in the university and reform K-12 schools at the same time” (Abdal-Haqq, 1998, p. vi). This type of partnership affords multiple levels of expertise and experience to be represented in the professional development school (PDS) triad. The mentor teacher brings the skill and expertise of the practitioner in the context of the classroom, the supervisor (professional development associate - PDA) may offer either the theory as a university faculty member or a graduate student, or the expertise of the practitioner as a reassigned classroom teacher. The third member of the triad, the intern, who ordinarily exhibits a thirst for knowledge, and also contributes her own experiences, often displays a willingness to take risks and try new ideas. All triad members benefit from the melding of these areas of expertise and experience, allowing learning to take place in many different ways.

The integration of methods coursework with field experiences is a common feature of the professional development school. Pre-service teachers are afforded the opportunity to complete course assignments in authentic classroom environments with children with whom they have formed a teacher-student relationship.
“Successful partnerships provide opportunities for preservice teachers to apply the instructional strategies introduced in methods courses into authentic contexts” (Burton, 2007, p. 18). This provides a blending of theory and practice which is likely to strengthen relationships between the university and the school district.

More than a quarter century ago, The Holmes Group (1986) made the claim that “competent teachers interpret the understandings students bring to and develop during lessons; they identify students’ misconceptions, and question their surface responses that mask true learning” (p. 29). Investigating the learning reflected in student work requires a commitment to deeply explore student learning data. In professional development school communities, it is possible for the triad - mentor teacher, intern, and supervisor - to combine their diverse experiences and expertise to examine student work, discover student understandings, and make informed decisions about future instruction. The study of the collaborative work of the triad is an area that could contribute to the growing body of research about professional development school partnerships.

Professional development schools provide an ideal context in which to study inquiry-oriented talk, an inquiry process, or an inquiry stance. “Inquiry is considered by many to be a distinguishing feature of the PDS” (Abdal-Haqq, 1998, p. 32). To those who “live” in the PDS, it is the hallmark of the program. Patrizio (2009) claims, “Theoretically, participants in a PDS take an inquiry-based approach to improving student learning as they learn together about themselves, their practices, and their students” (p. 163). This environment is fertile ground for exploring ways in which
inquiry might play a critical role in the development of pre-service and inservice teachers.

“In the 1980s, with reformers clamoring for change, the PDS emerged as the innovation that could effectively link teacher and student learning” (Trachtman, 2007, p. 198). From that time, much has been written about the goals and principles of professional developments schools (Abdal-Haqq, 1998; Burton, 2007; Rutter, 2011; Snyder, 1999). In more recent years, researchers have been asking questions about the effectiveness of PDSs and concerns about their sustainability (Badiali, 2011; Maier & Bump, 2011; Teitel, 2011).

At a time when leaders in the professional development school movement are writing about how the landscape has changed over the past 25 years, it is important and appropriate to take a closer look inside successful PDSs to see what factors are not only causing them to survive, but to thrive and flourish (Teitel, 2011). One such factor might be the existence of the professional development school triad - mentor teacher, intern, supervisor. There is little or no research about how PDS triads function as a group that is defined by multiple dimensions of expertise and experience. One contribution of this study is to provide insight into that gap in the literature.

**Connections to the Literature**

The present study was situated within a 20+ year professional development school partnership between a major research university in the northeast and the school district adjacent to its campus. During the lifetime of the partnership, this PDS worked through many challenges of adjustment and change. Through balanced leadership and a commitment from all participants, the partnership grew and thrived.
Its dedication to using inquiry as a way of learning to teach continues to introduce new teachers into the profession who are sought after in the field, in part because of their stance toward inquiry in their teaching platform. It is within this healthy context of a professional development school (PDS) that the present study unfolded.

The characteristics of the members of the PDS triads featured in this study differed from those highlighted in the studies in this literature review. The collaborative inquiry groups highlighted in this literature review held similar roles. For example, in Patrizio’s (2009) study, set in a professional development school setting, all members of the collaborative group were preservice candidates. Similarly, Nelson, Slavit, and Deuel’s (2012) participants in their multi-year case study were all secondary science and math teachers. Although the Nelson et al. (2012) participants were either science or math teachers and varied in their years of experience, they convened as a common group of secondary classroom teachers. In a related study, Ballock’s (2008) work looked at developing an awareness of each member’s expertise and the negotiation of roles taken by the group, but did not address the impact of group members’ broad role differentiation found in the present study, in which a preservice teacher, a mentor teacher, and a university supervisor talk about student work together (p. 2).

Putnam and Borko (2000) make the following claim:

The notion of distributed cognition suggests that when diverse groups of teachers with different types of knowledge and expertise come together in discourse communities, community members can draw
upon and incorporate each other’s expertise to create rich conversations and new insights into teaching and learning. (p. 8)

Chapter Summary and Preview

Chapter Two described the scholarly literature that informed this research study. Links were made to three major bodies of literature: (1) inquiry in the practice of teaching, (2) the origins and strategies for looking at student work (LASW), and (3) the components of a professional development school partnership that encourage collaboration and hence, the development of a stance toward inquiry.

The next chapter is dedicated to describing a rationale for selecting case study methodology as an appropriate qualitative methodology for this study. It describes the characteristics of case study methodology – the context, the participants, the methods of data collection and data analysis. The chapter ends by presenting concerns about credibility and trustworthiness, and the importance of the researcher’s perspective.
CHAPTER 3: THE RESEARCH DESIGN

All types of qualitative research have in common the search for meaning and understanding, the researcher as the primary instrument of data collection and analysis, an inductive analysis process, and a product that is a rich description of the phenomenon (Merriam and Associates, 2002, p. 15). Qualitative research is emergent rather than tightly prefigured” (Creswell, 2009).

Qualitative Research

Qualitative research is interpretive (Creswell, 2009; Mason, 2002; Maxwell, 2013; Merriam, 2009; Stake, Robert E., 2000). Holliday (2007) claims that qualitative research “maintains that we can explore, catch glimpses, illuminate and then try to interpret bits of reality” (p. 6). Mason (2002) identified the basic elements of a working definition of qualitative research in this way:

1. Concern with how the social world is interpreted, understood, experienced, produced or constituted.

2. Use of data generation methods that are flexible and sensitive to the social context.

3. Based on methods of analysis, explanation and argument building which involve understanding of complexity, detail and context. (p. 3)

These authors’ beliefs guided the positioning of my research interests in the qualitative research paradigm. With that in mind, however, I also remained open to Holliday’s (2007) claim that “social research is a complex area, and attempts to
divide it into hard categories will always suffer from oversimplification. Qualitative research will always involve quantitative elements and vice versa” (p. 2).

Case Study

Bogden (1992) claims, “It is by no accident that most researchers choose for their first project a case study” (p. 62). Case studies focus on understanding contemporary phenomena within their real settings where the boundaries between the context and the phenomena are not evident (Yin, 2012). Although case studies vary in their complexity, they all look specifically at one setting, one subject, one set of documents or one event (Merriam and Associates, 2002). Other features that are commonly agreed upon are a clearly bounded system in time and place, a thick and rich description, multiple sources of data, and the phenomenon being studied being absolutely inseparable from the context.

Whereas quantitative researchers often collect many repeated observations to get a good representation of the data, Stake (1995a) recommends “finding good moments that reveal the unique complexity of the case” (p. 63). He writes that during the search for these instances, “there is no particular moment when data analysis begins” (1995a, p. 71). As we experience new impressions, the goal is to make sense of the parts, to see how each part is related to another part, and to draw on previous experiences to make the new familiar. Using an interpretative lens, this study uses “people, and their interpretations, perceptions, meanings and understandings, as the primary data sources” (Mason, 2002, p. 56)

Merriam (2002) concurs that regardless of the goal, it is “the unit of analysis, not the topic of investigation, that characterizes a case study” (p. 178). This single entity is studied intensively and described in depth. In this study, the entity that was studied in depth was the substance of the dialogue of three professional development school triads during the fall of
2013. I considered how each PDS triad looked at student work and made decisions about how to meet the needs of a particular student. I was interested in the patterns of behavior that defined their conversations. During this process, I heeded Merriam’s (1998) caution to researchers to be aware of the high degree of subjectivity in the data collected. I repeatedly read the transcripts, carefully decided on coding categories or themes, and from this diligent work, composed a vivid, interpretive, and rich narrative.

To summarize, this qualitative research study used case study methodology as an investigative tool to analyze the inquiry process of three PDS triads over a series of three collaborative study cycles. (See Figure 1.2.) More specifically, this might be called an instrumental case study, where the “case is examined mainly to provide insight into an issue” (Stake, Robert E., 2000, p. 137). In this instance, the issue was the search for patterns of behavior within an inquiry process that impacted the growth and professional development of the PDS triad members. Taking all these ideas into consideration, case study proved to be the appropriate methodological approach for this study. The case was bounded by time and rooted in a particular context. There were multiple data sources and an interpretative lens for the analysis.

**Context of the Study**

Graue and Walsh (1998) defined context as “a culturally and historically situated place and time, a specific here and now” (p. 9). It was important to clearly describe the context of the study and consider its affect on the participants. Maxwell (2013) claims that qualitative research often involves a small number of participants interacting within a unique context. This allows the researcher to better understand how behaviors are “shaped by the unique circumstances in which these occur” (p. 30). This study examined three sets of three
participants interacting as triads in a unique professional development school partnership during the fall of 2013.

A professional development school partnership. “Since the mid-1980’s as part of the school reform movement, professional development schools have sought to revitalize teacher education in the university and reform K-12 schools at the same time” (Abdal-Haqq, 1998, p. vi). These goals require a strong partnership in place with members working with and for each other. In such a partnership, each partner is viewed as the agent of the others; it is an arrangement in which parties agree to cooperate to advance their mutual interests.

Perhaps Snyder (1999) says it best,

A PDS is a specific form of a district-school(s) – university partnership wherein the participants share a commitment (and a responsibility) to improve the education of students in the public schools by simultaneously renewing the lifelong education of teachers and the institutions responsible for that education. (p. 136)

And so, it is on these principles that professional development school partnerships are built.

The site of this study was the professional development school partnership between a large research university in the northeast U.S. and the school district surrounding its campus. This school district had a total enrollment of over 7,000 students and a faculty/staff of approximately 1,325. This particular PDS partnership began in 1998 in two elementary K-5 schools and one secondary English department. In 2013, the year of this study, the partnership had grown to include all district elementary schools (9), middle schools (2) and the secondary English department. During this time, the partnership depended “upon collaboration for [its] very existence … with each partner bring(ing) a critical element to the
relationship” (Robinson & Darling-Hammond, 1994, p. 203). The members of this partnership worked together to accomplish four goals, referred to as the “4 Es.”

1. Enhance the educational experiences of all children.
2. Ensure high quality inductions of new teachers into our professions.
3. Engage in furthering our own professional growth as teachers and teacher educators of all children.
4. Educate the next generation of teacher educators. (Nolan et al., 2009)

Evidence of the success of this PDS could be found in the national recognition that it had achieved: the 2011 Spirit of Partnership Award, National Association of Professional Development Schools [NAPDS], the 2009 Award for Exemplary Professional Development School Achievement (NAPDS), the 2004 Holmes Partnership Award for the best partnership between a university and a school district, and the 2002 Distinguished Program in Teacher Education Award from the Association of Teacher Educators [ATE].

During the fall semester of 2013, interns in this professional development school were enrolled in four methods courses, held in district classrooms and co-taught by university and district personnel. These methods courses incorporated inquiry as a theme in their coursework. In fact, one of the hallmarks of the partnership was its focus on inquiry. Interns were encouraged to engage in thoughtful reflection as a means of developing a future teaching platform that reflected a stance toward inquiry. To assist these full-year interns in understanding and experiencing this stance toward their teaching practice, they were required to conduct a teacher inquiry in the spring of their field experience. Mentor teachers and others, in both the district and the university, were also encouraged to work together to identify and address wonderings through inquiry and share the results publicly. Grounded in
this milieu, the site afforded an ideal context in which to explore the growth and development of an orientation toward inquiry within the triads.

Although there are numerous sets of local, state, and national guidelines for a PDS (e.g., NCATE PDS Standards, 2001; NAPDS Essentials, 2008), each PDS partnership often has its own guiding principles that set it apart from others. This particular PDS partnership had unique traditions referred to as the “4 Es”, noted above, that had implications for the present study. The third “E” states, “Engage in furthering our own professional growth as teachers and teacher educators of all children.” The university side of the partnership demonstrated this belief by providing numerous opportunities for the triad to come together throughout the school year to build community and to collaboratively take part in professional development opportunities. Moreover, in this particular PDS, the supervisor’s caseload allowed him/her to visit each intern’s classroom at least twice weekly. As a result, the supervisor was familiar with the routines of the classroom and typically knew each student by name and by distinguishing characteristics. Additionally, weekly intern meetings and monthly mentor meetings that included the supervisor were held to ensure open communication and to provide a forum to address questions and concerns within the PDS community.

From the district side of the partnership, mentor teachers expressed their belief in the importance of the triad relationship by participating in the intern selection process and the intern placement process, by providing input into the fall methods courses, by attending professional development workshops, and by taking part in PDS traditions and celebrations with their interns throughout the school year. The majority of these events were attended voluntarily and without compensation. From both sides of the partnership, this PDS openly
demonstrated its commitment to support and grow the triad relationship in a manner that is not evident in all professional development school partnerships.

All nine elementary buildings in the Sunshine Hills School District were partners in the professional development school partnership featured in the current study. The demographics of each school were similar. Each of the three triads in this study was situated one of the nine elementary school buildings. Each triad was in a different building.

Participants

The three mentors who participated in this study were selected using purposeful sampling. “In this strategy, particular settings, persons, or activities are selected deliberately to provide information that is particularly relevant to your questions and goals, and that can’t be gotten as well from other choices” (Maxwell, 2013, p. 97). One reason for choosing purposeful sampling is to “adequately capture the heterogeneity in the population” (p. 98). The other participants, three interns and three supervisors were assigned to their triads using the professional development school process used by this partnership for creating triads. In the present study, all the triads were located in the same school district in which the researcher worked as a PDS supervisor and methods co-instructor.

The idea behind qualitative research is to purposefully select participants … that will best help the researcher understand the problem and the research question. This does not necessarily suggest random sampling or selection of a large number of participants and
sites, as typically found in quantitative research. (Creswell, 2003, p. 185)

In the 2013-2014 school year, there were 48 PDS interns placed in K-4 classrooms throughout the partnering school district. The placement process began by assigning groups of interns to each elementary school based on the number of mentors in each school. Then, an intern/mentor social was held in the spring of 2013 at which time interns and mentors had the opportunity to meet and get to know each other. Mentor teachers were then asked to select “half plus 1” interns who they felt would be an acceptable match for her/him. For example, if there were 8 interns assigned to a school, each mentor would select 4 + 1, or 5 interns. These selections were then used to assign a mentor teacher to each intern. In the summer of 2013, a supervisor was assigned to each mentor/intern pair, creating 48 triads.

From these 48 triads, three mentors were purposefully selected representing three different grade levels and three levels of mentoring experience with the PDS in order to provide a group of mentor participants who varied as much as possible from each other. (See Table 3.1.) Each mentor in the study was contacted by email in spring 2013 before the study convened in fall 2013, inviting her to participate in the study. (See Appendix C) A follow-up meeting was scheduled to explain details of the study and confirm the mentor’s participation. When each of the three triads was in place, the intern and supervisor were also invited to participate in the study. Then, all 9 participants voluntarily signed IRB forms. (See Appendix D) Hereafter, the triads will be referred to as Triad TK, Triad T2, and Triad T4, or simply TK, T2, and T4 to indicate the grade level.
Table 3.1. Triad mentor research participants.

The mentor teachers, interns, and supervisor who participated in the study were all white females. The mentors varied in years of teaching experience (11-22 years) and experience/roles held in the PDS. The three interns were fourth-year university seniors. The backgrounds of the supervisors varied; one was a retired teacher, the other two were reassigned classroom teachers. All supervisors were PDS methods instructors who had various years of experience (1-5) teaching in different methods content areas (social studies -1 and classroom learning environments – 2).

Methods of Data Collection

“Methods linked directly to (the research question) permit the development of a logical chain of reasoning” (Shavelson, 2002, p. 62). Within the qualitative research paradigm, this study utilized multiple data sources that linked to the research questions. Maxwell (2013) describes three purposes for combining sources: 1. triangulation of data, 2. gaining information about different aspects of the phenomena being studied, and 3. overlapping methods to gain a greater depth of understanding (pp. 102-104). Researchers are encouraged to use more than one source of data to the validity of the findings (Merriam and Associates, 2002). Because “today’s research world is becoming increasingly
interdisciplinary, complex and dynamic, many researchers need to complement one method with another” (Johnson & Onwuegbuzie, 2004, p. 15). Data for this study were gathered through multiple sets of triad meeting transcriptions, student learning data (student work), and researcher reflexive journal entries.

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Meeting Transcriptions</th>
<th>Student Learning Data</th>
<th>Researcher Reflexive Journal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How do PDS triads inquire into and talk about student work in elementary mathematics over time?</td>
<td>X X X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>2. What is the substance, or focus, of the conversations?</td>
<td>X X X</td>
<td>X X</td>
<td>X</td>
</tr>
<tr>
<td>3. How do members of the triad connect place value concepts expressed in the student work to the CCSS?</td>
<td>X X X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4. To what extent do the triad conversations illustrate inquiry-oriented talk?</td>
<td>X X X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5. How do the roles played by triad members influence the nature of the conversations?</td>
<td>X X X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Table 3.2. Methods matrix. Key: M - mentor, I - intern, S - supervisor.

**Meeting transcripts.** Triad conversations took place during four distinct meetings in a series of three study cycles. (See Figure 1.2) The conversations were audio recorded and served as the primary data source. During the first meeting, each triad identified a “puzzling” student. In other words, the triad looked for a student whose understanding of grade level place value concepts was unclear, or puzzling. During the first meeting, the triad also identified assessment tools for further student evaluation (data exploration). Following the administration of the assessment tools (data collection), the triad met for a second time to review the results, discuss interpretations, and determine a student plan (data analysis). This study cycle was repeated two additional times. The present study examined four meetings for each triad over time: the initial student identification meeting and three data analysis
meetings during cycles 1-3. In total, data were collected from twelve triad meetings (4 meetings from each of 3 distinct triads) that took place during the fall semester of 2013.

**Student work / student learning data.** As part of an inquiry process, three PDS triads were asked to plan, implement, collect, and analyze student learning data and bring copies of the student work results to the triad meetings. Each triad collected one set of student work prior to each triad meeting. This was repeated for each of three study cycles. The collected student learning data were used to generate a discussion about the student’s understanding of place value concepts. These artifacts (student work) and the conversations that focused on the analysis of the artifacts were reviewed and analyzed. There were typically multiple pieces of student work administered and analyzed during each triad meeting.

**Researcher reflexive journal.** During the course of the study, the researcher made daily entries in an online journal. The first journal entry was written the week of August 18, 2103 and continued daily until the completion of the dissertation the week of January 12, 2015. The journal entries chronicled the progress of each triad and logged researcher questions or concerns about the ongoing planning of each study cycle by each triad. The entries were used as a secondary data source to highlight possible researcher biases and to be aware of how the biases may affect the interpretation of the data. Because the researcher was not present at the triad meetings, it also provided a record of logistical and technical information about the progress of the study.

**Data Analysis**

“[Data analysis and interpretation] is an ongoing process involving continual reflection about the data, asking analytic questions, and writing memos throughout the study”
During the analysis process, the contributions of each participant (mentor, intern, and supervisor) were examined multiple times and in multiple ways. Consistent with the beliefs of the Nelson et al. group (2012), the analysis also focused on characterizing a group stance toward looking at student work. In order to capture the collaborative nature of the conversations, individual exchanges were noted and then used to examine the stance evidenced by the group (PDS triad) as a whole. The “habits of mind or ways of being that underpin teachers’ group processes” (Maxwell, 2013, p. 4) was one of the foci of the analysis of the PDS conversations.

**Meeting transcripts.** Audio recordings of four triad meetings for each of three PDS triads were listened to, transcribed, and analyzed in an iterative and recursive process. Maxwell (2013) claims, “During this listening and reading, you should write notes and memos on what you see or hear in your data, and develop tentative ideas about categories and relationships” (p. 105). Before and during the coding process, multiple memos were written that reflected initial thoughts after listening to and then transcribing the audio-recording of each triad meeting.

The triad meeting transcriptions were the primary data source for the study. Open coding was used, a non-linear process that is often recursive. Corbin and Strauss (1990) state, “Open coding is the interpretive process by which data are broken down analytically. It stimulates generative and comparative questions to guide the research” (Corbin & Strauss, 1990, p. 12). As more data were analyzed, it was sometimes necessary to return to the old data and make revisions or adjustments to the codes. Using this method of analysis, the transcriptions exposed participation patterns, described the substance of the exchanges, reflected the triads’ orientation
toward inquiry in their conversation, and highlighted of the types of roles played by triad members. (See Appendix E) The next sections will talk more specifically about each of those patterns of analysis.

**Participation patterns.** The first analysis performed when reviewing the meeting transcriptions was a line-by-line tally of the dialogue by each triad member to examine participation patterns. (See Appendix F) The goal of this analysis was to check for the degree of balance in member participation and to recognize whether the patterns of participation by member changed over time. These patterns were then compared across the three PDS triads. (See Appendix G) The data from this analysis was used to address all four research questions.

**Substance of the conversations.** Initial codes were developed that described the substance of the triad conversations. These codes were based on findings from a 2012 pilot study. They were then revised after multiple readings of the meeting transcriptions. The five strands of mathematical proficiency, outlined by the National Research Council’s (NCR) in *Adding it Up* (2003) (See Table 3.3) and NCTM’s *Principles and Standards* (1989), provided the foundation for defining the codes that were ultimately used to describe the substance of the triad conversations. The three codes were SU (student understanding), IP (instructional practices) and SLB (student learning behaviors). The data from this analysis was used to address research question three – What is the substances or focus of the conversations?
Table 3.3. Mathematical proficiency strands. Taken from the National Research Council (2003, p. 5).

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
</table>
| student understanding (SU) | The triad discusses:  
  • what the student knows or understands;  
  • wonderings or questions about what the student knows or understands  
  • the student’s comprehension of mathematical concepts, operations, and relations  
  • the student’s skill in carrying out procedures flexibly, accurately, efficiently, and appropriately  
  • the student’s ability to formulate, represent, and solve mathematical problems |
| instructional practice (IP) |  
  • instructional practices that have been implemented or plans for future instructional practices;  
  • conversations between a triad member and the student, or an activity, a worksheet, or an assessment |
| student learning behavior (SLB) |  
  • how the student learns  
  • how the student thinks about what he knows  
  • evidence of the student’s constructive posturing toward learning mathematics  
  • indicators of struggles the student experiences  
  • indicators of the student’s learning style |


**Student understanding (SU).** The definition of the SU code was developed by linking the triad conversations to the first three strands of mathematical proficiency (NRC, 2003): 1. conceptual understanding, 2. procedural fluency, and 3. strategic competence. Dialogue coded as SU addressed the puzzling student’s comprehension of mathematical concepts, operations, and relations; skill in carrying out procedures flexibly, accurately, efficiently, and appropriately; and ability to formulate, represent, and solve mathematical problems. (See Table 3.4)
Instructional practices (IP). Instances of dialogue coded as instructional practices (IP) reflected the following belief from the National Research Council (2003), “Instruction needs to be planned with the development of mathematical proficiency in mind” (p. 424). Dialogue that addressed instruction that had previously taken place or that was planned to take place in the future was coded as IP. In some cases, instances of IP described a mathematical conversation between the puzzling student and a member of the triad. In other cases, IP described an activity, a worksheet, or an assessment in which the student engaged. (See Table 3.4)

Student learning behavior (SLB). Student learning behavior (SLB) was developed as a code by linking the content of the triad conversations with the remaining two mathematical strands from the National Research Council, 2003: 4. adaptive reasoning and 5. productive disposition. (See Table 3.3) Connections were also made with the NCTM’s Principles and Standards for School Mathematics (1989) in which mathematical disposition is defined. Moreover, student learning behavior, in this study, included not only the positive proclivities toward learning mathematics, but also the struggles and frustrations experienced by the student, often noted in the student’s learning style. In sum, SLB was defined as instances in dialogue that reflected evidence of the student’s willingness and interest to explore alternate solution strategies (how the student learns), the way the student thought and communicated about mathematics (how the student thinks), the student’s attitude toward mathematics, (instances of confidence and perseverance as well as struggles the student experiences), and the student’s learning styles (work habits). (See Table 3.4)
It seemed important to be clear about the relationship between student learning behavior and a mathematical disposition. According to the National Council of Teachers of Mathematics (1989), “disposition refers not simply to attitudes but to a tendency to think and to act in positive ways.” As discussed in chapter one, behaviors oriented toward inquiry are the noticeable behaviors that, over time, may contribute to the development of an inquiry stance. Likewise, student learning behaviors, are the noticeable behaviors that, over time, may contribute to the development of a mathematical disposition.

In this study, the PDS triads noticed numerous types of student learning behaviors. Some of these behaviors may have contributed to the development of a mathematical disposition, others may not have. In some cases, the observations may have simply been important information used to guide the development of an instructional plan for a particular student. All of these behaviors, both positive and negative, were important for the triad to consider as they analyzed student work.

Inquiry-oriented talk. The meeting transcriptions were also used to place instances of dialogue on an inquiry-oriented talk continuum. A framework adapted from the research of Nelson, Slavit, and Deuel (2012) was developed for this purpose. (See Appendix B) The revised continuum provided four levels of orientation toward inquiry in the talk, ranging from disconnected talk to inquiry-based talk. Disconnected talk referred to conversations that did not focus directly on the group's task. Connected talk referred to conversations about objective background or contextual information that were related to the student work being examined. Exploratory talk focused directly on describing, analyzing, and making inferences
about the patterns and concepts found in the student work. Inquiry-based talk referred to wonderings and curiosities that arose in the minds of the triad members and were shared with other triad members as they discussed the patterns in the student work. The purpose of revising the Nelson et al. talk descriptors was to create a framework that more closely represented the unique characteristics of the triad conversations in the present study. As the dialogue was positioned on the continuum, concurrently, a spreadsheet was created in which each instance of dialogue in each transcription was organized and recorded by talk category. (See Appendix H)

In the next pass through the data, instances from each of the three triads were compared to one another in each talk category, noting similarities and differences. Then, talk category descriptors were further refined and a memo was written that described preliminary findings from each triad and noted comparisons across the three triads. The data from this analysis was used to address research question four -

To what extent do the triad conversations illustrate inquiry-oriented talk?

**Triad member roles.** Throughout multiple readings of the meeting transcripts, ideas were noted about the roles played by each triad member. Wells (2000) argues, “It is not necessarily the most expert member(s) of the group who are most helpful in inducting newcomers; participants with relatively little expertise can learn with and from each other as well as from those with greater experience” (p.5). In this study, the roles the triad members played did not necessarily correlate with the triad member’s level of experience. As Wells (2000) states, in many cases, members of collaborative groups (such as PDS triads) can all learn with and from each other, regardless of their background.
It is reasonable to assume that each member of each PDS triad in this study belonged to a number of social groups. It is likely that, over time, those social groups increased in number and included not only family and friend groups, but various groups with whom there was interaction in the work place. Poetter and Badiali (2001) state, “The fundamental idea of monitoring and reflecting on your interaction with individuals also holds true for working with groups of colleagues” (p. 91). Just as there are various types of interactions among family or friend groups, there are often purposeful ways in which colleagues interact in groups. Accordingly, the dynamics of these interactions can affect the outcome of the group’s work toward achieving their goals. Friend and Cook (2010) “identify the three most important types (of groups) relative to daily interaction as family, friendship, and work groups” (p. 56). This study examined the dynamics of the dialogue of a work group - the PDS triad.

**Categories of roles.** There were four basic categories of roles assumed by the PDS triad members. These categories were developed by drawing on the research of (Benne & Sheats, 1948; Glickman, Gordon, & Ross-Gordon, 2004; Kwan & Lopez-Real, 2005). Kwan and Lopez (2005) identified three categories of roles played by mentor teachers in their research. In order of importance, according to the mentors they interviewed, the categories were: 1. the pragmatic, 2. the interpersonal and 3. the managerial. Theorists on group behavior, Benne & Sheats (1948) and Glickman, Gordon, & Ross-Gordon (2004) also defined three similar categories of group roles: 1. task roles, 2. personal and social roles, and 3. dysfunctional or individualistic roles. Using this research as a guide, the PDS triad
member roles were organized into the following four categories: 1. task-oriented, 2. probing, 3. interpersonal, and 4. managerial. (See Table 3.5)

<table>
<thead>
<tr>
<th>TRIAD MEMBER ROLES</th>
<th>TASK ORIENTED</th>
<th>PROBING</th>
<th>INTERPERSONAL</th>
<th>MANAGERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Storyteller</td>
<td>Tells stories that are related, but not necessarily focused on the task at hand. Often, but not always, gets the triad off task.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Expert</td>
<td>Focuses on prior knowledge and opinions about the mathematics, the student’s understanding or the instructional practices instead of wondering what the student work being examined might be saying.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Contributor</td>
<td>Contributes logistical or technical information based on observations of the student, usually in response to another triad member.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Teacher</td>
<td>Teaches the other triad members by asking scaffolded questions to help them understand what might be going on in the data. Rather than interacting with the triad, the teacher stands outside the conversation and tries to elicit responses.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Learner</td>
<td>Takes an interest in learning more about the task.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Wonderer</td>
<td>Poses wonderings about the student work for the triad to consider. Inviting others to respond. Characteristic of inquiry-based talk.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Questioner</td>
<td>Asks a clarifying question of the triad, often just for information or an explanation. Characteristic of exploratory talk.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Listener</td>
<td>Is often heard responding with “yeah”, “uh hum”, “yes”, “ohhh”, “ahhh”, “Isn’t that interesting?”.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Agree-er</td>
<td>Is often heard responding with “exactly”, “right”, “okay”. Accepts what others say, not necessarily a contributor.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Encourager</td>
<td>Offers encouraging, complimentary comments, affirms, supports, praises, demonstrates warmth and a positive attitude.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Facilitator</td>
<td>Assists the triad in achieving their common goal by keeping the group discussion on task and flowing smoothly.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.5. Triad roles and definitions.

