A Community of Practice Approach to Teacher Learning

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A COMMUNITY OF PRACTICE APPROACH TO TEACHER LEARNING

A DISSERTATION

Submitted to the Faculty of
Montclair State University in partial fulfillment
of the requirements
for the degree of Doctor of Philosophy

by
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A COMMUNITY OF PRACTICE APPROACH TO TEACHER LEARNING

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ABSTRACT

A COMMUNITY OF PRACTICE APPROACH TO TEACHER LEARNING

by Jayne L. Tanis

Teacher effectiveness has been targeted by government agencies and educational think tanks for raising student achievement and providing equitable education for all. Exploring how teachers enacted their development of practice in a teacher-initiated learning community of practice to improve student achievement in mathematics exposed mediating factors responsible for teacher learning. This qualitative study drew upon Aristotle’s discussion of *phronesis* and Lave and Wenger’s (1991) concept of legitimate peripheral participation to interpret how artifacts produced within and across communities of practice reified the elements of collaborative teacher learning that lead to changes in instructional practice during a reform initiative. These findings add to research regarding Wenger’s (1998) community of practice conceptual framework as a means to investigate the nuances of collaborative teacher learning within and across school communities.

*Keywords:* community of practice, teacher professional learning, teacher practice, boundary objects, brokers, agency, *phronesis*, artifact, reform
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DEDICATION

In loving memory of my dear aunt, Robin DeMarco.

I am finally finished.

Dr. Jayne L. Tanis
# TABLE OF CONTENTS

## CHAPTER ONE: INTRODUCTION ................................................................. 1

Background to the Present Study ................................................................ 3
Statement of Purpose .................................................................................. 4

## CHAPTER TWO: THEORETICAL FRAMEWORK AND LITERATURE REVIEW ...... 7

Theoretical Framework .............................................................................. 7
  * Legitimate Peripheral Participation ................................................................. 9
  * Community of Practice .................................................................................. 10
  * Phronesis ........................................................................................................ 15

Literature Review ....................................................................................... 17
  * Search Terms and Parameters ........................................................................ 17
  * Boundary Encounters, Brokers, and Boundary Objects .................................... 18
  * Mutual Engagement, Joint Enterprise, and Shared Repertoire ....................... 20
  * Critiques of Wenger’s Community of Practice Framework ............................. 22

## CHAPTER THREE: METHODOLOGY ........................................................ 24

Methodological Approach ........................................................................... 24
  * Mitigating Researcher Positionality ................................................................. 25
  * Trustworthiness ............................................................................................. 26

Context ........................................................................................................ 28

Participants .................................................................................................. 30
  * Lynn .............................................................................................................. 31
  * Alina ............................................................................................................ 32
  * Barbara ........................................................................................................ 32
  * Christine ...................................................................................................... 33
  * Elld .............................................................................................................. 33
  * Geraldine ..................................................................................................... 33

Data Collection ............................................................................................ 34
  * Observation ................................................................................................. 35
  * Artifacts ....................................................................................................... 35
  * Interview ..................................................................................................... 36

Data Analysis ................................................................................................. 37
  * Codes .......................................................................................................... 37
  * Themes ....................................................................................................... 38
CHAPTER FOUR: FINDINGS ................................................................. 40

Engaging with a Curriculum Initiative ................................................................. 40
   Moving toward Co-Constructing Knowledge in Context ......................................... 40
   Engaging as Agents ...................................................................................... 46
   Using Technology to Mitigate Temporal Constraints to Learning ................................ 50
   Brokering Across Communities of Practice ...................................................... 55

Summary ......................................................................................................... 58

CHAPTER FIVE: FINDINGS ............................................................................. 60

Changes in Classroom Instruction ........................................................................ 60
   Transitioning from Teacher-Centered to Student-Centered Instruction ......................... 61
   Developing Shared Practice and Common Artifacts .................................................. 64

Summary ......................................................................................................... 68

CHAPTER SIX: ANALYSIS OF FINDINGS ..................................................... 69

Artifacts as Reifications of Teacher Learning ........................................................... 69
Artifacts as Reifications of Relational Skills .............................................................. 71
Artifacts as Reifications of Learning Trajectories ....................................................... 72
Artifacts as Reifications of Teacher Agency .............................................................. 74