Task-oriented roles provided information that moved the group forward toward achieving the goals of the task. Sometimes the information was shared by the triad member acting as a storyteller. Other times the information was presented directly through the role of an expert or a teacher. When a triad member did not have the experience or background to share information, she sometimes shared information that she had observed directly. In this role, the triad member was an objective contributor. And in other cases, information was requested by one of the triad members who was a novice wishing to gain information as a learner. The
focus of task-oriented roles was toward sharing or acquiring information that contributed to the accomplishment of the task.

Triad members who invited further discussion through exploratory or clarifying questioning characterized probing roles. Usually the questions were posed as wonderings, although in some cases they are more logical or technical. Dialogue representing a probing role was typically categorized on the talk continuum as inquiry-based or exploratory talk.

Triad members who promoted a positive tone to the conversation characterized interpersonal roles. This was accomplished by being a good listener or by showing agreement with someone’s contribution. It was also demonstrated by encouraging a triad member to share more of her thinking or to build on an idea that was suggested. Members playing this role were instrumental in maintaining a positive and productive triad meeting.

One managerial role noted in the analysis was that of facilitator. When a triad member took responsibility for moving the meeting forward by strategically asking a question or asking the group to return to the original question, this member was described as the facilitator.

It is worth noting that the roles described in this study were not the type of group roles that are pre-determined and assigned to various group participants. Instead, they were unspoken roles identified in the dialogue that appeared to impact the conversation in a significant way. The identification of dominant roles by triad members was determined by listening to and recording instances in the dialogue that reflected a particular role across the triad meetings. (See Appendix B) When a triad
member made multiple statements across multiple meetings that reflected a particular role, that role was considered to be a dominant role. The dominant roles played by each triad member will be discussed in each triad story (chapters 4, 5, and 6). The data from this analysis was used to address research question five - How did the roles played by the triad members influence the nature of the conversations?

**Student work / student learning data.** Each triad mentor was given a three-ring binder. Inside the binder was information about the study cycle, a template for scheduling triad meetings, a list of the *Common Core State Standards* for place value concepts, and three plastic sleeves in which to store copies of the student work collected during each study cycle. When the third cycle of the study was completed, the researcher collected the binders. During the analysis process, the student work from each triad was used as data to support patterns that emerged in the triad conversations over time. In particular, the student work provided evidence of the triad’s understanding of the mathematics. This was reflected in both the problem choices that were made by the triad and the manner in which they talked about the resulting student work.

**Credibility**

Maxwell’s (2013) validity test checklist describes four focus areas that help to rule out possible threats to the validity of a study and to establish credibility. Those areas are rich data, respondent validation, triangulation, and comparison (p. 125). This section will discuss how these focus areas were used to establish credibility in the present study.
In writing descriptive passages, it is helpful to use quotes... from the context so that the reader as well as the researcher can analyze the data” (Erlandson, Harris, Skipper, & Allen, 1993, p. 147). In the present study, claims were supported with significant chunks of dialogue from the triad conversations. In this way, the voices of the participants were clearly heard, which contributed to the establishment of credibility. Moreover, the audio recordings of the triad meetings were transcribed verbatim, allowing the actual words of the triad members to be the focus of the analysis.

Erlandson et al. (1993) claim, “Prolonged engagement helps the researcher build trust and develop a rapport with the respondents” (p. 133). In a pilot study in 2012, one study cycle of three PDS triads, similar to the present study, was explored. It was found that more than one study cycle was needed to be able to make credible claims. Consequently, in the present study triad members were given the opportunity to build rapport with each other over time by participating in three complete study cycles. As a result, triad members had greater occasion to develop trusting relationships that contributed to the collection of rich data from the three triads over the course of the three study cycles.

The use of multiple sources of data collection helped reduce the risk of misrepresenting the intentions of the participants. It triangulated evidence from one source with that of another (Creswell, 2009; Glesne, 2006; Mason, 2002; Maxwell, 2013). Although the transcripts of the triad meetings were the primary data source, the triads were also asked to keep a record of their meeting schedules and copies of the selected student work. Copies of all email and written communication from the
triads were kept throughout the research study. Moreover, the researcher kept a reflexive journal beginning in the early planning stages of the study. This journal provided information such as “the researcher’s schedule and logistics, insights, and reasons for methodological decisions” (Erlandson et al., 1993, p. 143). It provided the means for reflecting on the process, asking tough questions, and staying committed to a timeline. In the end, it created an audit trail for the study (Erlandson et al., 1993).

The study of multiple triads allowed for cross-triad comparisons. In selecting the triads, purposeful sampling was used to choose three mentor teachers with different backgrounds and records of teaching experience. The remaining six participants were individuals assigned to the mentor teachers, 3 as interns and 3 as supervisors. Accordingly, the three interns and three PDAs were not selected purposively, and therefore represented a variety of opinions, values, and beliefs. These nine individual participants provided both “typical and divergent data to maximize the range of information obtained” (Erlandson et al., 1993, p. 148)

Peer debriefing helps build credibility by allowing a peer who is a professional outside the context and who has some general understanding of the study to analyze materials, test working hypotheses and emerging designs, and listen to the researchers’ ideas and concerns. (Erlandson et al., 1993, p. 140)

I have been a part of a doctoral student writing group for over two years. Four colleagues and I have provided support for each other in writing for course assignments, conferences proposals, professional vitas, and other related projects. All
writing group members were in the same doctoral program, albeit at different points in their programs. They participated in decision-making with one another and regularly offered advice and feedback to each other. Within the writing group, I had a single writing partner who became very familiar with my study, and over time developed into a critical friend. “Critical friends are trusted colleagues who seek support and validation of their research to gain new perspectives in understanding and reframing of their interpretations” (Samaras, 2011, p. 5). My critical friend asked questions, played devil’s advocate, and provided alternate explanations to issues and concerns that arose (Erlandson et al., 1993, p. 142). This critical friend, along with the practices described above, helped to protect the credibility of the study and ensured that the findings carried integrity.

**Trustworthiness**

“Ethics in research is not a cumbersome ‘add on’ to naturalistic inquiry, but a logical outcome of the paradigm” (Erlandson et al., 1993, p. 132). Issues of ethics are inherently present in all qualitative research. Mason (2002) claims, “Qualitative researchers should be as concerned to produce an ethical research design as (they) are to produce an intellectually coherent and compelling one” (p. 41). Erlandson et al. (1993) view a code of ethics as a series of safeguards that include:

1. protection against physical and psychological harm,
2. protection against privacy and confidentiality,
3. protection against unjustifiable deception, and
4. informed consent to participate (p. 155).
When completing required IRB requirements, it was important to be thorough and transparent in responding to the application prompts. Likewise, when writing the informed consent document, the intentions of the research in which the participants were involved was clearly stated and regularly revisited to assure that the research was being conducted in the manner in which the participants had consented. (See Appendix D) In this respect, “ethical concerns should be involved in every aspect of (the) design” (Maxwell, 2013, p. 7). Erlandson et al. (1993) advise, “Informed consent obtained at the beginning of the research must be renewed continuously because of the human context and the power relationships within it continuously shift” (p. 153). Being open to continual review was an asset to the study.

Worries of credibility and trustworthiness were kept in check by being mindful of these issues, as well as by being alert to additional concerns that may have surfaced throughout the research study. Erlandson et al. (1993) summarized this idea in this way, “The researcher establishes a partnership with the stakeholders in the study, a partnership that requires a free and honest exchange of the separate constructions of all participants and in return offers opportunity for growth and empowerment” (p. 160).

**Researcher Perspective**

“Traditionally, what you bring to the research from your own background and identity has been treated as bias, something whose influence needs to be eliminated from the design, rather than a valuable component of it” (Maxwell, 2013, p. 44). More recently, researcher identity has not been viewed as a liability, but as a relationship building process that “allows you to ethically gain the information that
can answer your research questions” (p. 90). In a qualitative study, the researcher is the instrument of data collection (Creswell, 2009, p. 175). For this reason, it is valuable to understand who the researcher is and what her personal interest is in the topic at hand.

Framing my thinking around personal goals (driven by my passion), practical goals (what I want to accomplish) and intellectual goals (what I want to understand), I sorted through prior experiences that defined my researcher identity and played a role in my researcher biases (Maxwell, 2005, p. 16). As a retired educator, I brought many years of prior experiences, many highlights of which were directly related to my research topic. My evolution as an educator resulted in strongly held opinions about what I felt were the most effective strategies for teaching K-6 mathematics. It was important for me to identify those opinions, write them down, and reflect upon them as my study unfolded. Otherwise, they may have seriously impaired my ability to be unbiased in my interactions with study participants and in the processing and analysis of the data.

Likewise, study participants may have been astutely aware of my views about teaching mathematics. I had worked with many of them in my prior role as a curriculum leader. It was important for me to be aware of developing distortions in which my participants may have responded in ways that they thought I would endorse instead of how they really felt (Erlandson et al., 1993, p. 134).

The motivation for my study came from a number of personal goals. I chose the topic, in part, because I often looked back on the evolution of my own beliefs about teaching elementary mathematics and wished that I had been a more reflective
practitioner earlier in my teaching career. In the early 70’s, I would have described myself as a traditional or conventional teacher of mathematics, focusing on students learning math-facts by rote and teaching the procedures of standard algorithms. Twenty-five years later, I participated in a three-year research study in which I experienced the power of teaching mathematics using a conceptual, problem-based approach. This experience affected my own practice extraordinarily and ignited my passion to not only continue to learn more about my own teaching, but to share my new way of thinking about teaching elementary mathematics with my colleagues.

In the years that followed, I became a district-level curriculum support teacher, and subsequently, the K-6 mathematics and science curriculum coordinator. During that time, I worked with district teacher leaders to adopt and implement a progressive, standards-based mathematics curriculum program. After almost a decade of fruitful work resulting in the shifting of teachers’ practice to a more conceptual approach to teaching mathematics, an organized parent group intervened and the district returned to a more traditional approach to teaching and learning elementary mathematics. Having lost the district “math wars”, I never lost my passion for continuing my work of helping teachers understand the benefits of teaching and learning of mathematics using conceptual, problem-based strategies.

When I retired several years later, I decided to search for a way to continue to contribute to the field of teaching elementary mathematics. I enrolled in a university Ph.D. program in Curriculum and Instruction with an emphasis in Curriculum and Supervision. I began to work in the university’s professional development school, supervising full-year interns and co-teaching an elementary mathematics methods
course. This was the station of my career at the time of the writing of this dissertation. As a member of the professional development school community featured in this research study, I had regular interactions with all members of the triads - mentor teachers, interns, and supervisors. The mentor teachers and supervisors were aware of my beliefs from prior curriculum work and interns learned those beliefs by participating in the elementary mathematics methods course of which I was a co-instructor. I was mindful of how I interacted with all the triad member participants, reserving my own biases and striving to capture their genuine and true thoughts as study participants.

**Limitations**

“It is assumed that one could find similar results in another PDS environment. However, since professional development schools differ so greatly in form and structure, these findings are limited to characterizing this singular PDS” (Manno, 2011, p. 98). To a certain extent, the same is true in this study. Findings in this particular professional development school are not necessarily generalizable to all PDSs. I would argue, however, that connections could be made to other contexts that have similar structures in place.

A practice that created a limitation to the present study was that K-4 mathematics resources for teaching place value concepts were not consistent across the triads. Although there was a core resource in use within the district, decisions to use supplemental resources were made by each triad. A specific resource was not provided or suggested to the triads in this study. Each triad made decisions about resources independently.
The student work that was analyzed in the triad conversations was not collected until the end of the study. Accordingly, a majority of the triad conversations were transcribed before the student work was shared with the researcher. In the absence of the researcher being present at the triad meetings, it was sometimes difficult to match the precise pieces of student work that were being discussed to specific places in the dialogue. In future research, it is suggested that the student work be collected at the same time the audio recordings of the triad conversations were collected and transcribed.

Another limitation of this study was that the desire to participate did not originate from the participants. Instead, participants were asked, or recruited, to engage in an inquiry process with their PDS triad. This was not an existing initiative to which they were already committed. Although the participants appeared to be eager and willing to participate, the degree to which they were truly interested in the study was difficult to determine.

Time may have been another influential factor that created a limitation. Most triads met during a planning period or before or after school. The length of the triad meetings was 30-45 minutes. The meetings may have been more productive had there been time designated during the school day with guest teachers covering the class while the meetings took place. The triad’s time commitment to participate in this study went above and beyond their overall commitment to participate in the professional development school partnership. Mentors often sacrificed a planning period or met during their lunch period that is contractually a “duty free” period. In light of this, it is possible that this sacrifice could have affected their attitudes toward the triad conversations. “When the community secures a certain amount of time in which to hold group meetings and when these group meetings continue over a long
period, participants have the opportunity to develop credible relationships in which to form and develop ideas” (So, 2013, p. 189). These triads did not secure dedicated time to hold their triad meeting, and therefore were not afforded the opportunities described by So. However, because the PDS triads interacted regularly outside the study, credible relationships were more likely to have developed.

Chapter Summary and Preview

Chapter 3 described the research design of this study. It included background information about qualitative research and described how case study was chosen as the methodology best suited for this research study. Explicit details about the context and participants of the study were shared. Important, commonly used methods of data collection and data analysis employed in this qualitative study were described. Issues of credibility and trustworthiness were identified and described. A personal narrative made visible the perspective of the researcher and included issues and concerns related to biases. Finally, the limitations of the study were acknowledged and discussed.

The next chapter will describe the story of the kindergarten professional development school triad – mentor teacher, intern, and supervisor – while engaged in looking at student work in elementary mathematics. It will relate the story of their journey through an inquiry process that took place across three study cycles. It will explore their understanding of place value concepts, describe the substance of their conversations, categorize their dialogue along an inquiry-oriented continuum, and recount the roles that each triad member played.
CHAPTER 4 - TRIAD TK

EXPLORING AN INQUIRY PROCESS

Nelson, Slavit, and Deuel (2012) write about inquiry as a cyclic process of planning, implementing, collecting, and analyzing data. Chapters 4, 5, and 6 explore the dialogue within the context of an inquiry process of three professional development school triads across a series of four triad meetings. By exploring the inquiry process, an understanding of how triad members thought about the mathematics in the student work was developed. It also allowed for the investigation of the substance of the conversations and the nature of the inquiry-oriented talk during the triad meetings. And finally, the role(s) each member played emerged from a review of the conversations. While the structure for the inquiry process was similar for each triad, the stories that emerged from the dialogue were rich and varied in nature thus providing insight into the complexity of the dynamics within collaborative inquiry groups, such as a PDS triad. Chapter 4 is the story of the inquiry process of a kindergarten PDS triad - mentor teacher, intern, and supervisor - known as Triad TK.

Introduction

Triad TK was a kindergarten professional development school triad - mentor teacher, intern, and supervisor - situated at Lakeside Elementary in the Sunshine Hills School District. Triad TK was part of a team of 2 kindergarten classes at Lakeside Elementary. In the 2013-2014 school year, 2 PDS interns were placed at Lakeside, one in kindergarten and one in first grade. Trina (mentor), Avery (intern), and Emily (supervisor) each agreed to participate in the current study. The triad met four times
throughout the fall of 2013. (See Table 4.1) The meetings were held at various times of the day - before school, during a planning period, or after school.

![Table 4.1. Triad TK meeting dates and times.](image)

<table>
<thead>
<tr>
<th>Triad</th>
<th>Meeting 1</th>
<th>Meeting 2</th>
<th>Meeting 3</th>
<th>Meeting 4</th>
</tr>
</thead>
</table>

**Table 4.1. Triad TK meeting dates and times.**

**Triad TK Participants**

**Mentor:** Trina. At the time of the study, Trina had been a kindergarten teacher for 11 years. Previously, she had worked as a school librarian, a private pre-school teacher, and a kindergarten para-professional. She had been a mentor in the PDS for 4 years and during the school year of this study, was selected to be a PDA (professional development associate, or supervisor) for the following school year.

**Intern:** Avery. Avery was a fourth year undergraduate university senior in Childhood and Early Adolescence Education. She was of traditional age for a senior intern. Avery was matched with Trina and her kindergarten classroom in the spring of 2013 and began her full year internship in fall 2013. Avery was a confident and hard working intern. She came from a family of teachers. In her written application for the full year PDS internship, she shared that she had had the opportunity to work with a group of students on a daily basis for extended periods of time and had been able to develop strong relationships with her students. She had a genuine desire to be the best teacher she could be. Moreover, Avery had had positive experiences with her
own mathematics teachers and wanted her own students to have positive experiences as well.

**Supervisor: Emily.** Emily was a hybrid educator. Hybrid educators are those who cross or span institutional boundaries in their work. Emily retired from Sunshine Hills School District in 2011 with 38 years of service in the public school system. She had taught all grade levels (kindergarten, primary, and intermediate) and had also been an instructional support teacher for 12 years. Emily had taught in three different schools in Sunshine Hills School District, had mentored four interns in her own classroom. She had also been a PDA (supervisor) for more than 5 years, during which time she had supervised 45 interns. During the 2013-2014 school year, Emily supervised six interns across two buildings in grade levels ranging from K-4. Avery was one of two interns, the only kindergarten intern, Emily supervised in Lakeside Elementary.

**Triad Meetings Overview**

Overall, Triad TK’s inquiry process of planning, implementing, collecting, and analyzing data was clearly focused on the intern’s (Avery) learning throughout the four TK meetings. Trina (mentor) and Emily (supervisor) viewed the goal of the triad meetings primarily as an extension of Avery’s elementary mathematics methods course assignment. Accordingly, the overall sense of the conversations among the TK triad members was on guiding Avery through an extended assignment for her elementary mathematics methods course. Trina and Emily actively participated in the conversations in supportive roles. Their comments were commonly directed toward helping Avery learn how to evaluate the student’s mathematical understanding and to
make decisions about future instructional practices. The following excerpt was one of many instances in which Emily helped Avery determine what could be garnered from the student learning data and what instructional strategies would be best to implement. This type of exchange exemplified the tone of the TK meetings overall.

Emily: So how does that data guide our questioning in instruction?

Avery: That when she’s receiving an intervention that it would be more beneficial for her for one on one.

Emily: Okay. And what skills specifically do you think you need to work on?

Avery: For .. I mean…

Emily: Given the data.

Avery: As a general student or for our math, just for like… ?

Emily: Well, you’re the teacher and you have to meet the individual needs of all the kids in the class, so many of the class are moving along very nicely.

Avery: Right.

Emily: But you have very specific data on this one little girl, so based on your data, what do we think we know, what do we think we need to reteach? Actually before we can even do the teen numbers.

Avery: Well, before we can even get to the teens, she needs the … It’s just, it’s interesting, yea, she needs the practice of the missing number and that concept of…
The Nature of the Student Learning Data

Triad TK submitted a total of 35 pieces of student learning data over the course of the study. During the first study cycle, 15 pieces were shared. Included in this collection were several assessments, i.e. the AIMSweb Test of Early Numeracy (TEN); a district assessment on number writing, shape identification and replication, and pattern creation; a classroom inventory of rote counting to 100, 1:1 correspondence counting, and number identification; and a check of patterning skills. Several pieces of student work focused on sequencing numbers from 1-20. One of the earlier pieces was a dot-to-dot worksheet. (See Appendix I) There was also a “make a pattern” worksheet featuring butterflies and caterpillars. On several of the pieces of student work, notes were attached explaining details of how the student interacted with the work. Additionally, a photograph of the student playing a computer game and a survey of how the student felt about learning math were shared.

Thirteen pieces of student learning data were shared during the second study cycle. A cut and paste worksheet demonstrated the student’s ability to sequence numbers from 1-10. (See Appendix I) Two worksheets asked the student to match a group of dots with the number it represented. Two worksheets asked the student to identify which of two numbers was greater. On three other worksheets, the student matched pictures that were the same and crossed out the one that was different. Three additional cut and paste worksheets asked the student to complete or extend a variety of ABC patterns. One class activity was a dot-to-dot (1-10) workbook sheet. A questionnaire asked how the student felt about learning math.
A sorting/cut and paste activity required the student to decide what a mouse would or would not do if brought to school.

Three pieces of student learning data were shared representing work completed during the third study cycle. There was a dot-to-dot (1-10) class activity sheet; (See Appendix I) an AAB pattern worksheet; and a 3-page Unit 2 test in which the student was asked to ring groups of a number, complete two dot-to-dot pictures (1-8 and 1-10), write a given number (7, 8, 9, 10), draw 7 fish, draw 9 balloons, and continue an AB, ABB, and AAB pattern. The majority of the student work was completed in one-on-one interventions with the TK intern.

**The Substance of the Conversations: Student Understanding, Instructional Practices, and Student Learning Behaviors**

Overall, the substance of the TK dialogue followed a predictable pattern across the four meetings. Each TK meeting opened with the intern sharing the student work that had been administered. This prompted a dialogue among the triad members about what the student understood that continued throughout the beginning and into the middle of each meeting. Suggestions for future instructional practices were interspersed throughout and highlighted at the end of each meeting. The triad also talked to some extent about student learning behaviors, such as the student’s level of distraction, impulsivity, inconsistencies, and time on task. Avery (intern) was the primary contributor of these types of student behaviors followed closely by Trina (mentor). This is perhaps not surprising, given that Avery and Trina worked with the student on a daily basis in the classroom.
In the following excerpt from meeting 2, the triad discussed what the student understood about the mathematics. Emily (supervisor) asked Avery (intern) to share what she thought the student work suggested. Emily started the conversation and then stepped aside as Avery and Trina discussed the results.

Emily: Okay, so what does this, what are our wonderings? What does the work sample lead us to believe? What do we think she knows?

Avery: I think she has the rote knowledge. I think her comprehension, like there’s a disconnect there.

Emily: Disconnect between what?

Avery: Between her understanding of the order of the numbers and the…

Trina: That she has it to rote to 20. That’s been fairly consistent, but even that hasn’t always occurred when she’s counting.

Avery: But in reverse.

Trina: But when it comes to understanding, that was the word that you just used, conceptually…

Avery: Yea.

Trina: That’s where there’s that disconnect.

At the end of each meeting, the dialogue shifted to a discussion of future instructional plans. The following example took place at the end of meeting 2. All three triad members participated in a collaborative discussion about next steps for the student during the next study cycle.
Emily: So if we started 1 through 5, it sounds like we’re going way back with manipulatives and getting quantity and number so we’re really working on that before we can move into those teen numbers.

Trina: So 1 to 5 start and then we can see where that moves.

Avery: And she also I thought like a number line could be helpful as well. Like definitely using the manipulatives but then seeing it on a number line so she can see. Like placing the manipulatives with the number line so she can see it getting bigger and she said she likes when we asked about her favorite activities. They were math builders and her favorite part of the day was like reading in big books and readaloud, maybe incorporating…

Trina: That’s a great idea I have some wonderful counting books most of them are 1-10.

Notably, in extended conversation, the triad discussion reflected the belief that the student needed direct instruction and extra practice with a focus on skill development. The intern had visited the RTII (*Response to Instruction and Intervention*) class and observed strategies that supported a direct approach to instruction. In the following excerpt in meeting 2, Trina (mentor) suggested that instruction be similar to the RTII model - explicit, direct, and provide more practice time.

Trina: I’m wondering if we shouldn’t go back to 1 through 5 and look at visually each number, quantities of those numbers, auditory and visual? And see how she would do just with that? And if that’s not
consistent, then it’s coming up with some interventions to work on
and also I think that the only thing that I do with the distraction, I
think is important, when you’re coming up with what interventions
you’re going to do is to think like the RTII model, which is
obviously, she’s going to benefit from being at least in a smaller
group working on these activities or one on one because that will
make it more explicit and direct and more time on task.

Whereas dialogue about student understanding (SU) and instructional
practices (IP) were plentiful throughout the four triad meetings, specific student
learning behaviors (SLB) were only noticed a small percentage of time in the TK
conversations. And yet, the remarks about student learning behaviors that were
made provided useful information for the triad to consider. This information
included behaviors such as when the student struggled, her frustration level, her
ability to stay focused, the inconsistency in her work, and how easily she was
distracted. The following excerpt took place near the end of meeting 3. The focus
of this exchange was not about what the student understood mathematically; it was
an examination of learning behaviors that may have impacted the student’s learning.

Avery: And I did see her when she would start to struggle. She would go,
“I get mixed up, I get mixed up, this is tricky”. So she wasn’t
getting frustrated, but she was recognizing that something wasn’t
working for her. I did do, I did look back at the videos and did a
behavior analysis, but I don’t know if that’s exactly what it’s called.

Emily: She did that by watching the videos.
Avery: And what I noticed from that is she would talk out a lot like as far as just off subject. “I went to the mall yesterday. My dog Mia…”.

Just during activity, it wasn’t consistent, it wasn’t like it was tricky, she would start using it as an escape. There was no - that was another thing, I was turning my head, there was no consistency of why she was just talking off subject.

Trina: About her?

Avery: That she’s easily distracted because if anybody was in hallway, she’s talking to the person in the hallway.

Trina: And these observations were strictly from the time you were doing intervention, it wasn’t even large group. This was, (researcher), one on one, it was not five people keep trying to come and talk to me.

Overall, TK remained focused on the task and followed a predictable pattern in the structure of their meetings. Each meeting began with an overview of the student work, followed by a discussion of the student’s understanding. Included in this discussion was limited talk about the student’s learning behaviors. The meetings ended with clear ideas for student work to administer and share at the following triad meeting. These patterns of the substance of the conversations represent a key component of the triad’s cyclic process of inquiry.

**The Mathematics in the Student Learning Data**

Triad TK chose to work with a female student who was struggling with basic kindergarten mathematics standards for counting and cardinality. In spite of the student’s level of need, she did not qualify to receive additional services. The place
value objective for kindergarten was “work with numbers 11-19 to gain foundations for place value”. (See Table 4.2) The TK student had trouble with prerequisite skills such as identifying and counting the numbers 1-5 in sequence. This was a concern for the triad and they agreed that working with the foundational skills (1-10) was a necessary first step and would be key to ultimately helping the student understand more advanced place value concepts.

The Triad TK mentor and supervisor expressed concern beginning at the first meeting that their student would be unable to fulfill the requirements of the Common Core State Standards for place value in kindergarten, and therefore, they would not be addressing the goals of the study. In Number and Operations in Base Ten, the following objective for kindergarten is stated:

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<thead>
<tr>
<th>Kindergarten: Work with numbers 11-19 to gain foundations for place value.</th>
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<tr>
<td>1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 – 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.</td>
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Table 4.2. Common Core State Standards place value objectives for kindergarten.

Because the triad chose a “struggling” kindergarten student, it was not surprising that in the fall, she was not ready to address the end of year objectives for place value. However, the mentor and supervisor conceptualized the task as implementing student work that addressed the standards objectives. Because the student was not ready to work on those objectives, the triad was conflicted as to whether they were addressing the expectations of the study in regard to focusing on place value standards.

As time went on, Avery took the initiative to research place value activities in her textbook on teaching elementary mathematics. She shared those ideas with her
triad during meeting 3. She also spoke with her elementary mathematics methods
course instructors about this concern. They reassured her that addressing prerequisite
skills that involved grouping, such as counting by 2s, 3s, 4s, or 5s, making groups of
5, or working with 5-frames, were appropriate to “count” as place value activities that
addressed the triad’s task. Avery shared this information with Trina and Emily at the
beginning of meeting 4 in response to Emily’s routine question: “Why are we not
addressing the objectives of the Common Core?” Avery’s response to her mentor and
supervisor showed growth in her ability to make decisions about planning instruction.
She had taken responsibility for the task and had reached out on her own to learn
what counted as an appropriate place value activity for the student. The following is
an excerpt from the conversation in which Avery shared what she had learned about
place value and how the student responded to the work.

Emily: I’m sorry Trina. I want to go back just a minute because when
we started this, really we were looking at place value.

Avery: Yea.

Emily: So in what we have done, we’ve kind of shied away from…

Avery: Right.