CHAPTER SEVEN: CONCLUSION ................................................................. 77

Summary of Findings ............................................................................................ 77

Implications for Educational Research ................................................................. 78

Implications for School District Leaders ................................................................. 81

Limitations ......................................................................................................... 84

Final Comment ..................................................................................................... 85

REFERENCES .................................................................................................... 87

APPENDIX A ..................................................................................................... 101

APPENDIX B ..................................................................................................... 102
LIST OF TABLES

Table 1 Summary of Study Participants.................................................................31
LIST OF FIGURES

Figure 1. Community of Practice framework (Wenger, 1998, p. 73) ................................................. 12
Figure 2. Reflective journal entry ........................................................................................................ 27
Figure 3. Google Classroom blog entry ............................................................................................. 44
Figure 4. Excerpt of Geraldine's lesson reflection ........................................................................ 52
Figure 5. Sample excerpts of field notes of two classroom observations ........................................ 53
Figure 6. Sample problem-based activity and corresponding self-assessment rubric .................. 65
Figure 7. Sample fifth grade calendar .............................................................................................. 66
Figure 8. Teacher-created handout for students ................................................................................. 67
Chapter One: Introduction

Since the landmark release of *A Nation at Risk* (Gardner, 1983), teacher effectiveness and accountability have been the targets of government agencies, educational think tanks, and school districts across the United States for raising student achievement in the United States. The extent literature has categorized such initiatives to raise student achievement as being many “waves” of reform (Johnson & Kardos, 2000). Running concurrently with initiatives to raise student achievement is a call for more teacher learning to provide inclusive classrooms for equitable education for all (Datnow & Park, 2018; Scroggins, Herbel-Eisenmann, Harper, & Bartell, 2017).

Many in-service teachers with more than one year of teaching experience face the reality that their desire to change instructional practice to meet student needs is also mediated by factors that may compromise their ability to generate change (Cochran-Smith & Lytle, 1999; Cohen, 1988; Opfer & Pedder, 2011; Vangrieken, Meredith, Packer, & Kyndt, 2017). Recent rampant and persistent school reforms designed to equal the playing field for all students have instead standardized curricula, making it difficult if not impossible to change instructional practice to meet the needs of a diverse student body (Coburn, Hill, & Spillane, 2016; Spillane, 1999). Embedded within some of these reform initiatives, such as the TEACHNJ Act in New Jersey (NJDOE, 2014) is professional learning language that promotes fundamental understandings of how teachers can change instructional practice to promote college and career readiness (NJDOE, 2014).

Teacher practice is the enactment of a teacher’s decision-making process throughout a lesson (Danielson, 2011; Kennedy, 2005; Strong, 2011). The teacher is like a “do-it-yourself craftsperson who can put to use a host of materials” on the fly (Huberman, 1993, p.14). The
latter descriptions define a teaching *process*, or practice (Strong, 2011). It is ultimately up to how a teacher interprets a situation and how this interpretation influences their practice. And, the end result of this process is a reciprocal process of teacher and student learning (Lampert, 2010).

During a lesson, a teacher utilizes their accumulated set of principles and strategies to focus on fostering student learning while maintaining lesson momentum (Kennedy, 2005). This is extremely difficult to do in classrooms with complex student dynamics. To adapt to diverse learners, teachers rely on their knowledge of content and pedagogy to create engaging, standards-based lessons. Shulman (1986) describes this knowledge as ‘wisdom of practice’ or the knowledge that individual practitioners seem to hold as truth based on their years of experience and repeated exposure to similar complex tasks over time. Such knowledge is generated from multiple sources including books, classes, or observations, and teachers may view knowledge as either static or evolving (Buehl & Fives, 2009). Yet, during a reform, the practices teachers actually engage in differ from those “reformers espouse and often also from those the teachers themselves espouse” (Kennedy, 2005, p. 32). This conundrum may stem from a teacher’s lack of knowledge to implement the reform with fidelity. In response, school district administrators may implement professional learning opportunities to improve teacher practice.

As a current school district administrator, I am aware of outsourced, singular professional learning workshops and other resources to further professional learning opportunities for teachers to improve practice during reforms. Unfortunately, such process-product designs, while seemingly purposeful, may fail to either create or sustain positive outcomes (Desimone, Porter, Birman, Garet, & Yoon, 2002). Instead, educational research now supports embedding professional learning within a school structure such as in a community of practice or professional learning community (Dufour, 2004; Lave, 1996; Lave & Wenger, 1991; Opfer & Pedder, 2011).
Such strategic learning opportunities are effective during reform initiatives (McLaughlin & Talbert, 2006, p. 18) and serve as a viable means to closing the achievement gap in marginalized communities (Ball & Forzani, 2009; Feiman-Nemser, 2001).

**Background to the Present Study**

During the proposal stage of my dissertation process, I conducted a small-scale (n=6) pilot study with International Review Board approval that focused on elementary and middle teachers who were working together in a teacher-initiated community of practice in response to a reform initiative in the mathematics curriculum. A compelling finding from the pilot study involved teacher agency. Four participants in the pilot study consistently met over a 2-year period and continued to meet both in person and through an online platform to discuss their problems of practice or to set up informal observations. Teachers willingly discussed new instructional strategies to meet reform initiatives aligned with New Jersey’s standards in mathematics. One member who was on sabbatical leave also remained active in the learning community throughout the pilot study. To understand the social competencies that permitted this ongoing bond, I administered the Teacher Change Agent Scale (Lukacs, 2015) to all participants. Four of the scales were returned and coded using basic coding (Saldaña, 2016). A few themes emerged involving change, collaboration, and motivation. Pilot study participants were not resistant to suggesting changes. In fact, they indicated the ability to adapt to the needs of students when necessary. All responders also strongly valued a collaborative teaching environment as a method for influencing a change in teacher practice. They answered “strongly agree” with the following statement, “I believe when teachers work together, they are able to influence practice in their schools.” Lastly, all believed in themselves as key motivators and risk-takers among their colleagues. (See Appendix A for a summary of the results of the Teacher Change Agent Scale).
While I understood at the time of the pilot study that teachers participate in communities in different ways and learn how to participate in a community by interacting with others, the elements or processes of a community that contribute to teacher participation and ultimately, learning still remained elusive (Greeno, 1998; Lambson, 2010). For the purpose of my dissertation, I continued to examine the nuances of this teacher-initiated learning community to understand what sustained it as a viable method for ongoing teacher learning responsible for changes to teacher practice. The ultimate goal of my research was to provide a longitudinal description, which may serve useful to educational researchers and fellow school administrators. Thus, the aim of my study was to explore how a teacher-initiated learning community, known from this point as a community of practice, fostered teacher learning. The purpose of this research was not only to understand how members who are part of a community of practice tackle a reform initiative to improve/enhance instructional practice but how/why a community of practice formed and sustained itself in one high-performing school setting. Implementing a new mathematics curriculum in response to results on the Partnership for Assessment of Readiness for College and Careers (PARCC) mathematics standardized test was the focus of the reform. Because I began my inquiry in the summer of 2016 through a pilot study, I continued to examine the nuances of a teacher-initiated learning community to understand what sustains it as a viable method for ongoing teacher learning responsible for changes to teacher instructional practice.