Emily: …the idea of place value. Can you just remind us all why
we’ve back away from that particular objective?

Avery: Yea, originally, we just wanted to make sure she had a strong
sense of the numbers 1 through 5 and that she was successful
with using those numbers before we tried to build on those
skills and introduce other things. With the five frame, it is
really - that really does help with our idea of place value, because even if we are only working with five, she’s using her hand of 5 and she’s seeing – oh, well, how many more ones do I need to make a five? And that’s a group of 5. So working with groups of numbers is still working on place value.

Trina: So she’s making transfer of when I talk about 5. I remember I did the 5 group and the 10 group and the 10 frame, so she is making the connection from the hand to the other activities.

Avery: But once you go to 2 fives, that’s not consistent. So she’s getting the 5, she can do it with her hand and she gets the 1 to 5 frame but then if we had two 5’s. I’ll say how many 5’s are there? Well there’s 10. Sometimes she’ll say there’s 10, there’s 5, that’s not consistent.

In spite of the ongoing concern on the part of the mentor and supervisor that they were not specifically addressing the objectives set forth by the *Common Core State Standards*, Avery forged ahead and came to each meeting prepared with student work she had developed, administered, and evaluated. She shared multiple examples of student learning data, was able to identify the date and purpose of each one, and was prepared to report the results to the triad. By meeting 3, she not only brought physical copies of the student work, but she also had video-recordings of several of her interactions with the student. This wealth of student learning data served as the focal point of each TK triad meeting.
In the following short excerpt in meeting 3, Avery shared instructional strategies she used that involved grouping numbers, representing what she understood as prerequisite work with place value in kindergarten.

Avery: Right. So for the intervention I first started with allowing her to make groups with links so making a group of 1, a group of 2, a group of 3, 4, and 5. Then we were matching number tiles to match the number to the links and see her knowledge on that. If she was able to match the numbers and during the first intervention I think because it was a new task too, it was like it was a little bit like she did need more help support with it.

While Avery experimented with prerequisite place value activities that were appropriate for a struggling kindergarten student, Emily and Trina continued to be concerned that they were unable to address the place value objectives of the Common Core State Standards. This was exemplified in the previous excerpt from meeting 4 in which Emily continued to share her belief that the triad had “shied away from the idea of place value.” In the end, the triad felt the student had made significant progress by participating in the study, however, they still had concerns about gaps in her understanding.

**Triad TK Orientation Toward Inquiry Talk**

The majority of the Triad TK dialogue, across all four meetings, fell within the mid-range categories of the Inquiry-oriented Talk Continuum - Exploratory and Connected Talk. (See Figure 4.1) It was distributed fairly equally between dialogue that was exploratory or clarifying in nature (Exploratory Talk) and
dialogue that provided context and background information for the conversation (Connected Talk). There were several isolated instances of dialogue in meetings 2 and 3 in which the triad invited further exploration of the student work, expressing curiosity and wonderment (Inquiry-based Talk). Conversely, there was negligible dialogue that strayed from the task (Disconnected Talk) indicating that, for the most part, the triad remained focused on the task. (See Figure 4.1) The degree to which the triad’s conversations were inquiry-oriented impacted all components of the inquiry process - planning, implementing, collecting, and analyzing - as described below across each of the four TK meetings.

![Figure 4.1. Triad TK inquiry-oriented talk.](image)

**Triad TK – meeting 1.** Triad TK began their series of four meetings with a discussion about how to choose among three students they had identified as possible candidates for the study. Whereas TK used assessment data to make the decision about which student to choose to study, it was perhaps not surprising that nearly half of the dialogue was descriptive and was categorized as Connected Talk. For example, in the following excerpt, the dialogue between the mentor and the intern was a
discussion of various assessment results. At the end of the excerpt, the supervisor
entered the conversation, reiterating the findings of the intern and mentor and
expressing agreement.

Trina: That’s the grade median. So she counted in the Aimsweb to 40.
Avery: Okay, orally counted to 40.
Trina: And the grade median was 44, so she was in the green zone and she
wasn’t too far off from the grade mean. So that would be one area
that, and the end of year benchmark as you and I have discussed
many times is 100. So that’s really not a bad point for beginning
kindergartener.
Avery: So that would be a strength.
Trina: And this one.
Avery: Uhm.
Trina: That was the quantity screen.
Avery: Oh, okay. So for quantity, she was at 14 and the mean or the
average was 16. So.
Trina: And that’s actually the reason, that one is the one that identified who
would be in for math RTII and it hasn’t always been that. Sometimes
they change it around so that would be the reason, even though we
have this area of concern and this area of concern which is.
Emily: So we have number identification.
Trina: As an area of concern. And missing number.
Emily: Okay.
During this exchange, the triad members asked technical questions that generated objective information gleaned from the student work. The conversation focused on AimsWEB scores and how the student’s scores compared to the mean. In this case, the triad determined that areas of concern for this student were number identification and missing number, based on numerical scores. In general, these instances of dialogue were descriptive and directly connected to the task; the exchange generated information that assisted in determining the student’s needs. The decision about what student to study and what additional student work to collect was based on objective results of the assessments. Therefore, this represented Connected Talk.

There was approximately the same amount of Exploratory Talk as Connected Talk in meeting 1. In Exploratory Talk, inferences were made about what the student work demonstrated about the student’s understanding of the mathematical content. The following excerpt is an example of Exploratory Talk.

Trina: We did discuss that in data team a bit. That is really a 50-50, 50% call, either you say yea, more or less so that may have been easier for her, maybe she did hit some of those that she wouldn’t normally have hit on the AIMSweb because she was 50-50.

Emily: So oral counting, she had 40 which is not far off of where she needs to be. Number id, she had 18, which was significantly below. So what does that imply about her oral counting?

Avery: That she is below the average, that she’s (pauses) not on track with her peers?
Trina (mentor) suggested that perhaps the reason the student answered some of the problems correctly was because the question type had only two answer choices. In other words, the student had a 50% chance of getting the answer correct. Trina seemed to think that perhaps the student didn’t understand the concept to the degree that the data suggested and shared that concern with the triad. Emily (supervisor) followed with an clarifying question, “So what does that imply?”, speculating what that might signify about the student’s oral counting. The “scores” for oral counting and number identification seemed to be inconsistent and Emily asked the triad what they thought about the discrepancies. And finally, Avery (intern) attempted to offer a possible reason for the inconsistencies. She wondered whether that meant the student was not performing as well as the other students in the class. Avery asked the question, rather than making a statement about the student’s performance. These exchanges reflected conversation that went beyond simply looking at the objective results of the student learning data. This type of Exploratory Talk revealed how triad members were thinking and what they felt needed to be clarified.

**Triad TK – meetings 2-3.** Triad TK conversations peaked in Exploratory Talk in meeting 2, and then shifted back to reflect more of an emphasis on descriptive and factual exchanges in meeting 3. Furthermore, during meetings 2 and 3, the triad collectively hypothesized and reexamined their own understandings of the student learning data to a greater extent than in meeting 1. There was an increase in Inquiry-based Talk, representing a period of greater effort by TK to dig deeper into the student’s mathematical understanding in order to determine appropriate ways to structure instruction to meet the student’s needs.
Early in meeting 2, Avery (intern) and then, Trina (mentor) posed wonderings that represented an invitation to explore the student work more deeply. The following are two separate instances of dialogue that exemplify Inquiry-based Talk by Triad TK. Although a strong sense of Inquiry-based Talk represented only a small percentage of the dialogue in meeting 2, it set the tone for the triad to further explore what the student work suggested. The first instance below revealed wonderings shared by Avery (intern) and Trina (mentor).

Avery: Yea, okay, so on the 20\textsuperscript{th} of September was the first day we started collecting a little bit of data and it was just part of what she was working on. She did something with patterns and we noticed that she had difficulty reading the pattern and saying the pattern, being able to do the sequence. So we were wondering if there was a process difficulty or if it was like conceptually. So from that we’ve had created new wonderings and we’re wondering what else she might be able to do with patterns. Also, we were wondering if she looks at other students at this point. If she had looked at other students’ work and seeing what they are doing to know to what to do. Uhm.

Trina: One other wondering we had almost from the start, was she does really enjoy adult attention and peer attention, but really adult attention and we were wondering if when she’s working one on one with Avery even if it is an assessment or data collection if that would
be a positive? Would she try harder, or is it a go along with the
distraction piece?

Toward the end of meeting 3, the Lakeside Elementary Triad TK critically
and collectively analyzed what the student knew in an inquiring manner. The
following is a second example of Inquiry-based Talk.

Trina: I guess my wondering with that is - Was she comfortable enough, did
she think that she knew it that she didn’t need to look, because even
with her basic literacy skills which would be stronger than her basic
math skills, she has a tendency to still have to check to give herself
that okay,

Avery: Confidence?

Trina: So it’s just another wondering. Was she confident enough that she
knew the order?

Avery: Right.

Emily: That is another wondering, having watched Avery work with S in
the hallway, she reports that she likes math and certainly enjoys the
time that she spends with you. It’s interesting isn’t it really looking
at a student work and looking at the product and then trying to piece
it all together, what have we learned, what do we know?

The above excerpt followed a discussion about concern that the student did
not necessarily demonstrate what she knew, but was “copying” from her peers. The
triad had recently noticed that the student had not been looking at other students’
papers as often. They were wondering if this was because she was beginning to
develop a sense of confidence in her understanding of the mathematics. Clear
wonderings on the part of the triad were posed and acknowledged. Interestingly, the
wonderings were not always investigated fully at that moment in time.

There was not a substantial amount of Inquiry-based Talk in TK meeting 3.
Nonetheless, the presence of this type of dialogue, albeit nominal, seemed to play a
role in maintaining focus and encouraging thinking about alternative ideas as the triad
examined the student work.

**Triad TK – meeting 4.** The TK dialogue in meeting 4 looked similar to that in meeting 1. Perhaps that was because it was the final meeting and there was not an expectation to meet again. Wondering and hypothesizing waned and on occasion, the triad strayed from the task. The majority of the conversation, however, moved between exchanges of Exploratory Talk and those that were more technical in nature, or Connected Talk. True to form, Triad TK remained focused on the task. The triad talked about what they had discovered and expressed concern about future instructional plans. For example, in this excerpt, Emily (supervisor) encouraged Avery (intern) to share her ideas for a suitable instructional plan for the student.

Emily: You’ve spent this time working with her. What’s next? What do you think are your next steps based on what you have learned?

Avery: I think one is Trina and I have talked about maybe having (the researcher) come in and work with her. If possible to maybe give some ideas of different things we could try or interventions, what might help. And if she sees anything we’re definitely looking at other help, other fresh pair of eyes. Uhm. And I was thinking,
looking more as like I’m planning on continuing to work with her. But looking at more of the RTI like what they’re doing. I won’t work with her as much as they do, cuz they get the ½ hour every day. I’m working with her between 2 and 3 times a week. But on Fridays, they collect just like a little bit of data on what they’ve been doing, so ‘oh can you count these three, can you count’ and take that data. I’m kind of interested if I can use it or not, but I was thinking of maybe seeing how she does on those same skills that they are being tested on and because that’s kind of how RTI is, whatever they’re learning, then on Fridays, they are tested, the strategic monitor and I’d be interested in doing something more like that because I can, I’ve been getting data from what we’re doing but that is just more concrete.

At this fourth and final triad meeting, Avery had a great deal to contribute; she presented her ideas about what she thought might be best for the student and invited feedback, which is characteristic of Exploratory Talk. She shared strategies she would like to try that she had learned when she worked with the RTII program. Notably, Avery revealed that she recognized the strategies as being more procedural than conceptual, but felt they might be effective for this student.

Summary Triad TK—orientation toward inquiry talk. Triad TK remained strongly rooted in the middle of the Inquiry-oriented Talk continuum throughout the four meetings. Exploratory Talk played a compelling role, supported by Connected Talk throughout the study cycles. Although there was not a sizable amount of
speculating and conjecturing, when it was noticed, it contributed to and helped to shape the dialogue. The triad members looked carefully at the student work, asked questions of each other, and supported their ideas with facts that were descriptive and task-oriented. As a result, there was never a question about the focus of the conversations; TK’s inquiry process was solidly focused on the task.

**Triad TK Member Roles**

The majority of the roles noticed in TK were “task-oriented”. Task-oriented roles often assisted in providing information that moved the group forward toward achieving the goals of the task. The following section will describe the unique ways in which the TK triad members carried out their roles, within the context of their inquiry process.

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*Table 4.3. Triad TK dominant roles by triad member.*
**Triad TK supervisor roles.** As the facilitator, a managerial role, the TK supervisor was concerned with keeping the triad on task. Emily (supervisor) opened each meeting with a reminder of the group’s goals. Throughout each meeting, she listened carefully, reiterated points made by Trina (mentor) and Avery (intern), attempted to summarize the remarks, and moved the discussion forward. The following were the opening remarks made by Emily in meeting 2. As the facilitator, Emily set the stage for what the triad needed to accomplish during the meeting.

Emily: When we discuss S and the data that we have collected and take a look at that data and what we think we know by looking at the data and how we think we know what we think we know and what possible interventions might we design to help her with her math understanding.

In addition to offering the opening remarks to begin the meeting, Emily also facilitated the discussion throughout the meetings. The following excerpt was an example of when Emily highlighted a claim that Avery had made and asked her to elaborate on her idea. This was an example of Emily’s attempt to move the conversation forward, specifically in talking about place value concepts.

Trina: We’re still working on identifying 0 to 10, writing it. So we could never take that.

Avery: Yes, I would agree with that.

Trina: Would you say we’ve just never been able to go into that place value step because the foundational skills are not there.
Emily: You mentioned that she’s starting to use the vocabulary of place value.

Avery: Uhm hum.

Emily: Can you talk about that just a little bit more?

Emily also shared encouraging remarks with Avery. She was often heard making comments such as, “You’re doing a good job!”, “Way to go”, “You did a great job!”, “You’re spot on!”, and “You’re really good at picking up details.” In the role as an encourager, Emily moved the conversation along by keeping a positive feeling of accomplishment among the triad members, particularly with Avery (intern). The two primary roles that were played by Emily (supervisor) were the facilitator (managerial) and the encourager (interpersonal). (See Table 4.3)

**Triad TK mentor roles.** Trina (mentor) played the role of expert multiple times across multiple triad meetings. As might be expected, given that Trina was the lead teacher in the kindergarten class, she often offered comments as an expert about the students in her classroom, and in particular, about the student the triad was studying. For example, in the following instance, Trina shared her expert opinion about which student she felt would be the best choice for the study. In this particular instance, she did not necessarily invite others to share their thoughts; she contributed to the discussion by sharing her knowledge and opinion.

Trina: I would think from what we’ve observed, and, the, my past experience, I would agree, I think either are fine. I think any of those three would be fine for various reasons, but if you’re looking at one who maybe is going to need to try different interventions, that one
isn’t going to just be the cure all, end all, then S probably is the one that could benefit the most from that.

In another exchange during meeting 1, Trina, as an expert, offered her theory about why kindergarten students struggle when learning the teen numbers. Prior to this exchange, the intern and supervisor had hypothesized about what the student knew about the numbers 11-20. They talked about ways in which they might be able to determine her level of understanding. Then, Trina joined the conversation, sharing her opinion about why she thought kindergarten students are challenged when attempting to learn to write the numbers 11-20.

Trina: And what I can share about that and you’ve heard me say this many times, is the teens are a really tricky area and my theory is that because they’ll say 8 – teen, 7 – teen, when they start to get the idea, they’re still transposed because you say that first number first. So a lot of, once they start to get the idea of what it looks like, very often, there’s that transposing because of the way it is verbally, orally counted. It makes it trickier. So once we get past and they know, oh there’s a “one” in there and even though we do our saying - “teens are lots of fun, they always start with one”, and we model that and say that and practice it, it is still one of the areas that many kindergarteners struggle with.

The excerpt above represented knowledge in practice, knowledge Trina had gained through personal experiences in her classroom (Cochran-Smith, Marilyn & Lytle, 1999). It provided information for the triad to consider. It was directly
connected to the task and made a meaningful contribution to the conversation in response to previous comments made by Avery and Emily.

In addition to assuming the role of expert, Trina also used her skills as a storyteller to contribute to the triad conversations. When a story was shared, sometimes it was well connected to the task and provided a useful contribution. At other times it served as a distraction. In the case of the TK mentor, on several occasions, Trina told stories that provided useful background information about the student. For example, in meeting 4, as the triad was trying to decide next steps for the student, Trina told the story of the student’s prior experience in pre-school and why the student was actually old enough to be in first grade. It provided valuable information that impacted how the triad made decisions about future instructional practices for the student.

Trina: She would be in first grade. She went through what was called the ½ day kindergarten at a local church and it is a good program and I was actually, last night I was inquiring a little bit more about the teachers and some of the things that they do. I think it went til 12:30, so it wasn’t a short day and then toward the end they bump it up to 2:00 so they get used to the length of day. And the programming, they definitely are more in tuned with what we do in kindergarten than some of the other schools, so I think her prior experience there would have been a nice foundation for her. Even if maturity was the reason they opted to keep her in that program for another year, I think the foundation she received would have been a good start.
In summary, the two dominant roles played by Trina (TK mentor) were both task-oriented roles, the expert and the storyteller. (See Table 4.3) Her contributions provided helpful information that the triad used to make decisions about their student’s needs.

**Triad TK intern roles.** In the early stages of the study, Avery’s (intern) role in the triad conversations was that of a learner. As mentioned earlier, the TK’s focus was to assist Avery in learning how to look at student work, determine what the student understood, and decide on appropriate future instruction. Avery was a model learner; she accepted the responsibilities she was given and fulfilled those responsibilities without question. As a result, over time, Avery’s role shifted markedly within the triad. After meeting 1, her participation more than doubled. By the second meeting, she was the lead participator, maintaining that position throughout the remainder of the study. By the third meeting, there was evidence that Avery was becoming an expert within the context of the study, which is illustrated in the excerpt featured below.

As a learner, Avery was often asked to answer “test” questions posed to her by Emily (supervisor). Structured as a teacher to student exchange, Avery was quizzed about what she thought the student learning data was showing. This is one of numerous such exchanges found throughout all four triad meetings.

Emily: What do you think, this is just an educated guess. This is your hypothesis right now. What do you think would happen with her total understanding of numbers 11 through 20?

Avery: It would be tough for her.
Emily: Why?

Avery: Because of the concept of, she doesn’t have the letter identification and that’s an area for her to grow in. But, not like because we’ve observed the disconnect in other areas of math for her to count on, I think that would be tough for her.

Emily: Yeah, that’s a good answer.

Avery reportedly did significant research to assist with her lesson planning, and took the lead in offering suggestions for instructional plans for the next cycle of the study. Consequently, Avery became more comfortable talking about what she felt the student work was suggesting. In the following excerpt, during meeting 3, Emily (supervisor) asked Avery to share what she thought was indicated by a particular set of student learning data. In contrast to responses to similar questions in earlier meetings, Avery confidently shared her opinion of the progress she thought the student had made.

Avery: I think I’ve seen improvements 1 to 5 and I think she’s consistent in her rote knowledge, however, her number sense as far as - I haven’t talked about this, the topic of before and after came up. So during, I think during the fourth intervention, I introduced counting down from five, which she was not familiar with. So from that intervention, we’ve been practicing 5 4 3 2 1. If you asked what number came before four, she would not be able to tell you unless we were having a manipulative out and looking at it, what comes before.
Trina: So the evidence is showing growth?

Avery: Growth, yes.

Trina: Mostly rote?

Avery: Mostly rote.

The two primary roles played by Avery, (TK intern), were both task-oriented roles. Avery began the study as the learner and evolved into a blossoming expert within the context of the study. (See Table 4.3)

**Summary:** TK member roles. A study of the Triad TK conversations revealed that the dominant roles of the supervisor were a facilitator and an encourager, of the mentor were an expert and a storyteller, and of the intern were a learner and a blossoming expert. A unique development in the TK inquiry process was a noticeable shift in role by the intern. From the start, Avery (intern) was required to take primary responsibility for all aspects of working with the selected student in terms of designing, administering, and reporting student learning data. This required her to be dependable and accountable, and as a result, Avery was a major contributor in each triad meeting. Accordingly, her knowledge for practice and knowledge in practice grew significantly during the four meetings (Cochran-Smith, Marilyn & Lytle, 1999). This developed confidence in her ability to understand the student’s needs and to make research-based suggestions for instructional practices. As a result, Avery moved from being only a learner to becoming a blossoming expert.

**Chapter Summary**

Triad TK was characterized as the “focused” triad. There was negligible conversation that was disconnected from the task. Although there was some concern
by the triad about whether they were addressing the place value objectives for kindergarten, they remained focused on the task of understanding what the student knew and planning appropriate future instruction.

The triad began their work by reviewing objective data to choose the student with whom they would work. Their dialogue became more exploratory as the meetings progressed, then returned to a factual conversation as their work culminated. The intern learning was at the foreground of the triad’s work, which caused the emphasis on the student learning to be a secondary concern. Although the student did make progress in her mathematical understanding, it was the intern learning that remained the primary focus of the triad conversations.

The growth of the intern was observed in several aspects of her work with the triad. Her participation increased substantially throughout the triad meeting. She took initiative to research ideas for student activities and sought out the advice of her elementary mathematics methods instructors. When analyzing the student work, her confidence grew and by the last triad meeting, she was freely sharing her opinions about the student work.
CHAPTER 5 - TRIAD T2

EXPLORING AN INQUIRY PROCESS

Introduction

Chapter 5 is the story of the inquiry process of a second grade PDS triad - mentor teacher, intern, and supervisor - known as Triad T2 and situated at Great Falls Elementary in the Sunshine Hills School District. In the fall of 2013, ten professional development school interns were placed at Great Falls Elementary in classrooms ranging from grades k-4. Triad T2 was part of the primary division that consisted of 3 first grade classrooms and 3 second grade classrooms. This chapter explores instances in the T2 dialogue that impacted the components of the inquiry process: planning, implementing, collecting, and analyzing student learning data collected about a “puzzling” student.

Triad T2 met four times during the fall of 2013. (See Table 5.1) The length of each meeting varied. The purpose of the first meeting was to choose the student to study; it was 5 minutes in length. Meeting 2 completed cycle one and was approximately 20 minutes; meeting 3 (cycle 2) was 30 minutes; and meeting 4, (cycle three) was 15 minutes. The first meeting was held before school; the remaining meetings were held after school.

<table>
<thead>
<tr>
<th>Triad</th>
<th>Meeting 1</th>
<th>Meeting 2</th>
<th>Meeting 3</th>
<th>Meeting 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triad T2</td>
<td>Sept. 27 5:11 min</td>
<td>Sept 27 20:39 min</td>
<td>Nov. 18 31:43 min</td>
<td>Dec. 18 13:53 min</td>
</tr>
</tbody>
</table>

Table 5.1. Triad T2 meeting dates and times.
Triad T2 Participants

Mentor: Irene. Irene was a second grade teacher with 11 years of experience, 7 years in 2nd grade and 4 years in 3rd grade. She was familiar with the 2nd grade place value standards, having taught second grade for seven years. Although Irene had hosted PDS interns as a partner classroom in the past, this was her first year as a full-year professional development school classroom mentor.

Intern: Hanna. Hanna was a fourth year undergraduate university senior in Childhood and Early Adolescence Education. She was of traditional age for a senior intern. Hanna was matched with Irene and her second grade classroom in the spring of 2013 and began her full-year internship in fall 2013. Hanna had had multiple experiences with children prior to her internship, although none of them were over an extended period of time. During her year-long internship, she was often challenged by managing all the responsibilities involved in teaching a class of 2nd graders. She admitted that mathematics was not a strength nor passion for her.

Supervisor: Marie. At the time of the study, Marie had been a member of the professional development school partnership for 7 years, albeit not consecutive years. She was an intern in 2003-2004, was hired as a classroom teacher in Sunshine Hills School District in 2004-2005, and was chosen to be a hybrid educator (PDA – supervisor) in 2012. Marie had been a classroom teacher for 7 years, 5 years in second grade and 2 years in third grade, during which time she was a PDS mentor teacher for 3 years. She was completing her third year as a PDA when participating in the study. Marie was familiar with the 2nd grade place value standards, having taught second grade for 5 years.
Triad Meetings Overview

Irene (mentor) and Hanna (intern) referenced the second grade *Common Core State Standards* to develop assessment items that were used to collect baseline data. The data were used to analyze the student’s understanding of place value concepts. While discussing the results of the student work, Irene routinely took the lead in making suggestions for the next implementation round. Then, Hanna took responsibility for collecting (or developing) and administering the instructional pieces for the next cycle of the study. Throughout the inquiry process, Marie (supervisor) regularly contributed to the conversations and also co-taught with Hanna during study cycles 2 and 3. Overall, the triad worked collaboratively to analyze the results of the student work; all members contributed fairly equally to the discussion. At the end of the study, the triad celebrated the remarkable strides the student had made in her understanding of place value concepts. They recognized the student’s development of a strong sense of confidence that had evolved over time and was reflected in her work. All of these factors contributed to a positive and productive implementation of the inquiry process.

Irene (mentor) often set the tone of Triad T2’s inquiry process by her commitment to create a collaborative dialogue among the triad members. The triad’s interactive exchanges routinely reflected a balance of participation among the three members. Sometimes it was simply a brief remark of agreement or acknowledgement, but nonetheless, all members were routinely engaged in the discussion. This sense of a balanced dialogue grew and became even more apparent throughout the four meetings. By the fourth and final triad meeting, the
mentor, intern, and supervisor each contributed equally to the conversation, or approximately 1/3 of the time. The following excerpt is a typical balanced exchange among the Triad T2 members.

Irene: (mentor) Another thing, just understanding the hundreds, tens, and ones - that to write 100 you don’t always have to write 1 zero zero.

Just by putting the 1 in the hundreds position, so even doing things where you have like a 100s, 10s, and 1s chart and uhm, you know, put a 3, an 8, and a 2 and they should be able to say that’s 382. Well, now build that for me and what does that look like in both? You know what I mean? With the blocks and stuff.

Marie: (supervisor) Uhm hum.

Irene: Do you know what I mean? With the blocks and stuff. Alright, anything else? the notating?

Hanna: I have noticed that she draws pictures. So that is maybe something - there’s something there with her drawing pictures.

Irene: Yea, yea, and we’ve been working on efficient strategies so, she’s starting to use her tens and ones.

Marie: Right. That might help her. So rather than drawing circles…

Irene: Yes.

Marie: I can make 4 sticks.

Irene: Yes.

Marie: That would even be an improvement from where she is here.
Irene: Yes.

Marie: I think she gets that but…

Hanna: But she has sticks in there too. That’s what I don’t get.

**The Nature of the Student Learning Data**

Triad T2 submitted 9 pieces of student learning data over the course of three study cycles. The first was a place value pre-assessment given to the class early in September. (See Appendix J) During study cycle 2, approximately a month later, a second place value assessment was given. At the end of study cycle 3, a worksheet was completed by the student that showed her ability to draw sticks and dots to represent a 2-digit number and to identify the value of an underlined digit in a 2-digit number. (See Appendix K) Five additional pieces of student work (undated) were submitted in which the student was asked to draw sticks and dots to represent 2-digit numbers, add 10 to several 2-digit numbers, draw a picture of a 2-digit addition problem, identify numbers on a hundreds grid, and solve 36 addition and subtraction problems (1- and 2-digit problems, timed). The last piece of student work was a teacher plan with notes from a one-on-one session with the student. This plan included having the student identify numbers in the tens column of several given numbers, show two different ways to represent a 2-digit number with base ten blocks, and add 10 to a 2-digit number using the hundreds chart. The majority of the work was completed in one-on-one interventions with the T2 intern. In some cases, the T2 supervisor assisted in the interventions with the student.
The Substance of the Conversation: Student Understanding, Instructional Practices, and Student Learning Behaviors

The T2 inquiry process was defined by a fairly predictable pattern with regard to the substance of the dialogue beginning with the T2 mentor who typically initiated the conversation. The following excerpt is an example of Irene’s (T2 mentor) opening remarks about the student work. At the end of this excerpt, Irene invited Hanna (intern) to describe how the student had performed. Although the featured instance of dialogue by Irene was primarily a description of the student work, it also included background information about how Irene and Hanna had chosen the work, what they were interested in finding out, where the student was struggling, and what curiosities they had.

Irene: We’ve actually been trying to just find extra time in the day when Hanna can work with L. So about 2 weeks ago Hanna and I sat down together and looked at L.’s place value assessment. We looked at her unit 1 test to see where she was still struggling. So we came up with a week’s worth of activities that Hanna would do with L. So I’m going to describe what we came up with and then Hanna will talk about how L. did with each of those activities, where were areas that she was still struggling and where are areas where we are seeing solid improvement? So for the first session that Hanna had with L., we were just interested to see if she could draw a written representation of a number 84 or 67. After that we were curious if L. could take a drawing and then figure out what number, what numerical number that
was worth. So we used sticks and circles for that and then one area that we wanted to throw in there also was if we had the number 73 and we underlined the 3, would L. know what that 3 is worth. We did that with 73 and 48 and that was our first day’s worth of work. So Hanna would you like to talk about that first day’s worth of information that you gathered?