Statement of Purpose

Social and education research contain numerous models and descriptions of collaborative, social relationships in organizations and schools that sustain professional learning. This includes concepts such as communities of practice and an apprenticeship model of learning (Wenger, 1998), teacher learning communities within education systems (see, for example,
McLaughlin & Talbert, 2006, 2010) and professional learning communities (see, for example DuFour, 2004, 2015; Hord, 2009; 2015; Horn, 2010). In teacher and professional learning communities, teachers work collectively to increase students' access to and success in core academic subjects and are committed to working collaboratively to improve their instructional practice based on student data (DuFour, 2004; Ebbeler, Poortman, Schildkamp, & Pieters, 2016; Hord, 2009; 2015; Talbert, 2009). In a community of practice approach to learning, one’s learning, thinking, and knowing become socially constructed through situated negotiation and renegotiation of meaning (Wenger, 1998). Yet, seemingly absent in this research is the clarification of what dispositions, knowledge, and practices of teachers and other members of these communities are best suited for such capacity-building interventions (see, for example, similar claim in Marsh & Farrell, 2015). This ambiguity masks the actual processes of teacher learning, which has been represented as a “black box” of teacher learning; or, as a metaphorical roadmap to understanding the facets of the community that leads to success (Rigby, Woulfin, & März, 2016). Opening this box requires more examination of the social competencies appreciated most by those within the collective and collaborative enterprise that promote and respond to educational reform within an organization. After all, a collaborative learning community directly influences student achievement through a change in practice (DuFour, 2011; Lippy & Zamora, 2012).

Thus, it may be beneficial and timely for education researchers to try to unearth the relational components of collaborative enterprises that may enable or constrain its processes for teacher learning (Butler, Schellnert, & MacNeil, 2015). The existing educational literature describes teacher learning communities as neat structures, often housed within one school building and created by a school administrator. Or, they are created between university and
school partnerships as “third spaces” (Klein, Taylor, Onore, Strom, & Abrams, 2013). Yet, as a former school administrator, I have experience with top-down initiatives such as the formation of various teacher work groups. Participation in interdisciplinary teams, inclusion pairs, curriculum planning committees, school leadership teams, and professional learning communities rarely improves teacher enactment of new instructional strategies. Instead, educational research now supports embedding professional learning within a school structure such as in a community of practice (Desimone, 2011; Lave & Wenger, 1991; Opfer & Pedder, 2011). Exploring how teachers see and enact their development in a teacher-initiated learning community of practice could possibly expose mediating factors that drive professional learning in the age of reforms, since such reforms are seemingly here to stay.

To explore teacher learning in a community of practice, I formulated the following questions to guide my research for the present study:

1. In what ways do members of a community of practice engage with a curriculum initiative, and
2. How, if at all, is this depicted in their instruction?

In the following chapter, I begin with a description of the theoretical framework that provided both the lens for the present study and framing literature review. Then, in Chapter 3, I present the research methodology. In Chapters 4 and 5, I provide the findings to the study followed by a chapter dedicated to data analysis. In the final chapter, I provide a summary of the findings and a description of the study’s implications and limitations.
Chapter Two: Theoretical Framework and Literature Review

Theoretical Framework

For over a century in teacher education, the theoretical approach of learning through action and experience, or experiential learning, can be rooted in John Dewey’s seminal paper *Significance of the School of Education* (1904), which framed his desire to understand “the principles underlying educational practice” (p. 444) as a coeducational, or collaborative practice. He understood teacher learning and growth to be rooted in inquiry and experience and “the active participation in the education of one by others” (p. 449). Dewey’s paper is notable and significant for the present research study because it resulted from an educational shift, or reform. Up to this point in history, teacher preparatory schools like the Chicago Manual Training School served to provide practical teacher training during the Industrial Revolution in the United States. At the turn of the twentieth century, the focus of teacher preparation began to shift as society and its schools were encouraged to embrace a “social spirit” (Dewey, 1904, p. 450) and infuse culture, history, and science into the existing elementary and secondary school curricula. This shift in thought prompted educational theorists to view conflict and subsequent solutions as arising from curiosity and critical consciousness. In *How We Think*, Dewey (1910) continued to analyze how people are influenced by their own curiosities, which are developed by social stimuli and inquiry. For teachers, Dewey stressed that they should encourage inquiry among themselves as a way to nurture “a positive intellectual force” that prevents routines that diminish the possibility for change (p. 27).

Freire (1970, 1993) proposed critical consciousness, or problem-posing for teacher learning. Using a Freirian lens, teachers should ultimately engage in the re-creation of knowledge with others using dialogics and reflection to combat an antithetic “depository-
depositor approach” to education where a teacher is viewed as one who imparts knowledge to their students (Freire, 1993, p. 45). Students are not seen as capable constructors of knowledge. Similarly, with top-down, administrator initiatives, teachers may not be represented as capable initiators of change. Dialogue with others and one’s personal reflective thinking initiates a process of inquiry and acquiring something as a result of this inquiry is as Dewey (1904) had noted, secondary. In teacher education, the processes of reflective thinking, inquiry and, ultimately, acquisition of new knowledge through shared dialogics leads to democratic change and progress (Garcia-Carrion, Gomez, Molina, & Ionesco, 2017). Such efforts are more collaborative than directive, which is most likely necessary for reform initiatives to be successful.

Over the past 20 years, studies by prominent researchers in the field of workplace learning have also attempted to define teacher learning. Cochran-Smith and Lytle (1999) defined this learning as “knowledge-of-practice” where teachers use the context of their own classroom or school to inform, shape and implement a goal, such as closing the achievement gap for their marginalized students (p. 250). According to Feiman-Nemser (2001), teacher learning must be designed as a continuum to “strengthen and sustain teaching” (p. 1013). Teachers should be designing and implementing curricula that diversifies instruction to meet the needs of marginalized populations. This is an iterative process where teachers should constantly be seeking ways to improve student achievement within their respective classrooms.

Lave and Wenger (1991) defined learning as situational and socially constructed through participation in a novice-expert relationship. Lave and Wenger (1991) viewed learning as a social practice where “learning is one of its characteristics” (p. 34). They initially conceived this notion of learning by examining how tailors “engaged in a common, structured pattern of
learning experiences” as apprentices (Lave & Wenger, 1991, p. 30). This focus is on a member of a sociocultural community and their participation in social practice, as a fundamental form of learning (Lave & Wenger, 1991, p. 54). According to Lave and Wenger (1991) and Wenger (1998) members of a community negotiate and re-negotiate meaning to develop a shared understanding. Such an understanding leads to learning. Lave and Wenger (1991) see learning as “an inseparable act of social practice” (p. 31). While others may view knowledge construction and learning in other ways, for the purpose of my research, I will be utilizing Lave and Wenger’s (1991) approach as teacher learning as situated in a community of practice.

To reframe learning as a social process, Lave and Wenger (1991) focused their attention on what they termed legitimate peripheral participation, a concept that is central to the present study and derived from situated learning theory.

**Legitimate Peripheral Participation**

Legitimate peripheral participation involves participants who have intentional and cyclical relations within a community of practice that lead to internalization, transformation and change in identity for members who “desire to become full practitioners” (Lave & Wenger, 1991, p. 122). These members are usually part of social structures involving power, such as in a school or corporate context. Additionally, membership within a community can become a source of power for participants and a way to negotiate top-down initiatives through legitimate peripheral participation.

Peripheral participation is also about being located in and acting within the social world. Changing locations and perspectives within a social sphere are part of participants’ learning trajectories, developing identities and forms of membership (Lave & Wenger, 1991). Learning trajectories are perceived as being inbound where teachers join a community to learn something
new. Or, teachers may not fully join the community and remain on the periphery. Some members may cross boundaries and be members of multiple communities. And some members may be outbound, when their participation is exhausted. These are seen as concrete, rather than abstract learning trajectories (Lave & Wenger, 1991; Wenger, 1998).

Originally, Lave and Wenger (1991) used research from apprenticeships to describe legitimate peripheral participation and did not intend for this perspective to result in prescriptive measures for educational change. Since their introduction of legitimate peripheral participation, many educational researchers have cited this perspective to explain the process of teacher learning and knowing. For example, Woo and Law (2015) used it as a theoretical framework on a study examining the role technology plays for teacher learning in schools. Others have used it to explain the role of the cooperating teacher in a novice teacher program (Young & MacPhail, 2015). In looking at teacher learning, I am interested in observing the intentional and cyclical relations that exist in a community of practice of mathematics teachers. Legitimate peripheral participation may be responsible for the community’s ability to exist and sustain its work over time; therefore, it will be a major focus of analysis for this proposed study (Wenger, McDermott, & Snyder, 2000, p. 142). While I will be using the legitimate peripheral participation perspective as a lens to understand cyclical participant relations, I intend to use the community of practice framework to understand and possibly explain the relational components of the participants and characteristics of the community of practice in my proposed study (Wenger, 1998). In the following section, I describe the community of practice framework.