By the end of the study, Irene’s opening comments became briefer, allowing Marie and Hanna to share their feedback and opinions about the student work earlier in the meeting. Eventually, the conversation was equally balanced as the triad discussed what the student understood about place value, made suggestions for future instructional practices, and discussed what type of learning behaviors seemed to be impacting the results of the student work. The following were the opening remarks shared by the three T2 members in meeting 4.

Irene: I just want to give a little bit of background info that over the past week or two, Hanna has - we sat down and we talked about really just trying to cover the almost as a review from the past couple months. And just trying to hit certain things pretty strong that we talked about in our last conversation. And so today was the last day that Hanna met with L. and Marie actually joined them and there’s some data that they have to share with you.

Hanna: I basically took everything that we’ve ever done and went over. I used the cubes and sticks and had her show me different numbers and then Marie, you had her show - so if the number was 57, Marie said,
okay show me 47 and 67. And we said, can you show us a different way to show 57? And she had a little bit of difficulty with that.

Marie: I agree with you, so Hanna, I think was looking for, so she had the number was 57, so she had 5 tens out and 7 ones and show me a different way to make that number.

As each meeting came to an end, T2 routinely turned their attention to planning for the next study cycle. It was characteristic of T2 members to ask each other for input before making final decisions about the next set of student work samples that would be collected. In meeting 3, the following excerpt reflects a typical ending to a T2 meeting.

Hanna: So maybe ask her what pattern do you see?

Marie: Show her a 100s chart and can you color a pattern that you see and maybe you can have one and you color that pattern. What do you think my pattern is, what did I do? Just have more conversation about that 100s chart in general.

Irene: I was thinking about if you only had all the numbers that ended in 6 on the chart and you took out 56 and say, what number would go in that blank?

Hanna: Okay.

Irene: That makes me think of that *Investigations* activity where they used to fill where you would pull (a number).

Marie: That was great.

Irene: That was, we just did that maybe a month ago.
Marie: Okay.

Hanna: Even in our math methods course we’ve gotten forms that have the 100s chart and there’s spots missing where we have to write in.

The T2 conversations had only a limited focus on student learning behaviors. And yet, when there was evidence of dialogue that did address student learning behaviors, it seemed to significantly impact the decision-making process for the triad. For example (below), Irene (T2 mentor) shared her thinking about the efficiency of the student’s strategies, such as counting up, counting all, and counting on her fingers. Then, the triad expressed their concern that this student may need to find one strategy that worked for her and use that strategy consistently rather than trying to become proficient with several strategies. In this example, all triad members contributed to the analysis and planning component of the inquiry process.

Irene: Yeah. And you know what’s so interesting is that we always encourage our kids to think of different ways to solve problems, but she just might be one of those kids, that this is the way. Find one way, it’s your go to and …

Marie: Yea.

Irene: You might not understand it, but,

Marie: Right.

Irene: It’s the way you can get the right answer.

Hanna: Maybe there’s a different way to show her.
Irene: It seems like showing the 100s chart, the base ten, talking about patterns and then breaking out tens and ones.

Marie: You should line them up versus breaking them apart to reinforce the tens and the ones.

Hanna: Vertical. Like this?

Marie: Sorry (researcher), plain old line them up then. She’s doing so much work with tens and ones, that at least it would keep everything, these are the tens these are the ones. And that maybe someday we can break away from that when she has a stronger sense of place value.

Hanna: Understanding. Maybe I can try that this coming week or ask her which number’s bigger, but then what day was that? I tried to write the day on these.

Marie: Because I wonder like you might know, so if you pull up - I know that that’s been happening in class. Breaking 54 apart into 50 and 4. But does she really get that that’s what happens to 54?

Overall, Triad T2’s focus, or substance of their conversations followed a predictable pattern. The mentor typically brought the meeting to order with an update on the student work for the current study cycle. Each meeting ended with a deliberate effort to plan instruction for the next study cycle. Notably, T2 carefully analyzed the mathematical strategies used by their student when solving problems and used this
information to help them determine what the student understood about the mathematics.

The Mathematics in the Student Learning Data

Foundational skills and understandings of place value are commonly introduced and targeted for mastery in the primary grades. Second grade place value concepts are routinely “named” in 2nd grade curricula. They characteristically take a prominent place in the mathematics materials developed for second grade students. In Number and Operations in Base Ten, the following are the Common Core State Standards objectives for second grade:

<table>
<thead>
<tr>
<th>Grade 2: Understand place value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones.</td>
</tr>
<tr>
<td>2. Count within 1000; skip-count by 5s, 10s, and 100s.</td>
</tr>
<tr>
<td>3. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.</td>
</tr>
<tr>
<td>4. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using &gt;, =, and &lt; symbols to record the results of comparisons.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 2: Use place value understanding and properties of operations to add and subtract</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.</td>
</tr>
<tr>
<td>6. Add up to four two-digit numbers using strategies based on place value and properties of operations.</td>
</tr>
<tr>
<td>7. Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.</td>
</tr>
<tr>
<td>8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.</td>
</tr>
<tr>
<td>9. Explain why addition and subtraction strategies work, using place value and the properties of operations.</td>
</tr>
</tbody>
</table>

Table 5.2. Common Core State Standards place value objectives for grade 2.

Triad T2 identified place value concepts represented in the student learning data and were able to match them with the objectives outlined by the Common Core State Standards (CCSS) for 2nd grade. They collaboratively discussed evidence of the connections in their planning, their selections of student work to collect, the manner
in which the work was implemented, and the way in which it was analyzed. The following excerpt from meeting 2 demonstrated how Triad T2 used place value understandings that were determined in the pre-assessment to plan instruction for the student. For example, they speculated whether it would be useful to have the student identify which of two numbers was larger. Their discussion went beyond simply having the student identify the larger number. They wanted to know whether the student could explain how she knew which number was larger by using her knowledge of place value concepts. They also discussed the sets of numbers they would choose for the activity. They wondered whether varying the value of the digits in each place would impact the student’s ability to explain her thinking and hopefully provide more information about her understanding of place value concepts.

Irene: Yeah. I was wondering, do you think there would be any purpose in saying, Faye which number is bigger, 46 or 64?

Hanna: Uh huh.

Irene: And maybe we don’t even have the same numbers. Maybe it’s 23 and 47. Make them really different. I would be so interested if she at least knew which one was bigger.

Marie: And could tell you why.

Irene: Yes.

Marie: Does she use any of the knowledge of tens and ones? If she knows if that’s a tens, does she use that to support why she knows which one’s bigger?

Irene: Right. That’s an interesting one, right.
Hanna: Yes definitely.

Triad T2 not only examined the student’s understanding of how to use place value concepts when reading, writing, and comparing numbers, but they also explored how those understandings were applied to the operations of addition and subtraction. The following exchange between Hanna (intern) and Marie (supervisor) during meeting 4, demonstrated the progress the student had made in applying what she had learned about place value concepts to solving addition problems with regrouping.

Marie: I drew lines to separate the columns. So like one number goes here.

Hanna: That helped.

Marie: And she got the rest of the problems.

Hanna: We gave her like 3 or 4 more.

Marie: All regrouping.

Hanna: And she got them all right.

Marie: And her, even the adding was very accurate.

Hanna: Yes.

Marie: That she was doing in her head, with no fingers.

Hanna: And she was doing it promptly, it wasn’t waiting two minutes for her to add 7 and 3.

Throughout the four triad meetings, the members of Triad T2 demonstrated their ability to identify the student’s understanding of second grade place value objectives set forth in the standards and reflected in student learning data. From these findings, they were able to plan instruction that addressed additional expectations
outlined by the CCSS for second grade instruction and move the student forward in her understanding.

**Triad T2 Orientation Toward Inquiry Talk**

Triad T2’s inquiry process was characterized by talk that was primarily “questioning” in nature. Although the triad began the first in the series of meetings with descriptive and factual exchanges (Connected Talk), the remaining three meetings were dominated by a large percentage of Inquiry-based Talk and Exploratory Talk. (See Figure 5.1) Their conversations were riddled with questions and wonderings about how the student work could be interpreted. They often noticed things that were interesting or unexpected and collaboratively expressed curiosity about the significance of the data. The triad members showed genuine interest in each other’s opinions and views and invited further discussion of the evidence from one another. Notably, there was no evidence of dialogue that was not related to the task across all four triad meetings.

![Figure 5.1. Triad T2 inquiry-oriented talk.](image-url)
**Triad T2 – meeting 1.** Triad T2 meeting 1 of the inquiry process was atypical. The mentor and intern had met previously without the supervisor, not realizing that the complete triad needed to be present at each meeting. And so, the recorded transcript was more of a summary of the original meeting. It was a short meeting (5 min, 11 sec.) in which the mentor was the main contributor. There were two lengthy comments by Irene (mentor), one that was speculative (Inquiry-based Talk) and one that explored possibilities of how the student work might be interpreted (Exploratory Talk). During each of her two lengthy chunks of dialogue, Irene invited wonderings and revealed possible patterns of thinking about the student’s understanding of place value. The remaining instances of dialogue took place between the intern and mentor and were shorter, but more numerous. They exemplified talk about factual and technical information (Connected Talk). Although these factual exchanges represented a greater number of individual instances of dialogue, they contained less substantive information about the student.

**Triad T2 – meeting 2-3.** The T2 dialogue during meeting 2 was similar in nature to that of meeting 3. During both meetings, the conversation was dominated by instances of Inquiry-based Talk and Exploratory Talk. The following excerpt highlights an exchange between Marie (supervisor), and Irene (mentor), in meeting 2, that was speculative and invited further investigation of the student work.

Marie: Or have an understanding that these equal these. I think I’m wondering if like some student work related to base ten blocks would be something to… up to 100 even.

Irene: Yes. Yes.
Marie: Well, yea, I wonder, like if she had one block, would she know that was 100?

Irene: Exactly, and I think that she’s not quite ready for written representations. She’s so much more, she’s still a direct modeler, where having those actual physical blocks and sticks, and to be able to manipulate them, build numbers …

Marie: Exchange them.

Irene: Yea. So I think that would be one thing on our radar to do with her. Even lay out if we lay out three 100 blocks and three little cubes, could she figure it out with the physical blocks or is that even too difficult… anything in the 100s. But she does a pattern, which is very interesting.

Marie: It is. I just wonder about, yes, I think that uhm there is something like she was almost like…. It was not just random guessing.

Irene: It was a pattern.

Marie and Irene both noticed an interesting pattern the student used in thinking about numbers in the 100s. They expressed wonderment about the role the pattern played in the student’s understanding. They concurred that the student was not simply guessing what number was represented by the base ten blocks, but they could not substantiate how the student was using the pattern in her thinking about a particular number. This discussion was an example of Inquiry-based Talk that was speculative and invited others to share their ideas about the student’s thinking that
were not apparent by simply looking at the surface of the student work. There were numerous similar instances of uncertainty and speculation in meetings 2 and 3.

There was also a strong presence of Exploratory Talk in meetings 2 and 3. This type of dialogue highlighted how individual triad members analyzed the student work. The following chunk of dialogue took place in the latter part of meeting 3. It revealed inferences and tentative claims that were suggested and questioned by Hanna (intern) and Irene (mentor).

Hanna: Okay, I did not help her at all and the one that she got wrong was 17 plus 10 and after we were done, I gave her that problem. I wrote down 17 plus 10 and she said, oh 27. So I don’t know if she just made a mistake because she got every other one right.

Irene: Uh hum.

Hanna: But I did not help her. I don’t think she used the base ten blocks, I mean they are always there, and I don’t know if I always say “use these” but I always take them with me every single day.

Irene: You don’t recollect her using the base ten blocks on these? Do you think it was just the counting on?

Hanna: Either that or we have been working on plus 10 and what’s this number worth. So…

Irene: Yeah.

Hanna: I’d like to think that she’s starting to grasp the concept but …

Irene: Yeah. Yeah. So you didn’t see her actually physically counting on her fingers?
Hanna: Sometimes she’ll do it under the table, where I can’t see.


Hanna: But she did these pretty quickly if I remember correctly.

Irene: Did them quickly without really any hands-on manipulatives?

Hanna: Uh huh.

Irene: Go figure.

Hanna: Each day is new. I never know what she’s going to bring to the table each day.

The above chunk of dialogue between Hanna and Irene revealed their thoughts about both what the student understood and the instructional strategies that were utilized. For example, there was some question about whether the student had used the base ten blocks or had counted on with her fingers. Was she able to be successful without using any manipulatives at all? At this point in the triad meeting, they noticed that the student was beginning to make progress, although it was sometimes difficult to figure out how she knew what she knew. Throughout the inquiry process, triad members expressed their opinions and posed questions about what the student work suggested, which is characteristic of Exploratory Talk.

**Triad T2 – meeting 4.** During the fourth and final triad meeting, there continued to be substantial evidence of Inquiry-based Talk and Exploratory Talk in the dialogue, although to a lesser degree than in meetings 2 and 3. The triad was still “exploring” the student learning data. They were also thinking about finalizing the project, which seemed to be apparent by the increase in descriptive and factual contributions, or Connected Talk. Although the triad members continued to build on
each other’s comments, it was sometimes in a less inquiring or exploratory manner.

Despite the prevalence of more factual talk, the triad remained committed to analyzing the work of the student and considering ideas for future instructional practice. For example, the following are individual instances of dialogue that exposed questions and concerns held by the triad during the final triad meeting. Triad members revealed their thinking, conjectured, speculated, asked for clarification, noticed possibilities, and ventured tentative claims.

Marie: The first two times she tried to do it on her own, she took a ten away and brought out one one. Or did she add?

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Marie: I guess I just thought in terms of what we’ve been talking about with L., that might be really, really conceptual for her. The idea of 4 tens and 17 ones.

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Marie: I mean, she was, I don’t think she missed one, did she?

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Irene: So I was trying to see like, you know we’ve tapped her out of the tens, so is she ready maybe for hundreds?

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Hanna: Maybe that’s something else. Maybe when she gets here in the morning, she’s just not wanting to do math. We waited till 11 today.
Marie: We didn’t do any subtraction so I wonder what the skills are like in terms of understanding.

Summary Triad T2 - orientation toward inquiry talk. In sum, Triad T2 was characterized as the “questioning” triad. They rarely disconnected from the task and they actively explored their curiosities and thoughts of concern through recurrent questioning. These types of interactions included uncertainty, hypothesizing, and wonderment and played a major role in defining the inquiry process.

Triad T2 Member Roles

Triad T2 members demonstrated evidence of roles found in each of the four categories, task-oriented, probing, interpersonal, and managerial. In particular, there was significant evidence of the presence of probing and interpersonal roles. Probing roles were characterized by questions and curiosities (Exploratory Talk and Inquiry-based Talk). The interpersonal roles contributed to the social dynamics of the triad and were associated with a positive contribution to the components of the inquiry process.
Table 5.3. Triad T2 dominant roles by triad member.

**Triad T2 supervisor roles.** One of the roles assumed by Marie (T2 supervisor) was facilitator. Although she was not the only triad member who exhibited this trait, there was more evidence of her efforts to keep the triad on track than there was by the other triad members. Because this triad demonstrated a balance of participation among its members organically, there was not a strong need for one sole member to play the designated role of facilitator. In fact, the T2 mentor also exhibited some evidence of playing the role of facilitator. Actually, all three T2 members exhibited a strong sense of being resolute to contribute to the dialogue by asking probing questions of each other. Hence, it could be said that they all took responsibility, to some extent, for facilitating the triad conversations.

In the following excerpt, Marie (supervisor) acted as a “soft” facilitator by pointing out connections among comments made by triad members. This type of
Redirection helped the triad recognize similarities in their thinking. This style of facilitation was less directive. Moreover, it contributed positively to the tone of the inquiry process.

Marie: Here’s the other lack of number sense. Is that 51 is less than 54. So that goes back to your question about can she identify which is bigger. You could say to some kids, most kids, ‘Does that make sense?’ I mean 41 didn’t even change! 41 plus 10 is still 41 and all the rest is less. That is not even on her radar.

The more obvious and dominant roles played by Marie were wonderer and questioner. Perhaps because she was not in the classroom on a daily basis, Marie often asked questions of Hanna and Irene to gain better insight into the analysis of the student work. Marie’s questions and wonderings were noted, almost exclusively, as Exploratory Talk or Inquiry-based Talk. In fact, in many cases, her comments would move the conversation from Connected Talk to Exploratory Talk or from Exploratory Talk to Inquiry-based Talk. Although this might be seen as a type of facilitation, Marie’s exchanges reflected a more authentic desire to find out more about the student, as opposed to redirecting the conversation.

In the following excerpt during meeting 3, Marie invited the others to think about whether it would be helpful to ask the student to identify which of two numbers was larger. She then wondered if the student used her knowledge of place value to help her decide which number was larger. As was characteristic of this triad throughout the inquiry process, all three triad members were engaged in the exchange.
Marie: Yeah. I was wondering, do you think there would be any purpose in saying, ‘L. which number is bigger, 46 or 64?’

Hannah: Uh huh.

Irene: And maybe we don’t even have the same numbers. Maybe it’s 23 and 47. Make them really different. I would be so interested if she at least knew which one was bigger.

Marie: And could tell you why.

Irene: Yes.

Marie: Does she use any of the knowledge of tens and ones? If she knows if that’s a tens, does she use that to support why she knows which one’s bigger?

Irene: Right. That’s an interesting one, right?

Hannah: Yes, definitely.

And so, Marie’s primary roles in the inquiry process were probing in nature. She was the initiator of many clusters of dialogue that represented both Exploratory Talk and Inquiry-based Talk. Her goal was to look beyond the descriptive facts found in the student learning data. Marie often pushed the triad to consider alternative possibilities and regularly invited them to look for patterns and venture tentative claims, perhaps based in part on her recent teaching experience in second grade. Two of her dominant roles were categorized as “probing” - the wonderer and the questioner. She also exhibited evidence of being a facilitator.

**Triad T2 mentor roles.** The primary roles that Irene (T2 mentor) played in the inquiry process were task-oriented. Her contributions were often that of an expert
and also of a teacher. Additionally, she assisted in facilitating the conversation, as was true of Marie (T2 supervisor).

As a facilitator, Irene showed a regular pattern of inviting other triad members into the conversation. This perhaps contributed to the balanced participation among the three participants in T2 and explained the lack of evidence that any one member attempted to dominate the conversation. Instead, there were numerous instances in which Irene (mentor) shared her thinking and then invited others to respond or add on. The following were examples throughout each of the four meetings of Irene’s continual efforts to include others in the conversations.

Irene: So those are the assessments that we’re thinking of giving. Just a few observations. Hanna made an observation the other day that just gave us a little bit more of a glimmer of L.’s thinking and her thinking in terms of number sense. Would you like to share that?

Irene: Then Hanna just noticed that…and do you want to chime in about this with…. with the representation on the second page with the three digit take away 3 digit?

Irene: We also wanted to share the 100 charts so that she could see that just counting 10 really just takes you to the very next row. So do you want to talk about how that went?
Irene: Yea, yea. So we kinda talked about Hanna continuing to talk about patterns with the 100s chart and Marie did you want to reiterate that what you were thinking about the 100s chart?

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Irene’s task-oriented roles of teacher and expert were also noticed throughout the inquiry process, often in tandem. In meeting 2, Irene shared her expert knowledge in practice concerning typical second grade mathematical understandings. She also mentioned a conversation she had with Hanna (intern) that personified her mentoring style as a teacher. In these types of exchanges, Irene not only shared her knowledge, but did so in a manner that was instructional to the triad.

Irene: I think starting with 2 digit just to make sure because sometimes as I have said to Hanna, with math in second grade sometimes you assume that they understand things. The other day we did the 100s chart and you just assume that kids pick up patterns and trends on the numbers chart and it’s so crazy when it’s not obvious to them, or they can tell you everything you want to hear, but when you say okay what is 46 plus 10, and they have no idea to just bump down one. To them, L. would probably have to count 4, 5, 6, 7, 8, 9, 10. So maybe even doing some hundreds charts stuff to understand those relationships.

Similarly, in the following exchange, Irene posed a question and demonstrated her knowledge about how to best structure the instruction by suggesting that the student prove her work by using the base ten blocks. In this type of exchange, Irene demonstrated a collaborative style of sharing her knowledge and defined her
approach to the planning component of the triad’s inquiry process. Notably, all three triad members were engaged.

Irene: Did she have access to base ten blocks?

Hanna: Yes, she always does.

Irene: Okay.

Marie: She didn’t choose to use them.

Hanna: No.

Irene: Alright. So maybe another thing is insisting. You prove it. Before you answer anything, even with comparing two numbers, prove to me whatever you think whichever one’s bigger. So if we do 34 plus 10. Kinda forcing her to use base tens.

In sum, two of Irene’s dominant roles were task-oriented and were often noticed concurrently. She shared her knowledge in a manner that was instructional to the triad, exemplifying her parallel roles as an expert and a teacher. Additionally, both Irene (mentor) and Marie (supervisor) helped create a balance of participation by facilitating in a non-directive manner. In other words, they both moved the conversation forward when necessary by employing a collaborative approach to their interactions with triad members.

**Triad T2 intern roles.** In spite of the fact that Hanna had the least amount of teaching experience and perhaps the most to learn, the T2 mentor and supervisor both viewed all members of the triad, including Hanna, as learners. Perhaps being a learner was not the *primary* role of the mentor and supervisor; nonetheless, they did not see Hanna as the *only* learner in the triad. Accordingly, the primary focus of the
T2 inquiry process was on the student, not on the intern. Hanna’s mentor and supervisor supported and guided her in analyzing the data and planning the instruction throughout the triad meetings. At the same time, all triad members were committed to being equal participants in the inquiry process. For example, although Hanna regularly met with the focus student, Marie also met with the student and was a major contributor in describing the student’s progress in meeting 4.

Whereas Hanna began the study as a learner, she acquired knowledge in and for practice from Irene and Marie by listening and agreeing. Subsequently, over time, she grew into a developing expert in the context of the study. In the following exchange with Irene (mentor) that took place in the beginning stages of the study, Hanna was highlighted as a learner. Hanna demonstrated her willingness to participate by sharing her opinion and further, displayed her interpersonal skills by listening and agreeing.

Irene: I think she, this problem here is so much more abstract for a kid like her.

Hanna: Uh huh.

Irene: Because she really can’t model it, she can’t do the action of it.

Hanna: I feel like she sees two numbers and just adds.

Irene: She adds. When in doubt, add. With the multiplication problem, once again, she just added the numbers and she’s doing a very good job of drawing pictures, but the pictures don’t match with what the question is asking. So many times and honestly when I saw her doing it, I just let her go. But in the future I think I’m going to work with her where
it says there are 3 pencils boxes, and I would say, L., you have to draw the 3 pencil boxes.

Hanna: Take it step by step.

Irene: Yes.

Hanna: Break it apart.

Over the course of the inquiry process, these types of exchanges led to growth in Hanna’s ability to understand how to analyze the student learning data and make decisions about instructional plans. Before long, there was evidence of Hanna becoming an evolving expert in the context of the study. In the following excerpt, she showed confidence in sharing her understanding of the student’s progress. Interestingly, in this exchange, the role of listener and agree-er shifted to Irene (mentor).

Hanna: So that’s why I’ve been working basically - what’s this underlined number worth? She knows this is the ones column and she knows this is the tens column. She has that down. But I feel with me going through it, I talk through what I’m doing. I’m like, okay, I’ll give you one, she just looks at me.

Irene: Huh?

Hanna: But when I go through it with her, I feel like she understands and is with me, but when I ask her to do one.

Irene: Hmm.

Hanna: And I’ve started using 21 and like 32, lower numbers, cuz 63 was just...
Irene: Yea.

Hanna: I felt like it was too much for her.

Even as the study concluded, T2 continued to hypothesize about what instructional approach might be best for the student. In fact, Hanna shared new wonderings with the triad in the final minutes of the last meeting. In this way, Hanna demonstrated that she was invested in her work with this student and planned to continue to work with her when the study concluded. This investment provided further evidence that Hanna was becoming a rising expert. Not surprisingly, all triad members were involved in this exchange late in meeting 4.

Hanna: Maybe that’s something else. Maybe when she gets here in the morning, she’s just not wanting to do math. We waited till 11 today.

Irene: Yea. Who knows.

Marie: We did talk to her about what’s next for L..

Hanna: Uhm hum.

Marie: We didn’t do any subtraction, so I wonder what the skills are like in terms of understanding. She could remove and make smaller numbers with the base ten blocks, but what her subtraction would look like…

Hanna: The 495 student did some subtraction with her. I don’t think any was with regrouping, as you can see here 88 – 28. She crossed out because she didn’t know how to do that. So that’s definitely something.
Hanna’s roles were categorized as task-oriented and interpersonal. She started as a learner and grew into an emerging expert. This growth was nurtured and sustained by her interpersonal skills as a careful listener and respectful agree-er. Overall, she made important contributions to the T2 inquiry process.

**Summary: T2 member roles.** A study of the Triad T2 conversations revealed the supervisor as wonderer, questioner, and facilitator; the mentor as expert, teacher, and facilitator; and the intern as learner, listener, agree-er, and blossoming expert.

**Chapter Summary**

Triad T2 was characterized as the “questioning” triad due to the Inquiry-based and Exploratory Talk that dominated their conversations. This triad was also the most consistent and predictable in terms of the substance of their conversations. When examining student work, they balanced their discussion between what the student understood with ideas for future instructional practices. They used descriptive talk when needed to provide information to support their claims or address their wonderings. Their questions were always directed toward the task. Accordingly, they used their time wisely and were a productive team.

The T2 meetings started with a review of the student work and ended with specific plans for future instruction. There was limited, yet important discussion about specific student learning behaviors and how those behaviors impacted student understanding and instructional practices. There were several noteworthy developments that took place in T2 over time. First, the participation among the three triad members evolved into an equally balanced conversation by the end of the study.
The mentor shifted from taking a dominant role in the beginning to becoming an equal participant with the supervisor and intern by meeting 4. Second, Hanna (T2 intern) started as a learner in the beginning of the study, but by the final meeting had evolved into a developing expert. Finally, members of Triad T2 not only showed evidence of playing task-oriented and managerial roles in their conversations, but their interactions also suggested evidence of behaviors that were probing and exchanges that could be characterized as interpersonal.
CHAPTER 6 - TRIAD T4

EXPLORING AN INQUIRY PROCESS

Introduction

Chapter 6 is the story of the inquiry process of a fourth grade PDS triad - mentor teacher, intern, and supervisor - known as Triad T4 and situated at Friendship Lane Elementary in the Sunshine Hills School District. In the 2013-2014 school year, 8 professional development school interns were placed at Friendship Lane Elementary, 3 in the primary division and 5 in the intermediate division. Triad T4 was part of the intermediate division, which consisted of 3 third grade classrooms and 3 fourth grade classrooms. The fourth grade classrooms regrouped homogeneously for mathematics. Triad T4 worked with the highest achieving fourth grade math students. This chapter explores instances in the T4 dialogue that impacted the components of the inquiry process: planning, implementing, collecting, and analyzing student learning data collected about a “puzzling” student.

Triad T4 met four times throughout the fall of 2013. (See Table 6.1) The first two meetings were approximately 16 minutes. Meeting 3 was about 33 minutes and meeting 4 was about 24 minutes. All of the meetings were held in the mentor’s classroom during her lunch period, which was from 11:52 a.m. to 12:30 p.m.

<table>
<thead>
<tr>
<th>Triad</th>
<th>Meeting 1</th>
<th>Meeting 2</th>
<th>Meeting 3</th>
<th>Meeting 4</th>
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Table 6.1. Triad T4 meeting dates and times.
Triad T4 Participants

**Mentor: Sarah.** At the time of the study, Sarah had been a classroom teacher for 22 years. She had taught fourth grade for 12 years, kindergarten for 7 years, and third grade for 3 years. Sarah had been a mentor in the PDS for 13 years and was a hybrid educator (PDA - supervisor) for 3 years. For 2 of those 3 years, Sarah served as a co-facilitator in the professional development school partnership.

**Intern: Zoe.** Zoe was a fourth year undergraduate university senior in Childhood and Early Adolescence Education. She was of traditional age for a senior intern. Zoe was matched with Sarah and her fourth grade classroom in the spring of 2013 and began her full year internship in fall 2013.

**Supervisor: Greta.** At the time of the study, Greta was a first year hybrid educator (PDA - supervisor). She was assigned to two buildings in which she supervised 8 interns, 6 in Friendship Lane Elementary and 2 in Rothworth Elementary. Greta had been an intern in the 2005-2006 class of professional development school interns and was hired by the Sunshine Hills School District in 2006-2007 where she had taught second grade for 7 years before being chosen to be a PDA (supervisor) in the fall of 2013.

**Triad Meetings Overview**

Triad T4 was characterized as the “eclectic” triad because there was not an identifiable pattern of exchanges across the four T4 meetings and the topics discussed were sometimes unpredictable. For example, in one meeting the triad studied the student work carefully and made numerous inferences about the results, while in another meeting the triad was distracted by topics that were related, but did
not necessarily address the task directly. Nevertheless, there were threads of dialogue woven throughout the T4 inquiry process that created a unique and interesting portrait of T4. Although often only tangentially related to the task, the threads were rich and diverse and made contributions to the components of the intended inquiry process of planning, implementing, collecting, and analyzing student work.