**Community of Practice**

One way to establish a collective professional learning environment involves school leaders and teachers participating in a community of practice where learning, thinking and
knowing are socially constructed through situated negotiation and renegotiation of meaning (Lave & Wenger, 1991). Wenger, McDermott, and Snyder (2002) identified the following three components to improve an organization: (1) **domain** - focus on topic of interest; (2) **community** - learn by others; and, (3) **practice** - build a repertoire of best practices. This framework for learning and change are essentially dependent on conditions for teacher learning within the context of the school (Putnam & Borko, 2000).

In a community of practice learning, thinking and knowing are socially constructed through situated negotiation and re-negotiation of meaning (Wenger, 1998). A community of practice may be either contained within an organization or stretched beyond its boundaries. Such a community is not synonymous with generic terms of a group, team, or network. In a more recent article, Wenger along with Trayner and de Laat (2011), describe a community of practice as a “learning partnership among people who find it useful to learn from and with each other about a particular domain. They use each other’s experience of practice as a learning resource” (p. 9). For Wenger (1998), the domain is what gives a group its identity and distinguishes it from a group, team, or network. The dimensions of community and practice are one unit (Wenger, 1998). Within this unit, there exists a mutual engagement of participants engaged in negotiation and re-negotiation of an enterprise to develop a shared repertoire, or resources, to transform something within an institution or organization. Such resources become a reification or representation of the collaborative learning processes. Such collective learning “results in practices that reflect both the pursuit of enterprises and the attendant social relations” (Wenger, 1998, p. 45). This community of practice framework is illustrated in Figure 1.
Mutual engagement defines the social practice of the community (Wenger, 1998) within a community of practice. It is imperative for members of a community of practice to work together, “engage in discussion and exchange information and opinions to directly influence each other’s understanding as a matter of routine” (Wenger, 1998, p. 75). Such routines depend not only on individual competence but on the collective competence of the group. Participants’ complementary, yet temporal, contributions ultimately make or break the community of practice, or allow it to be either a positive or negative participatory experience. Within a community of practice, engagement is maintained around a domain, even if it is inconsistent at times. The composition of a community may contain both a “critical mass of experienced, skilled teachers” and novice teachers to ensure the group has the necessary components for teacher learning to occur (McLaughlin & Talbert, 2010, p. 37). Members negotiate and re-negotiate meaning around the domain. Such group dynamics are seemingly favorable for professional development to be successful (Vangrieken, Meredith, Packer, & Kyndt, 2017).

Learning communities are viewed by some educational researchers as fostering “better results and positive peer pressure,” which may lead teachers to reach goals and initiatives (Dufour & Mattos, 2013, p. 38). A condition for learning and improving teaching effectiveness is when the members of the community of practice are involved in joint work or enterprise. This
occurs when participants systematically negotiate meaning through interactive talk and learn through participation (Feiman-Nemser, 1998; McLaughlin & Talbert, 2010; Wenger, 1998). In the community of practice, knowledge is owned and situated in practice (Lave & Wenger, 1991; Wenger, 1998).

It is through the processes of participation and reification that knowledge is created and identities are formed. Participation and reification are two complementary dimensions within a community of practice that ultimately influence joint work or enterprise where participants systematically negotiate meaning through interactive talk and learn through this process (Wenger, 1998). Wenger’s conceptualization of participation includes the following: (a) how we locate ourselves in a social landscape; (b) what we care about and what we neglect; (c) what we attempt to know and understand and what we choose to ignore; (d) with whom we seek connections and whom we avoid; (e) how we engage and direct our energies; and (f) how we attempt to steer our trajectories (Wenger, 1998, p. 167-168). Participation and even non-participation can occur within, around, and/or across communities of practice (Wenger, 1998). Reification is the “process of giving form to our experience by producing objects that congeal the experience into thingness” (Wenger, 1998, p. 58). Ultimately, a balance of this temporal relationship between participation and reification must occur to keep the community of practice moving toward shared, recognizable goals.