It is worth noting that there was one lead T4 participant. Across the four meetings, Sarah’s (mentor) contributions comprised more than half the dialogue of each meeting. In meeting 3, her participation increased to two-thirds of the dialogue. The other two triad members maintained a low level of participation throughout, Greta’s (supervisor) participation rate was approximately 25% during each meeting and Zoe (intern) less than 15%.

Illustrative of the eclectic nature of the T4 inquiry process, the following excerpt in meeting 1 described the procedure used for choosing students from Sarah’s math class to attend learning enrichment instruction. The dialogue was descriptive and informative, and yet divergent from the task. It represented one of the diverse topics that was discussed as part of the triad’s inquiry process.

Greta: So here are two kids. So that would, does she (learning enrichment teacher) usually do a whole group or would she do, she pulls those kids out.

Sarah: And out of that group, only 4 of them went to enrichment last year, so…

Greta: Are there any other criteria, like did they look at?
Sarah: We looked at PSSA scores, the MAP criteria, the bottom line is at the 91%. We look at the Otis Lennon scores, we look at the work habits and it’s a rubric of 1 to 5, 5 being a really strong student in the classroom. Just patient, being able to verbalize math thinking, that type of thing. Uhm, so Zoe and I yesterday after school, we just kinda take a look because (learning enrichment teacher) is meeting with us Thursday, and I wanted to be prepared for that meeting, but it was interesting for me to see, for both of us to see, that our class, aside from 2 people, so that’s 16 people out of 18, meet the criteria of 91% or better in MAP testing.

Greta: And with all the other testing, they also like with the OLSAT or the... how many ideally do you send?

Sarah: I think that she really doesn’t want more than 6 or 7 tops, but I’m sure that could be changed up a bit. And the problem is, you struggle a little bit with the work habits, the criteria is easier to meet for some with the test scores, the Otis Lennon, but when it comes down to the classroom work habits it becomes a little different.

Greta: Uhm hum.

With the exception of meeting 2 (where the dialogue was more inferential), exchanges similar to the one above were common throughout the triad meetings. They provided information about issues associated with the math class, but often not directly related to examining the student’s understanding of fourth grade place value concepts.
The following excerpt was a representative example of Sarah (mentor) as the principal contributor to the conversations. In this passage, Sarah shared her thoughts about the student’s work habits. Greta (supervisor) was engaged and acknowledged her agreement, but did not make a major contribution. Zoe (intern) was not heard in this exchange. Sarah spoke 275 words, Greta spoke 17 words, and Zoe spoke 0 words.

Sarah: That’s what I mean by the impulsivity. It’s kind of like I want to get through but I want to get through it quickly. I’m not really learning for the sake of learning how to connect things and make sense of it. I’m just kinda just going though the motions and I think that he needs to recognize that and hopefully we can make him slow down a little bit and process what he’s doing, but that I like because that will tell us right now if he’s going to give up or if he’s going to sit there and try to figure it out. But he does, his light bulb will go on and it’s so obvious with this child.

Greta: Yea.

Sarah: You know some kids you don’t know if he’s got it or not, but he is like whoom! The facial expressions, the hand goes up, he’s on his knees.

Greta: Yea.

Sarah: He wants to share so it’s so much easier to know when he’s on it or not. But I like the minute thing so maybe we’ll just make some observations about where he feels puzzled and use that strategy with
him and also ask him to think through and talk out loud about some of the things he’s doing.

Greta: I think that’s a great idea. And you can really see where they’re getting stuck.

Sarah: It’s so nice in a classroom of 27 people. I still feel like this would be something you would focus on but it’s so much easier to try this, to be kinda individual with every one of your kids when you only have 18 students. I feel like we’re getting to know them as math thinkers so well right now and it’s only six weeks into school.

The Nature of the Student Learning Data

Triad T4 provided a diverse collection of student learning data. In the first study cycle, Triad T4 administered a math inventory that was used when choosing their puzzling student. It asked about the student’s attitude about learning math, why he thought math was important in his life, and how he would describe his work habits. (See Appendix L) A second piece of student learning data was class notes consisting of 4-digit addends added to 5-digit addends and also work from a rounding exercise. The triad also included the student’s goal setting conference sheet that addressed work habits and a record of his home fact fluency practice. Additionally, there was a page of 50 three-digit addition problems, another of 110 single-digit addition problems, another rounding exercise, a mixed practice that included three word problems, and a homework that connected multiplication to a hundreds grid.
Ten pieces of student learning data were submitted for study cycle two.
Two sets of class notes reflected a discussion on prime numbers. Another class-
notes page had several handwritten addition problems such as \(25,500 + 3,300 = .\)
The remainder of the student work reflected classwork and homework from a
gometry unit. Gridded diagrams provided dimensions that were used to calculate
perimeter and area of complex figures. In several cases, calculations for
determining perimeter and area were included on notebook paper. (See Appendix
L)

Nine pieces of student learning data were submitted for study cycle three.
The geometry unit continued to be represented in this collection with one practice
heet, one “quick quiz”, and a final assessment on area and perimeter. (See
Appendix L) In addition to the geometry pieces, there were two pieces that
reflected math fact practice, a *Calendar Math* component called “The Daily
positor”, and several pages of class notes on double-digit multiplication practice.
The majority of the work was completed as classwork or homework.

**The Substance of the Conversation: Student Understanding, Instructional
Practices, and Student Learning Behaviors**

There was not a predictable pattern that defined the substance of the T4
cussions across the four meetings. Instead, each T4 meeting had a distinctive
focus. For example, in meeting 1, the focus was on student learning behaviors that
affected the progress of the selected math student. The triad shared what they noticed
about the student’s work habits, what they thought was interesting about his work,
and what types of student work might be useful to collect. Each conversation had a
unique focus that impacted the planning, collecting, and analyzing components of the inquiry process.

There were several times during meeting 1 when the conversation was only tangentially connected to the group’s task. For example, they talked about how learning enrichment students qualified for services, how to distinguish between an equation and an expression, and how Zoe (intern) felt about participating in the study. Meeting 1 ended with dialogue about the benefits and the challenges of participating in the present study (excerpt below). Although T4 may have discussed future instructional plans for this student at another time, a specific plan for collecting student work for the next cycle was not discussed at this meeting.

Sarah: This isn’t going to solve his problems, but it’s the conversation that I think is important for us all to have cuz you’re taking her expert opinion, our expert opinions, whatever your opinions from what you’ve learned too. Combining that all and trying to look at samples of kids writing, how powerful is that?

Greta: So powerful.

Sarah: It’s so powerful. But it’s not going to be an easy.

Of the four triad meetings, it was during meeting 2 that T4 was unquestionably focused on the task. During this meeting, the triad examined specific examples of student work to inform their discussion. They shared opinions about the student’s thinking process, his positive attitude toward his work, and his confidence to participate in class. T4 talked extensively about the effectiveness of past instructional plans, as well as future plans to address the student’s learning style. For
example, in the following excerpt, Sarah and Greta talked about using the “glass, bug, mud” strategy to help the student communicate his level of understanding. Markedly, and similar to meeting 1, meeting 2 did not end with specific plans for collecting student work for the next cycle of the inquiry process. Again, that conversation may have taken place at another time.

Sarah: Right, right, right. And so I think that’s a great point. The idea is to we could observe how many times he classifies himself in the mud category. As we get into more and more of these different levels of activities, then maybe we can say to him, you know, see what he’s saying, ‘I’m mud, I’m glass, I’m bug’ and then kind of work through that if he is mud and bug.

Greta: I love that idea of saying ‘I am bug right now, but give me a minute.’ Sometimes it is just that.

Sarah: It’s that minute.

Greta: ‘Do I need a minute or do I need help?’ So maybe I need you to explain a little bit more to me. Okay, stop - give me a minute’ - kind of thing.

In meeting 3, Triad T4 strayed from the task for a substantial part of the inquiry process. Nearly 50% of the dialogue was outside the work of analyzing student learning data for student understanding, instructional practices, and student learning behaviors. Instead, T4 discussed topics such as timed fact tests, unrelated homework assignments, communication with parents, the use of fast arrays, another
classmate’s strengths, the responsibility of teachers to understand the needs of every student, and challenges the class was experiencing in computation and geometry.

As meeting 3 ended, the triad concluded their discussion by talking about how they would address both the individual student’s and the class’s needs in the future. The discussion below, between Zoe and Sarah, was not solely about specific plans for the focus student; they also addressed strategies they felt would be effective for the entire class. As was the case in meetings 1 and 2, meeting 3 did not end with specific plans for collecting student work for the next cycle of the inquiry process.

Zoe: I mean for the class we have, I think, the best way to handle with just everyone is to do the glass, bug, mud. Because it would be hard to break it up into groups because we just have so many different learners and I don’t think there would be enough time to do that. So the glass, bug, mud approach is probably the best. And then like checking up on them and seeing if they have questions. But then I think for him, I think he’s doing - that’s the best thing because most of the kids already have these established. You can’t really back track for him.

Sarah: Right. Right.

Zoe: So he has to practice outside on his own.

Sarah: Right, that’s true, that’s true. And like sometimes even in Calendar Math or other discussions, you take a step back for people that you think might need to remember this again or hear this again.

Zoe: Right.
In the final meeting, there was a return to more analytical exchanges among the triad members, primarily focused on the student’s learning behaviors such as strategies used to solve problems, how he made sense of the mathematics, and his ability to stay focused and on task. The following excerpt highlights strategies the student used to solve multiplication problems. The triad made the claim that the student understood place value conceptually, however, the specific place value concepts he understood were not clearly articulated. While there was a reference to the grouping of numbers when multiplying, there was not a clear statement about the specific place value concepts he used to solve a multiplication problem such as 22 times 30.

Sarah: But he shares his thinking. He is a phenomenal kid who can talk out loud about his thinking.

Greta: I feel like in the beginning you guys were a little concerned about his facts and how it was going to affect, when he had to do perimeter or when he had to do other things. Are you feeling like, it’s definitely an issue but it’s not something we can’t figure out?

Sarah: Right. I think it’s just a matter of taking his time and keeping the practice going and his parents are practicing too.

Greta: So he uses his fingers and stuff, but you think he conceptually understands place value? I keep going back to place value because that was where (the researcher) …

Sarah: I think he does conceptually understand.

Zoe: Uh hum.
Greta: Now when you said about the multiplication like the 22 by 30 and he’s able to use manipulatives, go on more with that.

Sarah: He would probably say I’m going to infer that he would say, ‘Oh, I need to make 22 groups of 30 and that’s going to take me a long time so teach me that method like’. That’s the directness of him. And I think he, he actually could do, I just the other day threw out there 2 digit by 1 digit just when they were finished with something and then 2 digit by 2 digit, 3 digit by 1, and there’s a variety of who knows what in here.

Overall, the examination of the substance of the T4 conversations uncovered several unique characteristics. First, T4 shared a preponderance of information about their student’s learning behaviors. They established their belief that the student’s thinking about the mathematics and his ability to stay focused on his work were important considerations when planning instruction. Second, the substance of the conversation of this eclectic triad was not predictable and did not necessarily reveal a pattern that evolved over time. Each meeting seemed to have a distinctive focus that contributed uniquely to the inquiry process. Finally, the mentor continued to take the lead in the conversation, shaping the substance of the dialogue by encouraging the triad to think about how the student thought about the mathematics, rather than simply what he knew about the mathematics.

**The Mathematics in the Student Learning Data**

The first three objectives of the CCSS for place value for grade 4 build on the grade 2 and grade 3 objectives. (See Appendix M) In these objectives, the
student will understand the meaning of digits by place, compare multi-digit numbers, and understand how to round to any place. These are “visible” objectives in most fourth grade math curricula. The remaining three objectives typically take a less prominent place in math materials developed for fourth grade. Although they provide a basic foundation for understanding, for example, traditional algorithms, they are often not included in many of the commercially produced curricula for fourth grade.

Triad T4 regularly connected place value concepts to their study of number systems using the Everyday Counts - Calendar Math Program. For example, the student work reflected evidence of the 4th grade place value objective #3 – use place value understanding to round multi-digit whole numbers to any place. In another instance, the 2nd grade place value standards were noted: #1 - understand that the three digits of a three-digit number represents amounts of hundreds, tens, and ones; and #3 - read and write numbers to 1000 using base-ten numerals, number names, and expanded form. Objectives 4-6, however, were not mentioned in the analysis of the student learning data, although there were opportunities where that could have occurred.
Grade 4: Generalize place value understanding for multi-digit numbers.

1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that $700 ÷ 70 = 10$ by applying concepts of place value and division.

2. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using $>$, $=$, and $<$ symbols to record the results of comparisons.

3. Use place value understanding to round multi-digit whole numbers to any place.

Grade 4: Use place value understanding and properties of operations to perform multi-digit arithmetic.

4. Fluently add and subtract multi-digit whole numbers using the standard algorithm.

5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Table 6.2. Common Core State Standards place value objectives for grade 4

In the following excerpt in meeting 1, Sarah (mentor) suggested types of student work the triad could collect that addressed place value objectives. She viewed these objectives as foundational, yet ancillary, and not the main mathematical focus of a lesson. She talked about the skill of naming the place value columns and understanding the meaning attached to each column (e.g., a digit in one place represents ten times what it represents in the place to its right). Sarah also mentioned that the focus student struggled to name the columns in algorithmic form. In this instance, the student’s struggle could have been due to a lack of understanding of place value concepts in developing strategies to perform algorithmic operations. (See Table 6.2, #5) However, the skills referenced below were reflective of 2nd grade place value objectives.

Sarah: Some examples of work we could collect for him would be during CM (Calendar Math) since the majority of this type of thing is done during CM or a quick review in the morning when they first come in as homework.
Zoe: Right.

Sarah: Also, so because this is number systems, it’s not going to be a full-blown lesson in the math book, so it’s going to be more CM, homework, review on the board. We could take pictures maybe of his work on an individual white board.

Zoe: Uh hum.

Sarah: And sometime I could have them bring their math journal back and they could put some problems in the journal and we could collect that to look at.

Zoe: Yea, that would be good.

Sarah: And just kind of focus on the naming the place value. I don’t feel he has a problem. He can name the places, but when it’s in a column form, an algorithm form, I think he loses his place.

Greta: Okay.

In the next excerpt, during meeting 2, T4 talked about procedures for rounding in which place value skills are foundational (e.g. use place value understanding to round multi-digit whole numbers to any place). (See Table 6.2, #3) This passage presumed that place value concepts were in use, although they were not stated explicitly. For example, the student had accurately rounded numbers to the nearest 100, 1,000, 10,000, and 100,000. It was not stated whether he had used a rounding rule, or had applied his understanding of place value concepts to complete the rounding process.
Sarah: He did. He did. But it was just interesting because he has them all over here. Look at what he has done here. He rounded. So I asked them to round, do you remember, were you here that day, I can’t remember.

Zoe: Yea, I was here.

Sarah: We asked them to round each number and obviously it looks like he, erased there, I asked him to round to nearest hundreds, the nearest thousands, the nearest ten thousands and the nearest hundred thousands. So he did those.

Greta: And is this correct? I have to think about this. So he rounded to the nearest hundreds?

Sarah: Yes.

Greta: And the nearest thousands. That would be the nearest thousands, which is the same as the nearest ten thousands.

Sarah: Yes, exactly.

Greta: Okay.

Throughout the four meetings, T4 talked about various mathematical ideas, such as the difference between an equation and an expression, using arrays to think about multiplication and division, memorizing multiplication facts, and skills required to calculate perimeter. These discussions, however, did not make strong connections to 4th grade place value concepts as defined by the Common Core Standards.
**Triad T4 Orientation Toward Inquiry Talk**

Triad T4’s inquiry process was described as “eclectic” because their conversations spanned a broad range of topics, as noted above. With the exception of meeting 2, there was a substantial amount of Disconnected Talk that caused the triad to stray from the task and contributed to shifting the discussion to a variety of topics. Each meeting had its own focus and was not necessarily clearly connected to the meeting before or after. Moreover, the extent to which the dialogue was inquiry-oriented varied significantly from meeting to meeting. For example, in meeting 2 the dialogue was primarily Exploratory Talk, while in meeting 3, almost half of the dialogue was Disconnected Talk. (See Figure 6.1) For these reasons, this “eclectic” triad offered a diverse set of exchanges in their conversations about their fourth grade, homogeneously grouped mathematics class.

![Triad T4 % of Inquiry-oriented Talk](image)

**Figure 6.1. Triad T4 inquiry-oriented talk.**

**Triad T4 – meeting 1.** Meeting 1 of the inquiry process was the student selection meeting. The dialogue in this meeting was balanced among clarifying questions (Exploratory Talk), supporting facts (Connected Talk), and unrelated
discussion (Disconnected Talk). In the following excerpt, the triad demonstrated
their belief that objective background information about the student was important to
set the stage for future discussions. In this chunk of dialogue, the triad supported
their decision to follow this student through the inquiry process.

Sarah: Yes, and he’s in our math class, and obviously he’s, we just did a
MAP test and we have decided that he could have gone to a different
math class.

Greta: Okay.

Sarah: But we do feel that he’s placed in the right math class at this point.
He kinda straddles two different math classes and we decided to keep
him in this math class.

Andrea: Okay and this math class again, is the …

Zoe: This is the higher …

Sarah: The higher achieving class, based on MAP scores, based on PSSA
scores, and based on student performance, so …

Greta: Okay.

Sarah: We were talking a little bit yesterday just in terms of getting our
groups prepared for other data prepared for our meeting with our LE
(learning enrichment) teacher and mainly all of our class but two people
meet the criteria of 91% in MAP or better.

Zoe: Did student B make that criteria, or was he one of the …

Sara: He was one of those who did not meet those criteria.
In the above exchange, the focus was on how the student performed on various assessments. His Measures of Academic Progress (MAP) scores were marginal. Nevertheless, the mentor felt that he was appropriately placed in the high ability math class. The triad recognized two other important factors that supported that decision: PSSA (Pennsylvania System of School Assessment) scores and student performance in class. The triad also discussed these criteria as it related to the placement of students in the learning enrichment class. This student stood out as one of only two students in the class who did not meet the MAP cut off score for receiving learning enrichment services.

In meeting 1, T4 used factual and objective data (Connected Talk) to support their decision to choose this student to follow through the three study cycles of the inquiry process. These types of exchanges were connected and built on each other, albeit in a factual manner. There was, however, an equal amount of evidence of both Exploratory Talk and Disconnected Talk. For example, the following were instances in which triad members noticed a pattern, expressed interest, or asked for someone’s opinion, which is characteristic of Exploratory Talk.

Sarah: The other thing we were talking about, which was interesting, is he has a lot of confidence in math.

Sarah: That’s at least what we’ve seen so far. I do notice that he does participate some, he doesn’t participate a lot.
Sarah: Uhm. Right, I think if he has a task, he’ll do it, I don’t think that he’ll push himself beyond that task. Do you agree with that Zoe?

Greta: Does it look like place value? Is he forgetting to carry the one?

The above instances of dialogue found throughout meeting, were clearly connected to the triad’s task and often invited further discussion from other triad members. These types of exchanges made up nearly one-third of the conversation. Likewise, there were a similar number of instances in which the triad was engaged in conversation that was not directly connected to the task of examining the student’s understanding of place value. The following was such an instance of Disconnected Talk.

Sarah: I think that’s why my interns struggle with getting started in

*Calendar Math*, because, my last year’s intern, she was just like, ‘you’re overwhelming me because you’re all over the place with

*Calendar Math*, you don’t have a routine every day.’ I have a basic routine. That would be the pattern on the calendar. And talking about those kinds of things, but I’m always taking a different route. In addition to, some of the staples, you know.

Greta: Yea, though I do see that you seem to come back and revisit ideas.

Sarah: Yes, yes.
Greta: Which makes perfect sense. I’m thinking I have caught you doing that pink thing where you’re adding change. Now does that change every month?

Sarah: That does. It will be a different multiplier next time.

Greta: But I love that you don’t do it every day, because then when you’re doing 3 or 4 numbers at a time, then you can really see something versus one day.

Sarah: Yes, right.

Greta: I feel like if you practice it 3 or 4 times, by doing it.

Sarah: Right.

Greta: And do you have a pattern or do you just kind of do it when you realize when it hasn’t been done for a few days?

Sarah: Well, what we typically will do is we’re supposed to be doing Calendar Math M, W, F.

Greta: Okay.

In the above exchange, the conversation focused on the logistics of when Calendar Math was scheduled each week and how the topic changed on a regular basis, which made it difficult for some interns to begin teaching with the program. This exchange was one of four significant conversation turns in meeting 1 in which the triad became distracted. The first one was an extended conversation about the logistics for placement into learning enrichment; the Calendar Math discussion (above) was the second chunk; the third was a lengthy discussion about the difference between an expression and an equation; and the last was a conversation between the
mentor and supervisor about the pros and cons of the current math curriculum. In sum, an analysis of meeting 1 uncovered an equal amount of Exploratory Talk, Connected Talk, and Disconnected Talk.

**Triad T4 – meeting 2.** Meeting 2 revealed an entirely different look and feel to the conversation. There was no evidence of distraction from the task. The majority of the conversation was Exploratory Talk with some evidence, albeit nominal, of Inquiry-based Talk. T4 members invited each other to further explore the student learning data (student work); they shared their thinking about the student’s understandings, asked questions about the student work, and offered tentative claims. The following is an example of an exploratory exchange among the members of T4, meeting 2.

Sarah: He seemed on the fly, just a couple of rounding numbers. But I like the fact that he was able to set the algorithm up and be able to at least continue to add those numbers, because mentally I don’t think, you know, that it’s as easy for him to do it in his head. That’s not an easy task. I’m not saying it should be, but he used the pencil paper. So I was just pointing that out. And then we were looking at over here we did the same kind of thing. I think he, I can’t read upside down, but what’s this?

Greta: It says the date and then …

Sarah: And he put the date there and then he did the same thing where he added on paper.

Zoe: Uh, hum. And then he did a subtraction problem for the next one.
Greta: And this time he did, there is a separation. There’s a line there that separates. Looks like he’s regrouped or whatever.

Zoe: Looks like two separate problems.

Sarah: Okay. That’s good. And then I gave them 86,526 and I asked them to round to the nearest ten thousands and the nearest thousands and so on, as you can see, and he seemed to get them all right.

Zoe: It looks like he erased but …

Sarah: I don’t know if he, I’m not sure if he made a mistake first or if it was just; when I talked to him about rounding, I feel like he pretty much gets what he’s doing.

This type of exchange had a commanding presence in meeting 2. It was clear that the student work served as the pinnacle of the conversation. The triad offered ideas about what the student knew based on what was noticed in the student work. They shared their thinking with one another and made tentative claims about what the data suggested. All members were engaged in the discussion and responded to each other’s comments and ideas. Based on this evidence, meeting 2 could be described as an “exploratory” meeting.

**Triad T4 – meeting 3.** The substance of meeting 3 changed substantially from meeting 2. Nearly half of the exchanges among the triad members created a sense of detachment from the task. Evidence of a high level of orientation toward inquiry was represented by less than one-fourth of the exchanges among the triad members. Facts and technical or logistical exchanges comprised the other three-fourths. The following is an example of Disconnected Talk that was detached from
the purpose of the meeting between the mentor and supervisor. This type of dialogue pervaded meeting 3. This exchange was a representative sample of what a disconnected conversation typically sounded like, both in this meeting and in other meetings.

Sarah: But apparently, he’s very nervous about not doing the right thing. That’s another thing that I’ve noticed lately is that his hands are flapping all the time when he’s trying to think. So (researcher), if you could see me right now you could see my hands in front of me, knowing that he is really struggling with an answer in his brain. And it’s usually a fact problem. It’s usually when he’s asked to recall a fact. And he can’t use his fingers or he can’t, you know think about it on paper. It might be 6 x 8, he’s like this (demonstrates), until he thinks of it.

Greta: Is he counting with his shakes?

Sarah: I don’t know. I don’t know if he’s counting with his shakes. I would guess not, but I don’t know. Just the thought or the idea that he has to retrieve it quickly makes him nervous. But his mom went on to say that they did the best they can and whatever and so she said I just wanted to let you know that. And then she said just know that he tried and I wrote back and said that’s all I care about is that he tried, and if you can’t come up with an answer in a couple minutes, or has no idea, he’s supposed to leave it blank and I think they clearly understand that now. But then she said, I also know that he’s been
struggling with his multiplication tables and I just wanted to tell you that we had a discussion and he has been working very hard on it this week and he made his own times tables charts and he’s doing better. Thank you.

Greta: Wow.

Sarah: So I just wanted to share the fact that yes, and I just wrote back and said that you know thank you for your email and letting me know and I do appreciate the fact that she did, but he does not have to struggle and work through these things if he doesn’t know how to do it. He can just say I don’t know.

Greta: Yeah.

Although Triad T4 talked about issues related to the focus student, there was little or no connection to his understanding of place value concepts. Moreover, there did not seem to be samples of student work driving the discussion. Interestingly, this was the longest Triad T4 meeting (33:40 min.), and Disconnected Talk comprised approximately 15 minutes of the meeting.

**Triad T4 – meeting 4.** The focus of T4 meeting 4 shifted back to more Exploratory Talk and less Disconnected Talk. In fact, almost half of the dialogue was probing in nature, in which the triad explored and questioned the student’s learning behaviors. T4 members shared their opinions about his work habits and ventured tentative claims about the student’s understandings. The following is an example of Exploratory Talk from T4, meeting 4.
Zoe: I even told Angie (intermediate team teacher), I said did you notice anything this morning because he just could not focus. He was getting up and talking to his friends. He was not focusing on work and then in spelling he was off task so he was just I don’t know if he just did not take his medicine that day, that’s what I asked Angie. I think she sent an email, I don’t remember but that day was the biggest and I feel that was one of the last times I was in here.

Sarah: And I had just got done month ago where things are seeming, they seem like he’s and then after Thanksgiving it was like wooo, so I don’t know.

Greta: Uhm.

Sarah: But I definitely think he needs repetition, he needs strategies. Because I think he was a very good learner with manipulatives, so when we get into fractions and decimals and use fraction bars and decimal squares, things like that, I think the multiplication and division will be interesting for him too cuz I can see that being a little tricky. What do you really understand about multiplying 26 by 30?

So …

Zoe: Yea.

Sarah: You know. He seems to have the procedures, he’s learned in prior grades down, but when it’s new, it just needs to be reinforced.

Greta: Do you still think he’s in a good class, like is this still …

Sarah: I do, he really thinks well; he’s a good verbal thinker.
Triad T4 hypothesized about the cause of a particularly difficult period of time for the student. The student had trouble focusing and the intern thought it might be helpful to ask another one of his intermediate team teachers if she had noticed the same struggles. The triad made conjectures about the student’s learning style and suggested that the next unit of study might be of more interest to him. They finished their conversation by agreeing that even though the student needed extra practice with new concepts, he was appropriately placed in the high ability math class, because he was a good thinker and was also able to share his thinking.

**Summary Triad T4 – orientation toward inquiry talk.** Triad T4 was characterized as the “eclectic” triad in part because there were few similarities in the extent to which they utilized Inquiry-oriented Talk across the four triad meetings. The dialogue in meeting 1 was fairly balanced across Exploratory, Connected, and Disconnected Talk. Meeting 2 was filled with Exploratory Talk about the student learning data in which triad members shared their opinions and ventured claims. In meeting 3, T4 seemed to be mostly distracted from the task and the dialogue was only marginally related to determining what the student understood about place value, representing Disconnected Talk. Interestingly, in meeting 4, the dialogue returned to Exploratory Talk for nearly half the discussion.

**Triad T4 Member Roles**

The majority of dominant roles in T4 fell within the category of task-oriented roles. As mentioned earlier, task-oriented roles often assisted in providing information that moved the group forward toward achieving the goals of the task.
More specifically, the Triad T4 mentor assumed the role of the storyteller and expert, the intern was a learner, and the supervisor was a facilitator.

Table 6.3. Triad T4 dominant roles by triad member.

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**Triad T4 supervisor roles.** Greta was a first-year supervisor, reassigned from her second grade classroom, supervising in a fourth grade classroom as one of her assignments. The primary role that she played in the inquiry process was that of facilitator. Greta demonstrated her skill as a facilitator in several different ways. As a facilitator, Greta repeated and summarized what the mentor and intern said. By doing so, she corroborated important parts of their conversation and built on their ideas by posing additional questions. In the following example, the mentor and the intern talked about the student’s learning behaviors, or work habits. They noticed that the student was quite confident in his mathematical abilities. He was not
troubled or uncomfortable when he made a mistake. Instead, he used those opportunities to seek additional help. As a facilitator, Greta repeated the essence of this conversation, summarizing and clarifying the point being made. This also allowed Greta to become more familiar with the work habits of the fourth grade student. In this way, she also played the role of learner.

Sarah: He can make a little mistake here and there, but he doesn’t seem to be bothered by that. He has a lot of confidence, so that was an interesting piece.

Zoe: He will willingly raise his hand if he gets it wrong to go over it so he can figure out what he does. He doesn’t care that it’s wrong. He wants the help to do it.

Greta: So we were talking about the criteria, enthusiasm and his willingness to put his hand up and say that he’s wrong because he wanted to solve things and understand where he’s made mistakes and stuff like that. That’s very cool.

Another way in which Greta demonstrated her role as facilitator was to make suggestions to move the conversation back to the task of determining what the student knew about place value concepts and what instructional practices might be helpful for him. The following are excerpts illustrative of that role found in meeting 1 and meeting 4 respectively.

Greta: So, uhm, you guys were mentioning the addition and subtraction and I noticed here, under place value number - under grade four, number 4 says, *fluently add and subtract multi-digit whole numbers, using the*
standard algorithm - and so then we started talking about how accuracy and fluency would fit within that.

Greta: So he uses his fingers and stuff, but you think he conceptually understands place value? I keep going back to place value because that was where (the researcher)...

Greta also facilitated throughout all four triad meetings by simply posing questions. Her questions seemed to stem from her desire to be an active participant in the conversation, to acquire more knowledge, and to keep the triad on task. The questions were sometimes her own wonderings and sometimes an effort to find out the opinion of another triad member. The following are two such examples, the first from meeting 2, and the second from meeting 3.

Greta: Because I’m now wondering with regards to the 100s, do you think he was running, so he’s got those strategies, does he run, I wonder if he runs through the strategies in a certain pattern. Like does he do his - is there a zeros, or fives, or nines, or ones. It would be interesting to see how he’s thinking about it. Is he looking for those easy 80 plus 20 things and then if it’s not that, then what are my other options?

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Greta: When he… when something clicks with him, how do you guys know it? What are the, what are the indications?

Although Greta’s primary role was facilitator, there were related roles that were also noticed. The manner in which Greta played her role as facilitator,
described above, allowed her to also be a learner. Moreover, although her participation was low compared to the mentor’s, she demonstrated her desire to remain engaged in the dialogue by her frequent comments of acknowledgement or agreement. For example, in response to numerous chunks of dialogues offered by Sarah (mentor), Greta was often heard saying, “okay”, “yea”, “hmmm”, “uh hum”, “ahhh”, “yes”. These comments were numerous, but brief. In this regard, she was also played the interpersonal role of agree-er.

**Triad T4 mentor roles.** As mentioned earlier, Sarah (mentor) took the lead in each triad meeting and maintained the lead throughout the study. The majority of the contributions she made consisted of stories she told and knowledge she shared. Accordingly, examples of those types of exchanges were plentiful throughout the four triad meetings. The following excerpts are illustrative of the task-oriented roles that Sarah played as storyteller and expert. In the first example, Sarah told a story of the struggles the student had when memorizing his multiplication facts. As part of this story, she told about a time when a homework assignment was confusing and the parent communicated her concerns to Sarah in an email. The chunk of dialogue below was a small part of a section that comprised the first 68 lines of the transcript of T4 meeting 3.

Sarah:  Okay. And this obviously, he did all of his tables. We’ve been talking about multiples and things like that and he did all of his tables on his own. And I wanted to read you this email from his mom. Because I had sent something home and I made a mistake in terms of telling the parents that, I told the kids, but apparently it
didn’t register well with them, that if they come to a problem in the booklet that they don’t know because it’s one of those daily oral math booklets, week one, Mon, Tues, Wed, Thurs, Fri, -week two, same thing. And so I said they are going to have some review problems, they are going to encounter problems that are easy, there are going to be facts, there are going to be thinking problems, but when they get to the Friday problem, it’s usually a problem solving problem and they might not be able to solve it.

In the next example, Sarah played the role of expert in meeting 4. In this passage, Sarah shared her observation that the student’s approach to solving problems about area was disorganized. She had shared a strategy with the student that she felt would improve his organization and provide a way for him to check his work.

Sarah: And what I’m finding with him mainly is he is a little bit disorganized because in his thinking - because he doesn’t have a system in place for how you attack, like in this example, area. I know it’s still number systems because you’re adding numbers in a way, so you have to have your understanding of your numbers but I was trying to show him the other day that when looking at a figure like this and you’re going to add so many different numbers, you need to have a system. So if you use 6 cm, put a light x through it and if you use 7 cm, and if you want to add them as you go in your
head, fine, but a good way to check yourself would be to list them on an additional piece of paper and check that you’ve got them all.

Sarah was the dominant contributor to the dialogue throughout the four PDS triad meetings, sharing information about a wide variety of topics. Her role was consistently focused on task-oriented concerns. She had a wealth of knowledge and experiences she was willing to share.

**Triad T4 intern roles.** It was perhaps not surprising that Zoe (T4 intern) played the role of learner, as she was the least experienced member of the triad. Her participation in the four triad meetings, however, was minimal. It was not apparent from the data that Zoe played a significant role in her triad’s inquiry process. The majority of the time, Zoe was a listener. If learning did take place, it happened by Zoe listening to her mentor’s and supervisor’s contributions. As a result, there was not observable evidence of her growth as a learner. Her most common responses in the dialogue were “uh hum”, “okay”, “right”, “yeah”. These comments were usually made in response to Sarah (mentor) and were noticed frequently throughout all four triad meetings. They defined Zoe’s role as a listener.

Occasionally, Zoe contributed information about the student’s learning behaviors that she had observed. These comments were usually in response to ideas being explored by either Sarah or Greta. In this way, Zoe was a contributor, a task-oriented role. Although she was not an expert or a storyteller, she was able to offer information based on her own observations of the student.
Zoe: He will willingly raise his hand if he gets it wrong to go over it so he can figure out what he does, he doesn’t care that it’s wrong, he wants the help to do it.

-----------------------------

Zoe: Right. Some of the kids have been taking an extra math sheet to practice on their own. He hasn’t shown any interest in it at all.

-----------------------------

Zoe: And that was like today on the board, we did one like this but it had three numbers and we went through it and he just missed carrying one number.

-----------------------------

Zoe: It was with a partner. So his partner was talking to him like you can definitely get a 100 here, and his partner was like, here I’ll give you a number, and was helping him out but he was just sitting there with his hands on his head, looking down at it.

-----------------------------

Zoe: Right, so he did attempt them, cuz some kids just wrote questions marks instead of trying. So he tried both of them.

Zoe’s presence was sometimes not obvious in the triad meeting transcripts. There were significant chunks of conversation in which her voice was not heard. As a result, it was difficult to characterize the part she played because of the lack of evidence on which to support claims about her role(s) during the inquiry process.
Summary: T4 member roles. A study of the Triad T4 conversations revealed the supervisor as facilitator, learner, and agree-er; the mentor as storyteller and expert; and the intern as learner, contributor, and listener.

Chapter Summary
A triad T4 demonstrated several unique characteristics. First, T4 shared a preponderance of information about their student’s learning behaviors. They established their belief that the student’s thinking about the mathematics and his ability to stay focused on his work were important considerations when planning instruction. Second, the talk of this eclectic triad was not predictable and did not necessarily reveal a pattern that evolved over time. Each meeting seemed to have a distinctive focus to the conversation. Next, the intern’s voice was rarely heard. As a result, it was difficult to make claims about the roles she played and to speculate about whether she experienced growth in understanding how to use student learning data to make decisions about student instructional planning. Finally, the mentor played a dominant role in the conversation throughout, contributing more than half of the dialogue across all four meetings.
CHAPTER 7: CROSS TRIAD COMPARISONS

The notion of distributed cognition suggests that when diverse groups of teachers with different types of knowledge and expertise come together in discourse communities, community members can draw upon and incorporate each other’s expertise to create rich conversations and new insights into teaching and learning. (Putnam & Borko, 2000, p. 8)

Chapter 7 begins with a discussion of the participants across triads, reflecting on the diversity in their expertise and experience. Next, the nature of the student learning data that was planned, implemented, collected, and analyzed by each triad is compared and contrasted. Then, four areas of impact on the inquiry process; the substance of the conversations, the mathematics in the student work, the orientation toward inquiry, and the roles played, are examined and compared across the triads. (See Figure 7.1) From these comparisons, the following claims are made: (1) When the understanding of student learning data was foregrounded as the primary task of all three triad members, advances in student learning across the study cycles were more clearly visible in the student work; (2) The quantity and substance of intern
ticipation in the inquiry process varied across the triads; and (3) The triads differed substantially in their conversations in regards to how clearly they connected place value concepts expressed in the student work to the Common Core State Standards for that grade level.
The Group

Langer, Colton, and Goff’s (2003) claim that teachers who analyze student work draw on their own professional knowledge base can be applied to the PDS triad members in this study by conceptualizing each member as a teacher, recognizing each member’s different level of knowledge, skill, and background. For example, each mentor teacher was the lead teacher in the elementary classroom in which the student being studied was assigned. The mentor teachers’ experience ranged from 11 to 22 years and the grade levels taught varied from kindergarten to 4th grade. As Langor et al. (2003) purports, more experienced teachers may possess more intricate webs of knowledge. And so, it can be argued that diversity in years of experience and grade levels taught impacted the mentor teachers’ contributions to the inquiry process.
In this PDS, the supervisor might be a graduate student or faculty member who could have had limited elementary classroom experience as the lead teacher. Yet, this was not true of the supervisors in the present study, all of whom were experienced elementary classroom teachers who were either retired or reassigned from their classrooms as a hybrid educator in the PDS. Their type of classroom experience, however, varied. Likewise, their years of experience differed. For example, their teaching experience ranged from 10.5 – 41 years. The grade levels they had taught varied from kindergarten through 4th grade and in some cases, they had held classroom support positions such as an instructional support teacher, or a classroom para-professional. Only one of the three supervisors had recent teaching experience in mathematics at the same grade level as the triad of which she was a member. And so, as was true of the mentor teachers, there was diversity in the experience and expertise of the supervisors.

The interns in the study had the most limited classroom experience. However, all three interns had pre-service teaching experiences as part of their university coursework, through summer jobs, or by volunteering in other student-centered venues. For example, they all had served as counselors at a variety of summer camps in which they interacted with children ranging from infants and toddlers to teenagers. Moreover, each intern had some experience working with special needs students, either in a learning support or life skills classroom. In every case, each intern had experiences outside the formal classroom, such as teaching dance classes, or babysitting/nannying. It is likely that this variety of prior experiences and knowledge
affected the contributions the interns made to the triad conversations and influenced the manner in which they viewed their participation in the study.

And so, there were three distinct types of “teachers” (mentor teacher, intern, and supervisor) as participants in this study; each one contributed to the inquiry process from a unique professional experience and knowledge base. Their varied webs of knowledge likely contributed to the anomalies that were discovered in the outcomes of their work together as a triad. As those anomalies are shared and discussed, the differences among the participants will be highlighted.

The Nature of the Student Learning Data

The quantity and nature of the student learning data shared by each triad varied. The total number of pieces of student work submitted by triad ranged from 3 pieces (Triad T2) to 15 pieces (Triad TK) for one cycle. (See Table 7.1) Although Triad T2 shared the least amount of student learning data, all of the student work specifically represented the teaching and learning of place value concepts in second grade. Likewise, Triad TK, who submitted the most student learning data, also collected work that represented the teaching and learning of place value concepts in their grade level. It seems feasible that the TK intern was able to spend more time with her puzzling student, thus generating more examples of student work. In contrast, Triad T4 shared multiple examples of both mathematics classwork and homework completed by their puzzling student, but the mathematical content reflected in the work was disconnected from the collaborative task of the triad and, for the most part, did not reflect place value concepts at the fourth grade level.
The type, as well as the quantity, of the student work varied across triads. Triad TK and Triad T4 used research-based assessment instruments (AIMSweb and MAP testing) when making the decision about which student to study. Triad T2 also administered a pre-assessment, but it was developed by the mentor and intern using the *Common Core State Standards* objectives as a guide. Overall, the majority of the work shared by Triad TK and T2 resulted from one-on-one interventions with the intern, whereas Triad T4 shared student work that was either completed as classwork or homework.

Although it was difficult to match exact pieces of student work with specific instances in the triad dialogue, the TK and T2 student learning data provided supporting evidence of the students’ knowledge of place value as set forth by the *Common Core State Standards* for each particular grade level and in some cases showed evidence of student growth. (See Appendix I for TK; Appendix K for T2) Conversely, the Triad T4 did not typically make direct connections in the student work to fourth grade place value objectives. There were, however, instances in the T4 student work that could have been connected to the fourth grade place value

<table>
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<tr>
<th></th>
<th>Study cycle 1</th>
<th>Study cycle 2</th>
<th>Study cycle 3</th>
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<tr>
<td>Triad TK</td>
<td>15</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Triad T2</td>
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<tr>
<td>Triad T4</td>
<td>9</td>
<td>10</td>
<td>9</td>
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</table>
objectives, e.g., when adding and subtracting multi-digit whole numbers. (See Appendix L) Nevertheless, these connections were not evidenced in the T4 dialogue.

The Substance of the Conversations

The inquiry processes of TK and T2 were both defined by a predictable pattern with regard to how each triad meeting started and ended. Both triads customarily opened the meeting with a summary of the student learning data, however, it was the intern that led the TK discussion, whereas it was the mentor who typically initiated the T2 conversation. Moreover, as each meeting came to an end, TK and T2 routinely turned their attention to planning for the next study cycle. This was not true of T4. In fact, there was not a noticeable pattern that defined the substance of the T4 conversations across the four meetings, unlike the trends found in TK and T2. As was noted earlier, it was not always evident that the T4 discussions were centered around student work nor were plans for the next cycle discussed at the end of the meeting.

As each triad’s inquiry process was explored, the substance of the triad conversations was examined for evidence of dialogue about: 1. student understanding, 2. instructional practices, and 3. student learning behaviors. (See Table 3.4) Given the focus of the study cycle, it was perhaps not surprising that the majority of the comments across triads were about student understanding (SU) and instructional practices (IP). In each cycle, the triad was asked to determine what the student understood about place value and then develop student work that would meet the student’s need for further instruction. On the other hand, comments
about student learning behaviors (SLB), the third focus area, were heard the least across the three triads’ conversations. (See Table 7.2) And yet, the comments about student learning behaviors were the most diverse and in some cases fostered the triad’s ability to connect the mathematics reflected in the student learning data to place value standards. For example, Triad T2, shared student learning behaviors (SLBs) such as specific mathematical strategies the student used, her willingness to ask questions, and the ability to reflect on her own thinking.

<table>
<thead>
<tr>
<th>Triad</th>
<th>SU</th>
<th>IP</th>
<th>SLB</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK</td>
<td>27%</td>
<td>66%</td>
<td>7%</td>
</tr>
<tr>
<td>T2</td>
<td>35%</td>
<td>50%</td>
<td>15%</td>
</tr>
<tr>
<td>T4</td>
<td>16%</td>
<td>52%</td>
<td>32%</td>
</tr>
</tbody>
</table>

Table 7.2 Percentage of SU (student understanding), IP (instructional practice), and SLB (student learning behavior) comments across triads.

Noticing these behaviors provided further insight into what the student understood about place value. On the other hand, Triad T4, who rarely addressed specific place value concepts in their conversations, talked disproportionately about student learning behaviors (SLBs) of their focus student. Their dialogue about SLBs spanned the entire spectrum: how the student learns, how the student thinks about the mathematics, his constructive posturing toward mathematics as well as his struggles, and his learning style (work habits). As they discussed these behaviors, however, they did not necessarily make connections to the student’s understanding of place value concepts.

There seemed to be a relationship between the degree to which the triad noticed evidence of place value objectives in the student work and how the triad
talked about SU, IP, and SLB. For example, T2, who made multiple connections to place value standards in the student work, talked the most about the student’s understanding of the mathematics; whereas T4, who made few connections to place value standards in the student work, talked the least about what the student understood mathematically. (See Table 7.2) Furthermore, it was curious that T4 paid considerable attention to student learning behaviors (SLBs), much more frequently than TK and T2, but did not connect those behaviors to the student’s understanding of place value concepts. As mentioned above, perhaps if the T4 discussions about SLBs had connected to the student’s understanding of place value objectives, the role the SLBs played might have been more revealing. The data, however, were inconclusive in that respect. Hence, the evidence suggests a connection between the triads’ ability to make connections to the place value standards in the student work and the degree to which they attended to the students’ understanding, the planning of instructional plans, and attention to the students’ learning behaviors.

**The Mathematics in the Student Learning Data**

When teachers analyze student work, they draw on their own professional knowledge base to try to interpret what they see. With more experienced teachers, the categories of knowledge are woven into intricate webs of connections on which they draw to interpret their students' work and to plan appropriate courses of action. (Langer et al., 2003, p. 28).

Members of Triad T2 demonstrated the ability to connect the place value concepts in the student work to the 2nd grade *Common Core State Standards (CCSS)*
(See Appendix M). For example, the mentor and intern used the CCSS for 2nd grade mathematics to collaboratively develop a pre-assessment tool to collect baseline data. This pre-assessment tool, along with student work they developed throughout the study, provided clear connections to the CCSS objectives for 2nd grade place value concepts. Each time T2 met to discuss new examples of student work, improvement was noted in the student’s understandings and efforts were made to push her understanding further. All three triad members demonstrated a solid commitment to determine what the student understood about place value and to use that knowledge to develop future instructional plans. In contrast to the other triads, T2 focused their efforts on the student understanding of place value as opposed to looking at other learning behaviors, or work habits. By welcoming each other’s comments and inviting each other into the conversations, they demonstrated a positive disposition toward their work together. In the end, T2 was able to celebrate the student’s progress, as evidenced in her student work, in understanding place value concepts that resulted from her participation in the study. (See Appendix K)

Triad T2 regularly made connections between place value concepts and the daily mathematical activities that were called for in the 2nd grade math curriculum. The triad’s conversations about the student work and subsequent instructional planning reflected these connections. Hanna’s involvement in this work provided an opportunity for her to further her own ability to analyze and plan instruction based on student work. As described in chapter 5, the relationship among the T2 members fostered a safe environment in which Hanna could experiment, take risks, and ultimately learn how to talk about student work productively with her triad. Hence,
T2 engaged in two simultaneous tasks, making sense of student work to benefit the second grade student and also socializing Hanna into the process of using student work as a way to understand and guide practice.

Whereas T2 capitalized on their ability to connect place value concepts expressed in the student work with the CCSS objectives, Triad TK’s and Triad T4’s ability to make those connections also influenced their work together, albeit in different ways. For example, TK expressed concern throughout the four triad meetings that they were not addressing the appropriate place value objectives for kindergarten. They struggled to see the connection between the kindergarten CCSS place value objectives and prerequisite work that was at an appropriate entry level for their student.

As noted in chapter 4, because TK chose a “struggling” kindergarten student, it should not have been surprising that in the fall, the student was not ready to address the end of year kindergarten objectives for place value. And yet, the triad began each meeting by justifying the student work they had chosen which represented prerequisite skills for kindergarten place value objectives. There always seemed to be a sense that the triad felt they were not addressing the assigned task – to evaluate what their student understood about kindergarten CCSS place value objectives. As time went on, it was Avery, the TK intern, through conversations with her elementary mathematics methods instructors, who came to realize that developing student work that focused on prerequisite kindergarten place value skills was a crucial and necessary first step for their focus student. (See Appendix I)
Whereas the TK intern and her mentor teacher demonstrated a positive disposition toward the teaching and learning of mathematics at the kindergarten level, the supervisor focused more on the facilitation of the meeting and less on the mathematical content. Instead of contributing mathematical ideas, she often repeated what the mentor teacher and intern had shared and asked questions about their review of the student work. In this respect, the supervisor was a learner of how to connect the mathematics in the student work to the standards. Additionally, the supervisor seemed to conceptualized the task primarily as an opportunity for intern learning. This positioned the intern learning in the foreground, moving the task of the student learning to the background in the context of the triad conversations.

TK’s questioning of how the place value concepts in the student work connected to the CCSS objectives seemed to impact their decision-making in regards to the instructional plans they developed for their student. Nonetheless, it did not prevent the triad from planning meaningful instruction. In fact, of all the triads, Avery spent the most time interacting with the student using a variety of tasks. Accordingly, she also collected the most student work. The student made progress, although limited, and yet, as a result of the intern’s intensive work, the triad was also able to recognize specific learning behaviors that seemed to affect the student’s progress, such as being easily distracted and impulsive, creating inconsistencies in her work. Their focus on learning behaviors as opposed to directly focusing on student understanding of place value seemed to reflect their uneasiness with the mathematical application of place value concepts to pre-kindergarten understandings.
“Appreciation of what individuals can contribute to each others’ education and professionalism is an important aspect of a joint relationship” (Lemlech, Hertzog-Foliart, & Hackl, 1994, p. 172). This type of appreciation, evidenced in Triad TK’s relationship (shared in Chapter 4), allowed Avery to share her new knowledge without feeling uncomfortable or in disagreement with her triad members, who were more experienced classroom teachers. The knowledge she shared seemed to provide a sense of relief to the triad, although the supervisor continued to express concern about not addressing the kindergarten CCSS place value objectives. On the other hand, the mentor teacher, an experienced kindergarten teacher, accepted what the intern had learned as confirmation that the work with numbers 0-5 was, indeed, the appropriate level of instruction for the student. And so, as was true in T2, the manner in which the TK triad members communicated with each other fostered a safe environment for the intern to take risks. Contrary to T2, however, the TK intern was given the primary responsibility to work with the student, whereas the T2 intern was supported more broadly and collaboratively throughout the entire process. At the end of the study, Triad TK still had questions about how to foster further growth in the student’s understanding of place value concepts. Nonetheless, similar to T2, they had made progress in understanding the student’s needs and gained experience in planning appropriate instruction.

Of the three PDS triads, T4’s ability to connect place value concepts in the student work to the CCSS standards was the most nebulous. They stated that place value objectives were part of the study of number systems, however, their conversations did not demonstrate familiarity with the notion that place value
concepts were foundational in understanding how to perform operations in multi-digit arithmetic. Instead, the T4 mentor teacher occasionally talked about place value skills that are typically introduced and mastered in the primary grades. Unlike TK and T2, there was little evidence to indicate whether or not Triad T4 connected evidence of place value concepts in the student work to the CCSS for 4th grade. Thus, the members of T4 focused a great portion of their inquiry process on the student’s understanding of mathematical concepts and skills other than those addressed in the CCSS for place value for their grade level.

The relationships among the Triad T4 members seemed to be congenial. Yet, it was difficult to determine T4’s disposition toward the mathematics. The intern’s lack of participation suggested that she may not have had a strong interest in learning more about the mathematics. However, evidence was not clear to support or dispel that notion. On the other hand, the supervisor seemed very interested in learning about the mathematics, but on occasion appeared to become frustrated, evidenced by her frequent attempts to keep the conversation focused. It may be the case that she was yearning to have a clearer understanding of the 4th grade place value concepts, but was unable to acquire that knowledge through her participation in the triad conversations. Again, there was not clear evidence to support that claim; however, it could be argued that if the conversations had been more balanced, claims about each member’s mathematical understandings may have been more transparent.

The greatest advancement of the student’s understanding of place value concepts was experienced by T2, who directly connected the mathematics in the student work to the CCSS place value objectives and also demonstrated balanced
participation by inviting each other to contribute to the conversations. Comparatively, the kindergarten student also experienced success in advancing her understanding of place value concepts, however, those results may well have resulted from the intern’s unwavering drive and determination. Avery was given the primary responsibility for collecting the data to review at each of the triad meetings and took that responsibility seriously. With encouragement from her triad, but also with the expectation to carry out the task largely on her own, she used her prior experiences and resourcefulness to implement meaningful tasks for her student. This heavy emphasis on the intern’s responsibility for carrying out the bulk of the work in both interpreting the student work and teaching the student is a strong indicator that Triad TK foregrounded the task of intern learning.

In contrast to T2 and TK, the T4 intern’s participation in the triad conversations was limited and evidence of her contributions was unable to be determined. In sum, connecting the mathematics in the student work to the Common Core State Standards, feeling welcome and comfortable to contribute and ask questions, and maintaining a balance of participation in the conversation, were conditions that seemed to have played a role in the diverse outcomes across the three PDS triads.

**The Orientation Toward Inquiry**

Similarities and differences were identified in the inquiry-oriented talk across the three PDS triads. (See Figure 7.2) For example, all three PDS triads (TK, T2, and T4) used Exploratory Talk on average between 40% - 45% of the time. And yet, this appeared in varying degrees and in differing situations across meetings.
Interestingly, there was not a pattern suggesting that the more often the triads met together, the more exploratory their conversations became; it was simply a type of talk that was consistently evident across the triads. It should not be surprising, considering the task, that the discussions were at least somewhat exploratory in nature. The task required the triads to examine the work of an individual student and determine his/her understanding of place value. To accomplish that goal, they needed to “explore” the student learning data. Furthermore, three study cycles was not an exceptionally long time to be engaged in examining student work.

During the inquiry process of each study cycle, it was also useful for the triads to discuss contextual and background information (Connected Talk) about the student and the student’s work. This information often provided the framework on which deeper discussions developed. Ultimately, the most productive conversations seemed to develop from triads who regularly revealed their thinking, shared what they noticed, and asked probing questions of each other, which is characteristic of Exploratory Talk.

Across the triads, there often seemed to be a link between Connected Talk and Exploratory Talk. Exploratory Talk often relied on Connected Talk; Connected Talk further supported Exploratory Talk. And so, it was not unusual to find the conversations hovering in the mid-range of the Inquiry-oriented Talk Continuum, between Exploratory Talk and Connected Talk. This was noticeable in all three triads, but particularly so in Triad TK. TK demonstrated these two types of talk 90% of the time compared to 74% and 69% for Triad T2 and Triad T4 respectively. In all cases, this type of talk seemed to support a consistent focus on the task, the willingness to explore possibilities, and a commitment to supporting claims with facts and details.
about the student. In spite of differences among the three triads in this study, they all revealed evidence of these two types of talk. And yet, they did not all achieve the same results.

![Inquiry-oriented talk comparison graphs.](image)

*Figure 7.2. Inquiry-oriented talk comparison graphs.*
There was also a noticeable pattern between Inquiry-based Talk and Disconnected Talk between Triads T2 and T4. Whereas T2 had the highest percentage of Inquiry-based Talk, they also had the lowest percentage of Disconnected Talk. In fact, there was no evidence of Disconnected Talk across their four meetings. Conversely, T4 had the lowest amount of Inquiry-based Talk and the highest amount of Disconnected Talk. And so, it can be argued that when triads inquire (Inquiry-based Talk), they are less likely to become distracted and the talk is more focused; when triads are unfocussed (Disconnected Talk), invitations to explore alternative perspectives are not offered and the talk is more random.

Excerpts from the triad conversations shared in Chapters 4, 5, and 6 support the claim that when the dialogue fell more to the left side of the inquiry-oriented continuum (See Appendix B), the quality and substance of the interns’ participation increased. This was true for Triad TK and Triad T2. For example, when engaged in Exploratory Talk, the dialogue revealed that triad members supported the intern’s participation by readily welcoming her thoughts and interpretations of the student learning data as it related to the collaborative task. They asked questions and openly sought out the opinions of others in the triad. They shared what they noticed, what they thought was interesting, what patterns seemed to be apparent, and occasionally ventured claims. When Inquiry-based Talk was evidenced, triad members invited each other to explore the student learning data further and consider alternative perspectives. There was wonderment, uncertainly, and hypothesizing. Everyone’s opinions were valued, regardless of their experience and expertise. Accordingly, triad members were willing to take risks, feel uncomfortable, and possibly change their
beliefs through participation in the triad conversations. This collaborative setting provided an environment in which intern learning was nurtured.

When these conditions were present in the talk, evidence indicated that intern learning about how to analyze student work and make decisions about future instructional plans took place. She was able to contribute more specific ideas about the mathematics rather than simply listening, agreeing, and asking questions. When the triad was able to collaboratively and productively explore the mathematics in the student work, they also were heard using the most Exploratory and Inquiry-based talk in their triad conversations.

**Roles Assumed by Triad Members**

The fourth area of impact on the inquiry process was the dominant roles played by the triad members. As noted in Chapter 3, the roles described in this study were not the type of group roles that are pre-determined and assigned to various group participants. Instead, they were unspoken roles identified in the dialogue that appeared to impact the conversation in a significant way. The roles discussed in this study were categorized as 1. task-oriented, 2. probing, 3. interpersonal, or 4. managerial. These categories were developed by drawing on the research of Benne & Sheats, 1948; Glickman et al., 2004; and Kwan & Lopez-Real, 2005.

Throughout the meetings, triad members demonstrated a variety of roles. When a triad member made multiple statements across multiple meetings that reflected a particular role, that role was considered to be a dominant role. Dominant roles by triad member are displayed in Table 7.3. Other roles by triad members were
noticed during the analysis, but were not considered to have impacted the conversations in significant ways.

**Role comparison across triads.** Across the three PDS triads, individual triad members often played similar roles. For example, all three supervisors played the role of facilitator, a managerial role. In this capacity, the supervisors attempted to keep the discussion on task and flowing smoothly. Perhaps not surprisingly, all three interns played the role of learner and all three mentors, at times, were seen as experts. Despite the fact that the dominant roles were similar in name, the manner in which they played out in the dialogue was sometimes different. For example, when Irene (T2 mentor) contributed to the dialogue as an expert, she often ended by inviting responsive ideas from the other triad members. This was not true of the “experts” in the other triads. And although Hanna (T2 intern) was a learner in her triad, as was the case with the other interns, she was not alone in that role. All T2 triad members were regarded as learners in the context of their triad meetings. This was not the case in the other two triads.