Having mutual relations, participants within a community of practice usually experience “complex mixtures of power and dependence . . . success and failure . . . resistance and compliance . . .” (Wenger, 1998, p. 77). Regardless if the experiences of mutual engagement are positive or negative, this dimension of a community of practice is ultimately responsible for fostering or inhibiting complex and diverse relationships engaged in the negotiation of a joint
enterprise, which I will describe next. It is also through *joint enterprise*, or the result of negotiation, that binds the community of practice (Wenger, 1998). As an example, the community’s negotiated response to a situation could be deciding to improve their pedagogical skills or content knowledge to raise student achievement in mathematics. This joint enterprise creates “relations of mutual accountability that become an integral part of the practice” (Wenger, 1998, p. 78). Joint enterprise does not mean agreement; instead, the members’ daily social practice of negotiation and renegotiation allows the group to reach consensus even though some members live with dissension. In my example, many mathematics teachers may favor a particular pedagogical decision when teaching multiplying fractions to a group of students; however, if the community of practice decides to implement a new teaching strategy, all members may be persuaded to put aside their different views during this joint enterprise. This persuasion may be the result of understanding the joint enterprise as an indigenous enterprise, or one that is “shaped by conditions outside the control of its members” (Wenger, 1998, p. 79). In the case of my example, mathematics teachers in many states within the United States face extreme accountability pressures. Being a member of a community of practice may enable mathematics teachers to develop “inventive resourcefulness” to respond to such conditions and may prevent deviant thinking among the members (Wenger, 1998, p. 79).

The third element of this unit of community and practice is the development of a shared repertoire of resources including “routines, words, tools, ways of doing things, stories, gestures, symbols, actions or concepts the community has produced or adopted in the course of its existence” (Wenger, 1998, p. 83). Wenger (1998) considers these resources a “repertoire” because they are rehearsed and reflect “a history of mutual engagement” among members of the community of practice (p. 83). This history becomes a resource for the negotiation of meaning.
and allows for coordination among members to reach a decision. It may also provide solutions to institutionally generated conflicts, help novices join a community, and create a collegial atmosphere (Wenger, 1998). As will be discussed next, Aristotle’s conceptualization of *phronesis* may serve as a useful lens to examine how practical wisdom may emerge from this repertoire over time.

**Phronesis**

When applying Aristotle’s concept of *phronesis* as a means to analyze teacher learning in a community of practice, the focus becomes not on only understanding how teachers developed their practical knowledge when implementing a new curriculum initiative but also how to represent this change. Phronesis is defined as practical wisdom, which is purely abstract, contextual, and possessed by those, like the participants in the present study, who are involved in local work that benefits a community (Aristotle, trans. 2001, IV; Halverson, 2004). Through action, teachers develop experiential knowledge which helps them negotiate and re-negotiate meaning in new situations. They make a judgement as to whether or not meaning is applicable for their respective classrooms. They also decide whether something needs to be adjusted to fit within a certain context. For example, in a classroom, teachers are constantly recognizing when to adjust or differentiate a lesson or where to end a lesson due to an altered bell schedule. These actions may be viewed by some as conjecture or simply as problem solving. Representing phronesis requires an examination of the products created as a result of the work or action of the individual or group.

Understanding how teachers join or create a community of practice to develop their instructional practice to meet reforms is important for the decision-making process that drives professional learning. Such an investigation will hopefully lead to conversations about teacher
practices that aim to close the achievement gap for marginalized populations and add to the growing narrative of what works to improve teacher effectiveness. Teachers also participate in communities in different ways (Greeno, 1998; Lambson, 2010). Furthermore, teachers learn how to participate in a community by interacting with others and learning how to solve problems of practice together. Understanding the dynamics of participation and reification would allow me as a district leader to work with others to support and advocate for authentic, purposeful professional learning experiences for teachers rather than to rely on outsourcing professional development to various companies (Little, 2002; Lave & Wenger, 1991).