Across the three PDS triads, more than half of the dominant roles noted were task-oriented roles. The mentor teacher or the intern played 92% of the task-oriented roles. These roles provided the structure for the triad conversations and often defined the goals of the triad meetings. Notably, the TK mentor’s and intern’s dominant roles were solely task-oriented. Triad T2 demonstrated a greater variety of dominant roles than TK or T4. In fact, T2 demonstrated dominant roles in all four categories: task-oriented, probing, interpersonal, and managerial. For example, the T2 mentor and supervisor demonstrated evidence of the dominant role of facilitator (managerial), the
T2 supervisor of wonderer and questioner (probing), and the T2 intern of listener and agree-er (interpersonal). Probing and interpersonal roles, in particular, were often associated with positive, inquiring contributions to the inquiry process of the triad.

<table>
<thead>
<tr>
<th>Role</th>
<th>Triad TK</th>
<th>Triad T2</th>
<th>Triad T4</th>
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<tbody>
<tr>
<td></td>
<td>S</td>
<td>M</td>
<td>I</td>
</tr>
<tr>
<td><strong>TASK-ORIENTED</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
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<tr>
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<td>✓</td>
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<td>Contributor</td>
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<td>Learner</td>
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<tr>
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<tr>
<td>The Wonderer</td>
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<tr>
<td>The Questioner</td>
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<td>✓</td>
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<tr>
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</tr>
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</tr>
<tr>
<td>The Facilitator</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.3. Dominant roles by triad member across triads. Key:  S - supervisor, M - mentor teacher, I - intern.

And so, Triad T2 not only followed the pattern of providing structure and goal orientation, but they also demonstrated evidence of roles that were probing, interpersonal, and managerial. The diversity of the roles in Triad T2 likely was a factor that resulted in a balanced participation pattern by the end of the study.

The TK intern and the T2 intern exhibited a similar pattern of growth in participation during the study. As time went on, both interns made more meaningful contributions to the conversations and demonstrated increased participation. Each of them could have been described as a blossoming expert by the end of the study. The support each received during the inquiry process, however, varied. Avery, the TK
intern, entered the study as a learner and was viewed as a learner by her triad throughout the study. In fact, it could be asserted that Triad TK foregrounded the role of the intern as learner throughout the study. Accordingly, her triad was very supportive throughout the inquiry process in a teacher-student type of relationship.

Her evolution into the role of expert was evidenced by the change in the nature of her dialogic interactions with the triad over time. It is likely that Avery’s triad recognized her growth, while still viewing her primarily as a learner.

On the other hand, although Hanna, the T2 intern, also entered the study as a learner, her triad treated all triad members as learners. The fact that Hanna had the least amount of experience did not appear to impact the conversations. Instead, Triad T2 foregrounded the task of understanding the student work. All triad members were equally involved in the study, not only by participating in the triad meetings, but also by taking part in the lesson development, the implementation of the lessons, and the analysis of the student work outside the triad meetings. As a result of this collaborative support, Hanna learned with her mentor teacher and supervisor.

While Avery and Hanna learned by doing, albeit in different ways, Zoe, the T4 intern, learned by listening. Evidence of whether she acquired knowledge or grew professionally in measurable ways, was not attainable. There was not observable evidence to support that type of claim for Zoe.

**Introduction to Claims**

This study revealed evidence supporting three claims about cross-role triads – mentor teacher, intern, and supervisor – engaged in a looking at student work in elementary mathematics over time in an professional development school (PDS)
setting. These claims address the conditions in which advances in student learning were fostered, the impact of participation patterns within the triad conversations, and the ability of triad members to connect the mathematics in the student learning data with the *Common Core State Standards* for that grade level.

**Claim 1.** *When the understanding of student learning data was foregrounded as the primary task of all three triad members, advances in student learning across the study cycles were more clearly visible in the student work.*

Each triad conceptualized the primary task of their conversations differently. Triad TK foregrounded the intern’s learning; Triad T2 foregrounded the understanding of the student learning data; and Triad T4 did not necessarily demonstrate one particular focus as the primary task of their conversations. Accordingly, the advances in student learning may have been impacted by these differences in how the task was conceptualized.

The greatest advances in student learning were recognized in Triad T2’s student work. For example, the results of the pre-assessment in study cycle 1 compared to the student work collected during study cycle 3 indicated growth in the student’s ability to accurately represent a two digit number with a sticks and dots drawing and to correctly identify the value of a particular digit in a two-digit number. (See Appendix J) These skills are mentioned in the 2nd grade *Common Core State Standards* for place value. (See Table 5.2)

There was also evidence of growth in the kindergarten student’s understanding of place value concepts in the student work collected by Triad TK. For example, whereas during study cycle 1, the student was unable to connect number
dots (1-5) in sequence, during study cycle 3, she was able to connect numbers dots from 1-10. (See Appendix I) This growth, however, may not be viewed as substantial as the growth of the T2 student. This raises the question of whether Triad T2’s intentional focus on the student learning as the primary task may have impacted the results.

Finally, it was not possible to determine whether there was growth in place value skills and concepts across the three study cycles for the Triad T4 student. The mathematics of the student work discussed in the triad meetings and the student work that was collected did not represent baseline or summative assessment data with which to make a claim about the student’s growth in understanding place value concepts as described in the Common Core State Standards for place value at the 4th grade level. (See Appendix L) The results across the three PDS triads supported the notion that when the understanding of student learning data was foregrounded as the primary task of all three triad members, advances in student learning across the study cycles were more clearly visible in the student work.

**Claim 2.** *The quantity and substance of intern participation in the inquiry process varied across the triads.*

When the PDS triads engaged in a collaborative dialogue in which participation was balanced among the triad members, the triad members were more likely to model talk patterns that were inquiring, inviting all members into the conversation. All members were treated as learners and the intern was provided the opportunity to contribute to the conversations as well as to learn from others.
Across the three triads, T2 demonstrated the most balance between attempting to understand student learning with opportunities for the intern to learn. For example, the mentor, playing the role of expert, not only shared her expertise, but also invited the intern and the supervisor to react and respond to her ideas and beliefs. This type of behavior likely played a role in developing a balanced conversation over time. It established a safe environment in which the intern and the supervisor could express their opinions and share alternative ideas. By the end of the study, all triad members were contributing fairly equally to the discussion (mentor teacher – 26%, intern – 33%, supervisor – 41%).

During exchanges of balanced participation by Triad T2 members, the talk was often Exploratory or Inquiry-based. This type of talk was characterized by a critical and collective analysis of the data by the triad. Accordingly, findings that were constructed by the triad represented the voices of all three triad members.

In the case of Triad T2, the triad members determined what the student understood about place value concepts by carefully examining and inquiring about the student learning data (student work). Then, together, they ventured claims about the best instructional plan to implement. As they questioned each other about the student work, they demonstrated a willingness to be open to new knowledge acquired while engaged in the inquiry process – what did the student understand and what were the best instructional practices to meet her needs? In that way, the mentor teacher, the intern, and the supervisor learned from each other while engaged in conversation. While focused attention was paid to what the student was learning, at the same time,
the intern was afforded the opportunity to learn by participating equally in the process.

The TK intern was also provided an opportunity to contribute to the triad conversations, albeit in a different way than the T2 intern. Instead of equal participation among the triad members, the intern’s participation grew steadily throughout the cycles of the study from 29% to 63%. Conversely, the participation of both the TK mentor teacher and supervisor decreased across the four triad meetings. This pattern was likely the result of the mentor and supervisor’s expectations that the intern take primary responsibility for completing the group task. As the meetings progressed, the intern’s role increased as she accepted the majority of the responsibility. This practice resulted in the intern being afforded the opportunity to be the primary voice in the analysis of the student work. Although the Triad TK intern rose to the challenge, it may not be likely that other interns in a similar situation would respond in the same manner.

The T4 intern was not afforded the opportunity to be a major contributor in her triad conversations. It was unclear whether the intern chose to exercise a quiet voice or whether it was the mentor and supervisor who viewed the intern’s role in the triad as secondary because of her lack of teaching experience. In fact, it was difficult to establish a strong claim about the intern’s role, one way or the other, due to her limited participation. For example, when the mentor teacher shared lengthy stories about past teaching experiences, representing Disconnected Talk, the intern was likely unable to identify with or contribute to the story because of her lack of previous teaching experiences on which to draw. As a result, it was probable that the intern
had difficulty developing a sense of what she could learn from the dialogue. Her voice became quiet in the conversations and it was difficult to know what she was thinking. Although the dearth of data representing the intern’s voice did not allow claims to be made about the intern’s contribution to the conversations, it was likely that it was minimal.

**Claim 3.** The triads differed substantially in their conversations in regards to how clearly they connected place value concepts expressed in the student work to the Common Core State Standards for that grade level.

When the PDS triad members were able to connect evidence of place value concepts in the student work to the Common Core State Standards (CCSS) for their grade level, the conversations around the student work tended to be more focused and the triad was less likely to become distracted. When these conditions were in place, there was often a specific focus on the student’s mathematical reasoning and they paid close attention to strategies used to solve problems; less attention was paid to work habits that didn’t necessarily impact the student’s understanding.

During the Triad T2 conversations, there was significant evidence in the conversations indicating that the triad members were able to make connections from the student work to the CCSS for place value in 2nd grade. For example, T2 stated that they referenced the CCSS to develop the student work they administered and analyzed throughout the study. Background experience and expertise may have also played a role in being able to make connections from the student work to the standards. Having been 2nd grade teachers, either currently or in the recent past, the T2 mentor teacher and the T2 supervisor were very familiar with 2nd grade place
value objectives. Unlike the TK and T4 supervisors, the T2 supervisor was
supervising in the grade level classroom in which she had most recently taught.

For these reasons, it appeared that Triad T2’s ability to make connections to
the place value standards in the student work contributed to the way in which they
talked about the student’s understanding of the mathematics. For example, instead of
focusing on the student’s work habits, they paid closer attention to the student’s
strategies for solving problems.

These standards connections were not noted as often in Triad TK and Triad
T4. When Triad TK determined that their student needed to focus on prerequisite
place value skills, this caused tension within the triad. They believed that the student
needed to work with the prerequisite skills, but were conflicted, thinking that they
were not addressing the CCSS for place value in kindergarten. Their discomfort with
this decision was never resolved among the triad members throughout the three study
cycles. Although they had productive discussions about the student’s understanding
of the prerequisite place value concepts, their focus continued to remain in question
throughout the four triad meetings.

Triad T4’s ability to notice connections in the student work to the CCSS place
value standards was the most difficult to determine. The conversations about their
student’s mathematical understandings did not address the majority of the 4th grade
place value objectives. Instead, T4 conversations often addressed the student’s
inability to learn his addition and multiplication math facts. Although they felt that
this affected his work in other areas of mathematics, connections to place value were
not made. Moreover, the triad’s conversations often addressed work habits that did
not necessarily impact the student’s mathematical understanding of 4\textsuperscript{th} grade place value concepts.

**Chapter Summary**

Chapter 7 discussed the diversity in the participants across triads. Then, the nature of the student learning data across the three triads were compared and contrasted. Next, four areas of impact on the inquiry process; the substance of the conversations, the mathematics in the student work, the orientation toward inquiry, and the roles played, were examined and compared. Finally, three claims were made that addressed (1) the conditions in which advances in student learning were fostered, (2) the impact of participation patterns within the triad conversations, and (3) the ability of triad members to connect the mathematics in the student learning data with the *Common Core State Standards* for that grade level.

The next chapter will discuss implications for professional development opportunities for teacher educators and school district leaders. It will also offer ideas for future research based on the findings of this study.
CHAPTER 8: DISCUSSION AND IMPLICATIONS

The most productive environments seem to be those where teachers regularly interact and engage in collegial conversation around meaningful and relevant issues” (Langer et al., 2003, p. 44)

Factors that lead to productive environments were uncovered in this study in which teachers were interacting in collegial conversations about their students’ work. Chapter 8 begins with a discussion of the contribution this research study makes to a gap in the literature on collaborative inquiry groups that are comprised of participants in diverse roles and who routinely look at student work to improve teaching and learning. Next, implications are explored that connect to the findings of this study and may provide important ideas for the work of collaborative inquiry groups in diverse roles. And finally, ideas for future research are offered that may enhance and extend this study in new and improved ways.

Introduction

This study examined the nature of the interactions within three PDS triads as they looked at student work over time. The triads represented different grade levels (K, 2, and 4) in different schools within the same professional development school partnership between a suburban/rural school district and a large research one university in the northeast. As described in Chapter 3, the mentor teachers were the only triad members selected purposefully; the interns and supervisors were randomly assigned using the professional development school placement process. The findings indicated that the only factor from the selection process that significantly impacted the results was the classroom grade level. This impact will be discussed below.
Speaking broadly, the study looked at how the participants interacted with each other, how they supported and learned with each other, and how they dealt with struggles and successes of fostering an authentic collaborative context in which all voices, no matter what the level of experience of expertise, were heard and respected. There was a diligent and focused triad (TK) that made good use of the data in their conversations, a questioning triad (T2) that shared wonderings and often invited further exploration of the data, and an eclectic triad (T4) that showed genuine concern for their student but was often distracted from the original task.

**Contributions to the Literature**

Organizing teacher learning around the study of student work is one particular way in which professional development can be situated in practice (Ball & Cohen, 1999). Much has been written about the benefits of looking at student work in collaborative inquiry groups (Langer et al., 2003; Little et al., 2003; Nelson et al., 2012; Patrizio, 2009; Pugalee, 2001; Slavit & Nelson, 2010). In most cases, the members of collaborative inquiry groups hold similar positions (Ballock, 2008; Nelson et al., 2012; Patrizio, 2009). For example, in some studies the inquiring group was a group of teachers from a particular school, grade level, or content area. In other studies, the inquiring group was a group of preservice teachers looking at student work as part of a university class or field experience. And yet, current research does not directly address the impact on teacher learning when group members vary significantly in expertise and experience.

**Group diversity.** In the present study, the role differentiation varied significantly; at one end of the spectrum was a preservice teacher and at the other, a
mentor teacher and a university supervisor. Thus, the triad members who participated in this study were engaged in two simultaneous tasks, making sense of student work to benefit the P-12 student and also socializing the intern into the process of using student work as a way to understand and guide practice. Although all three triads engaged to some degree in each of those two tasks, the task that was foregrounded varied across the triads.

Not surprisingly, there has been limited interest in research on how or what teachers learn when looking at student work alone, or by themselves. Instead, a more useful question might be: How do collaborative groups of educators in diverse roles look at student work productively over time? What are the factors that impact the outcomes of an inquiry process? The current research looked purposefully at three collaborative inquiry groups (professional development school triads) in which the members had varying levels of experience and expertise defined in part by the position they held as either mentor teacher, intern, or supervisor. Hence, this study contributes to the literature by providing new research about how rich conversations of PDS triads in practice can provide fresh insights into the work of collaborative inquiry groups in which the members hold multiple levels of expertise and experience.

**The inquiry process.** This study also focused on the inquiry process followed by these diverse groups of educators. An inquiry process is defined by Nelson, Slavit, and Deuel (2012) as a cyclic process of planning, implementing, collecting, and analyzing data in which the inquiry activity is related to the use of student learning data. Building on their model, this study focused on four dimensions of the inquiry process of the PDS triads: 1. the way in which the triad members
connected the mathematics expressed in the student work to the *Common Core State Standards*, 2. the substance of the triad conversations, 3. the orientation of their dialogue toward inquiry, and 4. the roles the triad members played as they discussed the student work. (See Figure 7.1)

Stigler and Hiebert (1999) claim, “By working in groups to improve instruction, teachers are able to develop a shared language for describing and analyzing classroom teaching, and to teach each other about teaching” (p. 123). These three PDS triads, with multiple levels of expertise and experience, were invited to gather for a common purpose - to collaboratively contribute their thoughts and ideas about student understanding and instructional planning while looking at student work. By examining the factors that impacted each triad’s inquiry process, diverse outcomes of each triad group were noted and compared with one another. On the topic of group learning, Wells (2000) argues, “participants with relatively little expertise can learn with and from each other as well as from those with greater experience.” (p. 5). This study takes a closer look into the inquiry process followed by several diverse groups of collaborative educators, or PDS triads. Accordingly, the results may dispel the notion, held by some, that mentors and supervisors are the holders of all knowledge and the intern is the only learner.

**Implications**

Although this research study took place in the context of a unique PDS partnership, there may well be implications for those who work in similar contexts. In particular, when groups of educators with diverse levels of expertise and experience gather together in collaborative inquiry groups, the outcome of their work
is likely impacted by the same or similar factors that were examined in this study.

There are numerous naturally occurring groups in school districts that are comprised of members with diverse levels of expertise and experience. For example, when instructional support teams (IST) convene, members may include the classroom teacher, the building principal, the instructional support teacher, the counselor, the reading support teacher, the parent, or others who have interacted with the focus student and possess meaningful data to contribute to the team. Additionally, in the district in this study, goal-setting conferences are held twice a year in which the classroom teacher, the parent(s) and the student meet together to discuss academic goals. Occasionally other support teachers may be invited to attend. Often, student work is used as a focus of the conversation. These are two examples in which it would be helpful for the group organizers to consider findings from this study that address productively facilitating inquiry-oriented talk, balancing participation, and maintaining a clear focus throughout the conversation.

Hence, this research has implications for teacher educators and school district administrators interested in understanding how collaborative inquiry groups of educators use student work to determine student understandings and plan future instruction. From the findings and wonderings raised by this research, three potentially significant areas of impact for teacher education and professional development for inservice teachers are discussed: connecting the content, orienting the talk toward inquiry, and balancing the participation.

**Connecting the content.** Dewey (1929) claims, “Deep knowledge of the subject is the fruit of the undertakings that transform a problematic situation into a
resolved one” (p. 242-243). If educators are to learn what their students know from looking at student work, it is important for them to be able to connect the mathematics expressed in the student work to the expectations outlined in the curriculum. District curricula are typically required to be built around a set of standards, as was the case in this study. Most teachers look at student work on a daily basis to determine what their students understand and to decide how to plan future instruction. How they go about doing that and to what they pay attention likely varies from teacher to teacher.

It could be argued, based on the findings of this study, that the classroom grade level was a factor that impacted the degree to which the triad members were able to make connections from the place value concepts reflected in the student work to the Common Core State Standards. It seemed as though the kindergarten and fourth grade triad members may have had questions about place value expectations to be taught at their grade level. This struggle with clarity raised several questions. When standards are developed at the state or national level, what measures are taken to determine whether specific objectives are developmentally appropriate for students at each grade level? Are the members of the standards writing teams comprised of both practitioners and content experts who, together, have the necessary experience and expertise to make appropriate decisions about what is developmentally appropriate for students at each grade level? Is the input given by each group of developers weighted equally?

A connected wondering is - What measures are in place in school districts and universities to assure that preservice and inservice teachers can accurately interpret
and apply the required standards objectives at their grade level? How is it determined, and to whom, measures of support are offered to address these needs? Does everyone receive the same professional development, or is there differentiation to meet individual teacher needs?

Customarily, there are organizational structures in place to make informed decisions regarding these challenges, such as the university department of curriculum and instruction, methods instructors, the district curriculum office, instructional coaches, building principals, or the teacher. The findings from this study suggest that this type of professional development is necessary and important. When the triad was able to make connections from the mathematics expressed in the student work to the standards objectives, their conversations were focused, their work with the student was productive, and their instructional planning was more effective. Developing common standards is an important task; however, this study suggests that developing mechanisms and structures to help educators connect the standards to their specific grade level and students is, at least, equally important.

Assuming the Common Core State Standards are developmentally appropriate, there are numerous ways in which curriculum support structures can provide opportunities for educators to interact and become familiar with operationalizing the standards expectations for their students. For example, districts organizing professional development workshops or universities offering courses for inservice teachers may meet this need. Coordinating after school study groups, subsidizing teachers’ attendance at conferences, or providing release time for teachers to form professional learning communities such as Critical Friends Groups may foster support
in this area. Nolan and Hoover (2008) state, “Collaborative examination of student work is the primary task of Critical Friends Groups, and this strategy has been demonstrated to be a powerful mechanism for promoting both teacher development and improved student learning” (pp. 147-148).

Unfortunately, implementing these solutions presents many challenges. Financial support is usually required, but perhaps more importantly, a time commitment is necessary. In elementary classrooms, where teachers are responsible for planning, teaching, and assessing student work in all academic content areas, finding time for one more thing can be challenging. Hargreaves (2000) argues, “Time compounds the problem of innovation and confounds the implementation of change” (p. 95). It is not uncommon to overhear teachers in the faculty lounge grumbling about not having enough time in the day to attend to the basic requirements of teaching, much less trying to find time to increase their knowledge of the content outlined by the standards. Implementing new programs or participating in initiatives for change are often ways in which to provide meaningful opportunities for professional development, but time remains a factor.

District administrators or those who can be creative about finding release time for teachers could provide solutions to time as an obstacle. Teachers could use release time to participate in professional development opportunities to enhance their ability to make connections from the mathematics expressed in student learning data to the standards expectations. Looking at student work is a job-embedded activity. It takes place every day in schools across the country. Providing guidelines for intentionally exploring the subject matter content in student work increases the
likelihood that teachers will expand their own ability to make connections from the student work to the standards expectations. School districts who invest time and effort in encouraging teachers to examine student work will likely realize immediate benefits.

Perhaps the best place to focus on learning standards expectations is in methods courses at the university level, before the time factor becomes as daunting. By learning how students learn the content, preservice teachers can strengthen their own knowledge of the standards. For example, preservice teachers could be engaged in solving mathematics problems, conducting inquiry-oriented science explorations, and volunteering for service learning projects in their methods courses. Through these types of experiences, they continue to interact with the content as they learn to teach. “Teaching is professional work with its own unique professional knowledge base” (Ball, Thames, & Phelps, 2008, p. 392). Often referred to as pedagogical content knowledge (PCK), much has been written about combining subject matter knowledge with knowledge for teaching to create PCK, or more specifically, mathematical knowledge for teaching (MKT) (Akkac & Yesildere, 2010; Ball et al., 2008; Chapman, 2013; Hill et al., 2008; Hill, Rowan, & Ball, 2005; Magnusson, Krajcik, & Borko, 1999; Shulman, 1986). A focused effort on acquiring subject matter knowledge would likely have a positive impact on the development of PCK or MKT.

**Orienting the talk toward inquiry.** Nelson, Slavit, and Deuel (2012) believe that “attention to teachers’ stance toward student learning data and the nature of their dialogic interactions are of fundamental importance to professional development that
utilizes student learning data” (p. 49). In addition to recognizing the importance of being able to accurately interpret the standards objectives, the extent to which the conversations illustrated inquiry-oriented talk also seemed to impact the productivity of the PDS triads. When inquiry-based talk was present in the dialogue, members invited each other to share their opinions; they encouraged each other to explore alternative perspectives. Given these conditions, one notable result was that the intern showed evidence of growth in learning how to use student learning data to inform instruction.

Trachtman (2007) argues, “Inquiry in teaching and learning may be … as simple as a group of teachers and teacher candidates sitting around a conference table debating the merits of student work and the ways in which they might change their practices to enhance students’ performance” (p. 199). Applying this belief to this particular PDS partnership, Trachtman makes a reasonable assumption, given that the PDS triad in this study is an established collaborative group with opportunities for weekly interaction. And yet, it may not be as simple as teachers and teacher candidates sitting around a conference table looking at student work. Each of the three triads in this study did not demonstrate the same level of inquiry-oriented talk in their conversations. And so, it is important to think about ways to provide opportunities to support the development of a disposition toward inquiry when collaborating with colleagues. The framework for inquiry-oriented talk used in this study could be a useful tool to address this challenge. It was designed specifically to analyze conversations of PreK-4 teachers who are looking at student work over time. It could be a useful training tool for preservice and inservice teachers who are either
examining their own audio-recorded dialogue, or exploring scenarios developed explicitly for professional development purposes.

There are many who believe that an inquiry stance toward teaching should be a goal for all educators, pre-service and inservice teachers alike (Butler, 2012; Cochran-Smith, Marilyn & Lytle, 1999, 2009; Cochran-Smith, M., Lytle, S. L., 1993; Dana, 2001; Jaworski, 2006; Wells, 2000). In many teacher education programs, some form of inquiry or practitioner research is now included in the preservice teacher education curriculum. The intention is to assist teacher candidates in becoming professionals who are life-long learners who raise questions and research their practice across the professional career (Cochran-Smith, M. et al., 2009, p. 1).

In the professional development school partnership featured in this study, inquiry is at the heart of their work. Preservice teachers are required to conduct an inquiry on their practice during the spring of their full-year internship. University supervisors and instructors coach pre-service teachers in the art of identifying an area of inquiry in their practice and guide them through the inquiry process. The interns’ work is made public at an inquiry conference held at the end of the school year, in which they present their work, along side of mentors, supervisors, and other district educators. When inquiry becomes the lens through which teachers view their work, over time, an inquiry stance is more likely to evolve.

Donnell and Harper (2005) claim, “In an era that is wrestling with the appropriate outcomes of teacher education and public schooling, inquiry can provide opportunities to develop a life-long approach to learning and teaching that encourages responsiveness to change, knowledge generation, and social action” (p. 163). This
work can be supported by offering university courses on teacher inquiry, providing district professional development workshops in which inquiry projects are designed and shared, or simply offering book study groups in which teachers learn what inquiry is and how they might use it in their practice.

Sergiovanni and Starratt (2007) write, “such a (differentiated) system (of supervision) is responsive to the individual needs and interests of teachers while protecting and enhancing instructional coherence” (p. 261). Currently there are new demands and requirements being placed on classroom teachers to demonstrate proficiency in teaching. Teacher evaluations require educators to show data-based evidence to support how they are continuing to improve their practice. This study provides a possible model for the implementation of an inquiry process that could be used in a differentiated system of supervision option for inservice teachers of the type suggested by Sergiovanni and Starratt (2007).

**Balancing the participation.** Another important factor in fostering productive interactions among triad members while looking at student work is to generate balanced participation. In this study, there were two simultaneous tasks, making sense of student work to benefit the P-12 student and also socializing the intern into the process of using student work as a way to understand and guide practice. When members of the group encourage each other to participate and also practice good listening skills, the groundwork is set for balanced participation. In a balanced dialogue, triad members often invite each other to deeply explore the student learning data, to consider alternative perspectives, and to be open to creating shared understandings. This condition levels the playing field and creates a sense of
equity, even when there are diverse levels of experience and expertise. Hopefully, the least experienced triad member (the intern) learns through her/his participation. However, the nine required essentials of a PDS require an effort to provide “ongoing and reciprocal professional development for all participants guided by need” (NAPDS, 2008a). Attention to this tenet will likely result in opportunities for learning for all members in the community, the P-12 students, the mentor teacher, the supervisor, and others.

One way in which to create balanced participation within a collaborative inquiry group is to follow a protocol. A protocol is a structured set of guidelines, usually with time frames attached, allowing members of the group to have designated time periods in which to speak without interruption. There is usually a facilitator who is responsible for “keeping time, protecting the presenter, and promoting thoughtful conversations” (Nolan & Hoover, 2008).

Since 1994, the National School Reform Faculty (NSRF) has created more than 200 protocols to use in Critical Friends Groups, classrooms, meetings, and other collaborative groups (NSRF, 2014). Some of the NSRF protocols were developed specifically to support teacher inquiry, to be used as tools to explore various topics and ideas. For example, the Cycle of Inquiry protocol outlines a process similar to the inquiry process followed in this study. This protocol could serve as a guideline for collaborative inquiry groups wishing to inquire into their practice and also investigate related literature and field expertise.

The 5 Whys for Inquiry protocol helps the teacher get at the foundational root of her/her question and uncovers multiple perspectives on the question. Some of the
standard components of this and similar protocols are presentation, clarifying
questions, discussion, responses, and a debrief.

Another protocol offered by NSRF is called *Inquiry Circles*. In this protocol,
participants are given time to do a written reflection, then share in partners, and
finally in circles of four. The purpose of the *Inquiry Circle* protocol is to generate
robust inquiry questions to guide teacher inquiry. These protocols and numerous
others can be found at [http://www.nsrfharmony.org/free-resources/protocols/inquiry](http://www.nsrfharmony.org/free-resources/protocols/inquiry).

Collaborative inquiry groups can also design their own protocols to address the
specific needs and goals of their group.

A protocol developed to guide the type of conversations in this study would
include several specific features. With the goal of limiting the amount of
Disconnected Talk, the protocol might begin with a “check in”. During the “check
in”, each triad member would have time to share thoughts that he/she brings to the
meeting that could potentially interfere with productive talk about the group task. It
might be a personal anecdote or a story related to the student work that doesn’t
necessarily contribute to the task. In this way, during the subsequent conversation,
triad members may be more likely to remain focused on the task, and less likely to
engage in Disconnected Talk.

The next part of the protocol, and perhaps most importantly based on the
results of this study, would be a guided discussion of how the group conceptualizes
the task, including their interpretation of the mathematics or subject matter content
around which the student work is centered. Members would have a chance to think
about the goals of the task and how the mathematics might look in the student work.
They would be given an opportunity to articulate their thoughts and understandings to the group. In this study, there was diversity in how the triad members connected the mathematics expressed in the student work to the standards objectives. Had these connections been more clearly articulated among the triad members, the results may have been more productive across the triads.

**Future Research**

“There is something important to be learned by giving close attention to students’ experience and students’ actual work” (Little et al., 2003, p. 185). Looking at student work in professional development school triads afforded the triad members the opportunity to reflect on diverse interpretations of the work and to share their knowledge and expertise with one another about future instructional plans. Similar studies are needed to generalize the findings to other contexts and other types of groups.

“Most professional development schools have as a central component the establishment of new learning communities where inquiry, critique, and reflection are the norms” (Putnam & Borko, 2000, p. 10). Triads have long been established as learning communities within professional development schools. Breaking from traditional student teaching models, the PDS supervisor’s greater availability allows for the establishment of strong triad relationships. Future research is needed to determine new and innovative ways in which PDS triads, and other collaborative inquiry groups, can learn together about teaching and learning.

Towers (2010) writes, “Strong inquiry-based teaching is a nuanced and complex practice and the evidence suggests that for beginning teachers the
knowledge upon which such practice rests may be tacitly held, and deeply embodied” (p. 260). Including preservice teachers (interns) in collaborative conversations about student work provides them opportunities to acquire knowledge in a transparent and authentic setting. The findings of this study suggested that immersing preservice teachers in meaningful and important conversations with experienced teachers and supervisors can enhance the learning of the preservice teacher. More in depth studies are needed that focus on the growth of all triad members in multiple contexts over longer periods of time.

Finally, the findings of this study suggest that preservice and inservice teachers need to be accomplished in being able to accurately interpret the subject matter that they teach and apply to their instructional practices. To begin to address this concern, research is needed to determine how goals and objectives in content areas such as mathematical place value concepts are determined. This important work needs to draw on the expertise of those who work directly with students and understand their developmental needs in partnership with subject matter experts in the field of education. The goals and objectives need to be clearly articulated and shared by citing authentic examples in practice. When decisions are made in this manner, only then can teacher educators and school district leaders design meaningful professional development opportunities for preservice and inservice teachers that will enhance teaching and learning in practice.
REFERENCES


Benne, K., & Sheats, P. (1948). Identifying both positive and negative group behavior roles.


APPENDIX A

Student Assessment Project

MTHED 420 Assignment 6
Student Assessment Project: Looking at Student Work

In this assignment, you – with the support of your mentor – will use selected pieces of student work to assess one child’s understanding of place value.

(1) Think about what it means to understand place value. Refer to your Teaching Student-Centered Mathematics textbook (PreK-2 or 3-5).

(2) Observe students in your classroom to determine what they seem to understand about place value.

• What supporting evidence from your observations helps you characterize the children’s

(3) Meet with your mentor to choose one math student whose place value understanding poses some wonderings for you. For example,

• Is there a child who has an unusual approach to solving problems that involve place value

• Is there a child who seems to have good number sense, but struggles with certain problems

• Is there a child who seems to struggle with many place value ideas and problems?

(4) During the meeting with your mentor, identify 2-3 pieces of student work that you can use to assess the child’s understanding of place value. You may ...

• Develop an assignment, activity, or “quiz” to assess some aspect of the child’s understanding

• Select samples of work about place value that the child has already completed, or

• Use the “levels of cognitive demand” framework (Figure 2.1 in your Teaching Student-Centered Mathematics textbook) to develop, adapt, or choose 2-3 place value tasks that have a high level of cognitive demand. Engage the child with these high-level tasks.
(5) Examine the student work you have collected. As you do, bear in mind the descriptions of place value understanding in your Teaching Student-Centered Mathematics textbook.

What evidence do you have, from your assessment, of the child’s understanding of place value? Draft some “results” of your analysis (claims and supporting evidence). Make note of lingering questions about the child’s understanding as well as new questions that have emerged.

(6) After examining the student work, meet with your mentor again to discuss your results. Revise your results as needed. These questions may be useful for guiding your conversation with your mentor:

• How would you describe the child’s understanding of place value?

• Do you notice anything surprising or unexpected?

• Is there anything about the assessment results that creates a wondering for you?

• Do any of the results seem to be related to instruction (positive or negative)?

• Is there anything about math instruction that you might change based on the results?

• How have your knowledge or beliefs been impacted by examining this child’s work?

(7) Prepare a round table presentation with your grade level group.
<table>
<thead>
<tr>
<th></th>
<th>APPENDIX B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inquiry-oriented Talk Framework</strong></td>
<td></td>
</tr>
<tr>
<td><strong>INQUIRY-BASED TALK</strong></td>
<td><strong>EXPLORATORY TALK</strong></td>
</tr>
<tr>
<td><img src="image" alt="Inquiry-Based Talk" /></td>
<td><img src="image" alt="Explanatory Talk" /></td>
</tr>
<tr>
<td>all members collaboratively inquire together</td>
<td>one person explores and invites others to explore</td>
</tr>
<tr>
<td><strong>• Talk as wonderings</strong> is deeply connected to the triad’s collaborative purpose; references may be made to past discussions and/or future possibilities.**</td>
<td><strong>• Talk as questions</strong> is clearly connected to the triad’s collaborative purpose; comments often reveal the thinking of the triad member.**</td>
</tr>
<tr>
<td><strong>• Talk always invites further exploration of the evidence and may include inquiring questions that invite alternative perspectives.</strong></td>
<td><strong>• Talk often invites further discussion of evidence, sometimes through questioning (exploratory and clarifying).</strong></td>
</tr>
<tr>
<td><strong>• Participants are absorbed.</strong></td>
<td><strong>• Participants are engaged.</strong></td>
</tr>
<tr>
<td><strong>• Purpose of the talk is to explicate.</strong></td>
<td><strong>• Purpose of the talk is to interpret.</strong></td>
</tr>
<tr>
<td><strong>• Claims, when made, are based on evidence that has been critically and collectively analyzed. Comments may express wonderment, uncertainty, and hypothesizing. Phrases in the dialogue might be, “I’m curious”, “so do you mean?”, “what if”, “it sounds like”, “I wonder”. “I’m curious” “I just don’t know”</strong></td>
<td><strong>• Claims, when made, are based on evidence that has been explored and questioned. Phrases in the dialogue might be: “I’m noticing”, “it looks like” “Can you tell me more about?” “maybe” (as a suggestion), “I think”, “I feel”, “this is interesting”.</strong></td>
</tr>
<tr>
<td><strong>• In general, triad members often generate new knowledge and create</strong></td>
<td><strong>• In general, the conversation is an emergent and developing process;</strong></td>
</tr>
<tr>
<td>Shared understandings; beliefs and value may be reexamined, transformational learning often occurs.</td>
<td>Triad members look for patterns and venture tentative claims.</td>
</tr>
</tbody>
</table>
APPENDIX C

Invitation to Participate

Dear (mentor)

It’s difficult to believe that we are welcoming the third cohort of PDS interns since I’ve retired and been involved with the PDS! How can that possibly be? The positive in all of this for me is that I have journeyed along my graduate school path and will be ready in the Fall 2013 to begin collecting data for my dissertation research study. That is the purpose of this email.

I am writing to ask if you would be willing to participate in my research. I am interested in studying one PDS triad from each division: K, primary and intermediate. My study will be an expanded version of one of the assignments from MTHED 420. It will involve completing three study cycles around a student for whom you, your intern and PDA find “puzzling” in terms of their understanding of a mathematical concept.

What type of commitment would this mean for you and your PDS triad? Most importantly, I am committed to making sure this study folds into what you might already do, for the most part, as a collaborative team. Meetings outside the school day would be minimal, if at all. It is expected that you will be able to meet within the school day to gather the following six short audio recordings of triad meetings.

1. **September:** conduct a 15 min. audio recorded triad meeting to identify your “puzzling” student and discuss what types of student work might be useful to administer/collect and review.

2. **September:** conduct a 15 min. audio recorded triad meeting before the end of September to review the student work and talk about how you might address the student’s needs.

3. **October:** repeat the cycle. At the first Oct. triad meeting, discuss what additional student work might be useful. At the second Oct. triad meeting, review the newly collected student work. (2 – 15 minute recording)

4. **November:** repeat the cycle. (2 – 15 minute recordings)

I will provide a framework and schedule for the two short (15 min) monthly meetings and will send reminders to keep your participation on track. Additionally, I will be available for any additional questions you may have along the way.

If you are interested in participating in my research study, simply reply to this email and let me know! I will then arrange for a time to come to your school at a convenient time to talk to you about additional questions you might have and discuss further details. You can make your final decision at that time.

Thank you for considering this opportunity to be a part of my study. I look forward to hearing from you and hope that we can collaborate this fall on this important work.

Best,
MJ
APPENDIX D

Informed Consent Form for Social Science Research

The Pennsylvania State University

Title of Project: Study of State College Area School District-Penn State University PDS triads, examining student work in elementary mathematics.

Person in charge: Mary Jayne Coon-Kitt
223 Chambers Building, University Park, PA 16802
814-238-3860; mjc224@psu.edu

Other Investigators: Dr. James F. Nolan
148 Chambers Building, University Park, PA 16802
814-865-2243; jimnolan@psu.edu

Purpose
The purpose of this research study is to examine and understand how PDS mentors, interns and/or supervisors/coaches inquire into and talk about student work in elementary mathematics.

Procedures
You will be asked to audio record between 4 - 6 meetings between mentor, intern, and/or supervisor or coach. You may also be asked to participate in one audio recorded interview about your experiences as a participant in the project.

Benefits
• The direct benefit to you should be improvements and meaningful changes in individual student instructional planning in mathematics as a result of dialoguing about student work.
• The study also has potential benefits for other school-university partnerships. We hope to help others understand these innovative types of practices.

Duration/Time
The meetings should take about 15-20 minutes each to complete. The interview should last approximately 30 minutes.

Statement of Confidentiality
Your participation in the research will be kept confidential. The researcher who interviews you will know your identity, but the tape itself and its transcription will have no link to your identity. If you decide to provide journals, we will ask you to remove your name before giving them to us. If you invite observations, your name will not be recorded on the observation notes. All data will be kept securely in 223 Chambers Building for a period of 5 years after the information has been collected and will be destroyed by 2018. Pseudonyms will be used in reporting all results.

Right to Ask Questions
You can ask questions about this research at any time. Please contact Mary Jayne Coon-Kitt @ 814-238-3860 with questions, complaints or concerns about this research.

Voluntary Participation
• Your decision to participate in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.
• You must be 18 years of age or older to consent to take part in this research study. If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below.
• You will be given a copy of this signed and dated consent form for your records.

_____________________________________________  _______________________
Participant Signature                              Date

_____________________________________________  _______________________
Person Obtaining Consent                           Date
## APPENDIX E

### Data Using Open-Coding in the Dialogue (Sample)

<table>
<thead>
<tr>
<th>TK meeting 1</th>
<th>TK meeting 2</th>
<th>TK meeting 3</th>
<th>TK meeting 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mentor opens</strong>: Data that had been collected to make decisions about the student – looking at the work physical copies</td>
<td><strong>PIA opens discussion</strong>, begins the questioning of the intern – trying to focus on the task. <strong>Continue</strong> to summarize 106 more chunks of conversations 229, 223, 248, 252, 279 <strong>FACILITATOR – STUDENT</strong> chunk: 224-235 wrap up 232</td>
<td><strong>Intern opens</strong>, brings student work, actually has videos of her work. <strong>FACILITATOR</strong> brings student work, actually has videos of her work. <strong>PDA</strong> starts the goal, explains the recording, why we’re still focusing an <strong>11:19</strong> <strong>FACILITATOR</strong> 170-173</td>
<td><strong>Intern opens</strong> again, long chunk, explains the interventions, met 6 times IP and SU 22 <strong>QUESTIONER</strong> mentor. <strong>SL</strong> <strong>SL</strong> (consistency, impulsivity, impulsive 113)</td>
</tr>
<tr>
<td><strong>How is the intern going to organize the information? Intern on the spot</strong></td>
<td><strong>PDA continues to repeat what mentor and intern share mathematically, asking for confirmation. 122 asking questions 329</strong></td>
<td><strong>FACILITATOR</strong> asks intern what does that mean? 249 106 305 <strong>FACILITATOR</strong></td>
<td><strong>PDA</strong> offers apologies for going back to the task of the study 49 has the conservation again, as the other one. <em>In</em> why they aren’t looking at 11:19 against <strong>FACILITATOR</strong></td>
</tr>
<tr>
<td><strong>Leading</strong> the intern how to make decisions – continual questioning — that’s a good answer 271-277 <strong>TEACHER</strong>/STUDENT 48-481.</td>
<td><strong>PIA</strong> continues to repeat what mentor and intern share mathematically, asking for confirmation. 224-235 wrap up 232</td>
<td><strong>Intern</strong> explains <strong>Interventions</strong> <strong>STUDENT</strong></td>
<td><strong>Intern</strong> explains that 5 frames ARE related to place value 56</td>
</tr>
<tr>
<td><strong>Mentor</strong> sharing her observations about a student as well as background information chunks <strong>EXPERT</strong> based on my experience 343-347</td>
<td><strong>Mentor</strong> and <strong>Intern</strong> talk about SLB</td>
<td><strong>Interventions</strong> that week 56</td>
<td><strong>PIA</strong> Can you talk about that a little bit more? <strong>SL</strong> 128, refocusing on task 236</td>
</tr>
<tr>
<td><strong>PDA</strong> trying to get the group to synthesize the data <strong>EXPERT</strong> doesn’t contribute mathematically, only repeats. Asks intern and <strong>mentor</strong> to make the decision</td>
<td><strong>Mentor</strong> and <strong>Intern</strong> talk about SLB</td>
<td><strong>Intern</strong> – long stretches of conversation</td>
<td><strong>Intern</strong>: More evidence of becoming more of an <strong>EXPERT</strong></td>
</tr>
<tr>
<td><strong>FACILITATOR</strong></td>
<td><strong>PIA</strong> continues to repeat what mentor and intern share mathematically, asking for confirmation. 224-235 wrap up 232</td>
<td><strong>References text as resource</strong></td>
<td><strong>IM</strong> <strong>Interventions</strong> 126-172</td>
</tr>
<tr>
<td><strong>Mentor</strong> begins to make suggestions about IP</td>
<td><strong>Mentor</strong> continues discussion, direct instruction, time on task 292</td>
<td><strong>Encourage</strong>: <strong>PIA</strong> now to go 106 275 379 (compliments as a teacher would)</td>
<td><strong>Intern</strong> offers a suggestion for an instructional practice that she say in RTI class, links it to <strong>SL</strong>. <strong>Interventions</strong></td>
</tr>
<tr>
<td><strong>EXPL AN</strong> <strong>CONNECT</strong> a bit of DIS</td>
<td><strong>SLB</strong> 345: time attending taking out, she was checked out.</td>
<td><strong>Mentor</strong> discusses progress in a connected way 274, intern talks about progress in an EXPL way 165</td>
<td>The conversation ends with discussion about <strong>SL</strong></td>
</tr>
<tr>
<td><strong>EXPL CONNECT</strong> a bit of DIS</td>
<td><strong>Mentor</strong> concludes activity, looks at next steps 312</td>
<td><strong>PIA TEACHER</strong> lecture on micro and macro view of education 215</td>
<td><strong>MENTOR</strong> starts on a discussion about <strong>SL</strong>. <strong>connect</strong> background information 100 and 270</td>
</tr>
</tbody>
</table>

**Mentor** and **PIA** compliment **Intern** on what a great job she did. **Mentor** and **Intern** wanted to consider other interventions, but weren’t sure where to turn next. The conversation ends with discussion about **SL**.
### APPENDIX F

Line-by-line Tally of Dialogue by Triad Member
(Sample)

<table>
<thead>
<tr>
<th>TRIAD MEMBERS PARTICIPATION PATTERNS</th>
<th>Triad TK</th>
<th>Triad T2</th>
<th>Triad T4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meeting 4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>31.40 MIN</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33% M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52% I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15% P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>13.53 MIN</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26% M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33% I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41% P</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **24.43 MIN**                        |          |          |          |
| 55% M                                |          |          |          |
| 18% I                                |          |          |          |
| 27% P                                |          |          |          |
## APPENDIX G

Percentage of Participation Among Participants

<table>
<thead>
<tr>
<th>TRIAD TK</th>
<th>Mentor</th>
<th>Intern</th>
<th>PDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting 1</td>
<td>43</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>Meeting 2</td>
<td>31</td>
<td>41</td>
<td>28</td>
</tr>
<tr>
<td>Meeting 3</td>
<td>18</td>
<td>63</td>
<td>19</td>
</tr>
<tr>
<td>Meeting 4</td>
<td>33</td>
<td>52</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRIAD T2</th>
<th>Mentor</th>
<th>Intern</th>
<th>PDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting 1</td>
<td>81</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Meeting 2</td>
<td>62</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>Meeting 3</td>
<td>48</td>
<td>35</td>
<td>17</td>
</tr>
<tr>
<td>Meeting 4</td>
<td>26</td>
<td>33</td>
<td>41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRIAD T4</th>
<th>Mentor</th>
<th>Intern</th>
<th>PDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting 1</td>
<td>60</td>
<td>12</td>
<td>28</td>
</tr>
<tr>
<td>Meeting 2</td>
<td>62</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>Meeting 3</td>
<td>66</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>Meeting 4</td>
<td>55</td>
<td>18</td>
<td>27</td>
</tr>
</tbody>
</table>
APPENDIX H

Inquiry-oriented Talk Continuum Spreadsheet (Sample)

<table>
<thead>
<tr>
<th>Time</th>
<th>Inquiry-based Talk</th>
<th>Explanatory Talk</th>
</tr>
</thead>
<tbody>
<tr>
<td>230-321</td>
<td><strong>It’s kind of like I was doing with the</strong></td>
<td><strong>COMMUNICATION</strong></td>
</tr>
<tr>
<td></td>
<td><strong>site. I remember I was having them do</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>the task that they were working on</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>in the classroom.</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>I said, “What are you doing?”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>They said, “We’re trying to”</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and they explained what they were</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing.”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>I asked them again, “What are you</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing?”</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>They said, “We’re trying to”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and they explained what they were</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing.”</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td>232-327</td>
<td><strong>I didn’t know if I could help with</strong></td>
<td><strong>COMMUNICATION</strong></td>
</tr>
<tr>
<td></td>
<td><strong>her homework or if she needed me</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>to work on her own.</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>I asked her again, “What are you</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing?”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>They said, “We’re trying to”</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and they explained what they were</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing.”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>I asked her again, “What are you</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing?”</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>They said, “We’re trying to”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and they explained what they were</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing.”</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td>238-257</td>
<td><strong>I guess she’s worried that</strong></td>
<td><strong>COMMUNICATION</strong></td>
</tr>
<tr>
<td></td>
<td><strong>she won’t be ready for the test,</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and she wants her parents to</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>be able to help her.</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>I asked her again, “What are you</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing?”</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>They said, “We’re trying to”</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and they explained what they were</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing.”</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>I asked her again, “What are you</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing?”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>They said, “We’re trying to”</strong></td>
<td><strong>talking about</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and they explained what they were</strong></td>
<td><strong>it.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>doing.”</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td>350-404</td>
<td><strong>So, our next question was</strong></td>
<td><strong>COMMUNICATION</strong></td>
</tr>
<tr>
<td></td>
<td><strong>about what she was doing in her</strong></td>
<td><strong>It’s a way of</strong></td>
</tr>
<tr>
<td></td>
<td><strong>homework.</strong></td>
<td><strong>talking about</strong></td>
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<td></td>
<td><strong>I asked her again, “What are you</strong></td>
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<td><strong>doing?”</strong></td>
<td><strong>It’s a way of</strong></td>
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<td><strong>They said, “We’re trying to”</strong></td>
<td><strong>talking about</strong></td>
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<td><strong>and they explained what they were</strong></td>
<td><strong>it.</strong></td>
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<td></td>
<td><strong>doing.”</strong></td>
<td><strong>it.</strong></td>
</tr>
</tbody>
</table>

**Note:**
- **COMMUNICATION**: Engaging in conversation about the task or activity.
- **IT’S A WAY OF**: Expressing a need or desire through language.
- **TALKING ABOUT**: Discussing activities or tasks at hand.
- **COMMUNICATION**: Communicating effectively with others.
- **IT’S A WAY OF**: Using language to convey intent.
- **TALKING ABOUT**: Focusing on ongoing tasks.
- **COMMUNICATION**: Engaging in dialogue.
- **IT’S A WAY OF**: Expressing thoughts or ideas.
- **TALKING ABOUT**: Discussing experiences or processes.
- **COMMUNICATION**: Communicating with others.
- **IT’S A WAY OF**: Using language to achieve specific goals.
- **TALKING ABOUT**: Focusing on tasks or activities.
- **COMMUNICATION**: Engaging in dialogue.
- **IT’S A WAY OF**: Expressing needs or desires.
- **TALKING ABOUT**: Discussing tasks or activities.
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- **COMMUNICATION**: Communicating effectively.
- **IT’S A WAY OF**: Using language to achieve specific goals.
- **TALKING ABOUT**: Discussing experiences or processes.
APPENDIX I

Triad TK Student Work Samples

Kindergarten student work: September 2013 - Cycle 1
Kindergarten student work: October 2013 - Cycle 2
Kindergarten student work: November 2013 - Cycle 3
APPENDIX J

Triad T2 Pre-Assessment

Name ______________________________ Date ____________________

Place Value Pre-Assessment

1. Write the number that is shown.
   a. \[ \begin{array}{c}
       \hline
       | & | & | \\
       \hline
       | & | \\
       \hline
     \end{array} \]
   \[ \_ = \_ \]
   b. \[ \begin{array}{c}
       \hline
       | & | & | & | & | & | \\
       \hline
       | & | \\
       \hline
     \end{array} \]
   \[ \_ = \_ \]

2. Write what the underlined numbers are worth.
   a. 83 _____
   b. 64 _____
   c. 395 _____

3. a. Skip count by 5’s: 45, 50, 55, _____, _____, _____
    b. Skip count by 10’s: 60, 70, 80, _____, _____, _____
    c. Skip count by 100’s: 600, 700, 800, _____, _____, _____

4. Write the numbers.
   a. thirty-six _____
   b. seventy _____
   c. four hundred and twenty-nine _____
   d. six hundred and twenty _____
   e. eight hundred and four _____
APPENDIX K

Triad T2 Student Work Samples

2nd grade student work:  September 2013 - Cycle 1

2. Write the number that is shown.
   a. \( \begin{array}{c}
   111
   \end{array} \) = 34
   b. \( \begin{array}{c}
   \square \square \square \square \square \square \square
   \end{array} \) = 1008
   c. \( \begin{array}{c}
   \square \square \square \square
   \end{array} \) = 100

3. a. Skip count by 5's: 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100.
   b. Skip count by 10's: 60, 70, 80, 90, 100, 110, 120.
   c. Skip count by 100's: 600, 700, 800, 900, 1000, 1100, 1200.

4. Write the numbers.
   a. thirty-six 36
   b. seventy 70
   c. four hundred and twenty-nine 429
   d. six hundred and twenty 620
   e. eight hundred and four 804
Triad T2 Student Work

2nd grade student work: November 2013 - Cycle 3

- Draw 37
- Draw 82
- What is the underlined number worth?
  - 37
  - 30
- What is the underlined number worth?
  - 23
  - 20
  - 72
  - 2
APPENDIX L

4th grade student work: September 2013 - Cycle 1

MATH INVENTORY

NAME: [Blank]

DATE: 9/3/13

1. How do you feel about math?
   I don't care for it.

2. Do you think you are good in math? Why?
   Yes, because I'm smart.

3. What are your best areas in math?
   Addition

4. What are your weakest areas in math?
   Division

5. Do you think it is important to be good in math? Why?
   So you can

6. What do you think are characteristics of students who are good in math? Why?
   They are smart.

7. What do you do when you come to a math problem you can't solve?
   I ask for help.

8. How do you use math outside of class?
   When I counting my allowance
   I do my homework.

9. What do you usually do after school when you get home?
   I read or watch T.V.

10. Do you most like to do when you have free time? Why?
    I read or watch T.V.

11. What else should I know about you to teach you effectively this year?
    I get stressed out easily.
    Also, I'm a visual learner.
4th grade student work: October 2013 - Cycle 2

Work for the Problems

1. \(3 \times 6 = 18\) cm
2. \(15 + 6 = 21\) cm
3. \(28 + 10 = 38\) cm
4. \((9 + 6) + (8 + 2) = 31\)
5. \((10 + 12) + (20 + 25) = 77\)
6. \(25 + 10 = 35\) mm
7. \((10 + 12) + (20 + 25) = 77\) mm
8. \((8 + 2) + (4 + 7) = 19\) mm
9. \((9 + 6) + (12 + 10) = 31\) mm
10. \((8 + 2) + (4 + 7) = 19\) mm
11. \((9 + 6) + (12 + 10) = 31\) mm
12. \((9 + 6) + (12 + 10) = 31\) mm

Answers:

- 1. 18 cm
- 2. 21 cm
- 3. 38 cm
- 4. 31
- 5. 77
- 6. 35 mm
- 7. 19 mm
- 8. 19 mm
- 9. 31 mm
- 10. 31 mm
4th grade student work: November 2013 - Cycle 3

Find the perimeter and area of each figure.

1. Perimeter 20 cm, Area 21 sq cm

2. Perimeter 31 yds, Area 30 sq yds

\[ \frac{10}{20} + \frac{15}{30} = \frac{27}{30} \]
Grade K
Number and Operations in Base ten
Work with numbers 11–19 to gain foundations for place value.
1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or
drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand
that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.

Grade 1
Number and Operations in Base ten
Understand place value.
2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the
following as special cases:
   a. 10 can be thought of as a bundle of ten ones — called a “ten.”
   b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine
      ones.
   c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine
      tens (and 0 ones).
3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of
   comparisons with the symbols >, =, and <.

Grade 2
Number and Operations in Base ten
Understand place value.
1. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706
   equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:
   a. 100 can be thought of as a bundle of ten tens — called a “hundred.”
   b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven,
      eight, or nine hundreds (and 0 tens and 0 ones).
2. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and <
symbols to record the results of comparisons.

Use place value understanding and properties of operations to add subtract.
5. Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the
   relationship between addition and subtraction.
6. Add up to four two-digit numbers using strategies based on place value and properties of operations.
7. Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties
   of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method.
   Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens
   and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.
8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–
   900.
9. Explain why addition and subtraction strategies work, using place value and the properties of operations.

Grade 3
Number and Operations in Base ten
Use place value understanding and properties of operations to perform multi-digit arithmetic.
1. Use place value understanding to round whole numbers to the nearest 10 or 100.
2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of
   operations, and/or the relationship between addition and subtraction.
3. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 \times 80, 5 \times 60) using strategies
   based on place value and properties of operations.

Grade 4
Number and Operations in Base ten
Generalize place value understanding for multi-digit whole numbers.
1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the
   place to its right. For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and division.
2. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare
two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

3. Use place value understanding to round multi-digit whole numbers to any place.

**Use place value understanding and properties of operations to perform multi-digit arithmetic.**

4. Fluently add and subtract multi-digit whole numbers using the standard algorithm.

5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

**Grade 5**

**Number and Operations in Base ten**

**Understand the place value system.**

1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

2. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

3. Read, write, and compare decimals to thousandths.
   a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).
   b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

4. Use place value understanding to round decimals to any place.
VITA

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EDUCATION

The Pennsylvania State University, University Park, PA

- Ph.D. in Curriculum and Instruction, Emphasis in Curriculum and Supervision, May 2015.
- B. S., Elementary and Kindergarten Education. August 1972.

PROFESSIONAL EXPERIENCE

- Faculty Member, Curriculum and Instruction, August 2015.
- Graduate Assistant, Curriculum and Instruction, 2011-2015.

NATIONAL AND STATE CONFERENCE PRESENTATIONS

- ATE, Examining the inquiry-oriented talk of professional development school triads, presenter. February 2015.
- PAC-TE, Examining the dialogue of professional development school triads as they inquire into and talk about student work, presenter. October 2014.
- NAPDS, How do professional development school triads (mentor, intern and supervisor) inquire into and talk about student work in elementary mathematics, presenter. February 2013.
- NAPDS, Uncovering supervisors’ reflective coaching strategies in promoting intern reflection through journal writing, co-presenter. February 2013.

GRANTS AND FELLOWSHIPS

- ATE, Association of Clinical Fellow. 2015.
- Phi Delta Kappa Educational Foundation, Kozak Fellowship recognizing leadership, research, and service to public education, domestically and internationally, $1500. April 2014.
- Arthur Blumberg Scholarship, $400, COPIS (Council of Professors of Instructional Supervision), Fall conference. 2012.