As an example, Halverson (2004) investigated the different dimensions of phronesis for school leadership practice. He found that while school leaders need research-based processes to guide them, they also required exemplars of how such techniques are utilized by teachers in their respective environments. Halverson (2004) referred to these examples as phronetic narratives (p. 105). Phronetic narratives “rely on the development and use of artifacts as occasions to show how leaders marshal technical and theoretical resources on the context of practice” (Halverson, 2004, p.114). Other researchers have also used the concept of phronesis to investigate the nuances of teacher learning and the supports necessary for it to flourish in school contexts. To investigate mathematics teaching and learning, Korthagen and Russell (1999) used phronesis to explain how teacher learning is situation-specific; it can be viewed as an ongoing practical experience with an emphasis on reflective thinking and problem solving. While knowledge development is a necessary process for teacher learning, epistemic knowledge is static; learning how to use it, adapt it, or learn more about it, is dependent on context, which may be better explained through a lens of phronesis. To understand the expression of phronesis, or wisdom of practice, artifacts are used.
In the next section, I provide a review of empirical research that sets the community of practice framework aside from simply a group of teachers labeled as a community of practice but may not be engaged in the work it was created to do. It also focuses on studies with middle school teachers and/or administrators as participants and is limited to qualitative research because I wish to study how teachers participate in a school as a living organization (Wenger 1998) to examine their learning processes within natural and situated contexts. The review of literature is not exhaustive, rather it limited to peer-reviewed studies focused on using the community of practice framework to expose teacher learning and the influences that may influence or impede it. I also limited my studies to those with participants who are in-service mathematics teachers. Past educational research in mathematics instruction has supported teacher learning as participation in a teacher community of practice (Graven 2004; Matos, 2009).

**Literature Review**

**Search Terms and Parameters**

For this literature review, I used the following search terms to identify pertinent studies that focus on participation and reification within a community of practice: *community of practice, legitimate peripheral participation, situated learning theory, mathematics instruction, learning community, participation, reification, and reform*. I used a range of prominent education academic databases including Academic Search Complete, Education Research Complete, ERIC, Middle Search Plus, and Teacher Reference Center. I also scanned references and articles in many scholarly journals including *Teaching and Teacher Education, Journal of Teacher Education, Education and the American Educational Research Association (AERA) journals* to gather studies for this review.

The systematic search focused on studies investigating teacher learning in a community
of practice situated in the mathematics discipline. A search of peer-reviewed research written in the English-language and completed within the last 10 years was conducted using electronic databases and an academic search engine (Google Scholar) for related research since 2008, which should be an appropriate range for literature reviews for a dissertation (Feak & Swales, 2009). However, only a limited amount was discovered, so I expanded the search to include research from the past 15 years focused on teacher learning in K-12 settings, some of which had policy-driven reform initiatives in place.

Included in this review are 14 relevant articles where researchers have used the community of practice framework to explore teacher learning in the mathematics discipline. In all of the studies, the teacher learning community was created by a top-down initiative from district administration. During my review of this literature, the following themes emerged: (1) boundary encounters, brokers and boundary objects; (2) mutual engagement, joint enterprise and shared repertoire; and, (3) controversy over the use of the community of practice framework to explore teacher learning.

**Boundary Encounters, Brokers, and Boundary Objects**

Three research teams focused their qualitative studies on institutional settings where members of various communities of practice participated in and across communities of practices to meet a certain goal (Butler, Lauscher, Jarvis-Selinger, and Beckingham, 2004; Cobb, McClain, de Silva Lamberg & Dean, 2003; Stein and Coburn, 2008). Cobb et al. (2003) found three different types of interconnections among communities of practice within one institution including how members participate as boundary encounters, brokers, and the reification process that produces boundary objects that act to memorialize the encounters of the community members. Boundary encounters occurred when members of one community worked with another
community and such a relationship contributed to or hindered the success of the community. For example, several teachers working together to learn a new curriculum is a positive encounter; however, a school leader who visits the community to critique its work hinders, or disrupts, the activity. Similar to Cobb et al. (2003), Stein and Coburn (2008) investigated how such communities aligned to meet a certain goal. They found that certain members of communities of practice were also engaged in boundary practices, or encounters, where they interacted with other communities of practice to negotiate meaning about the new standards-based curriculum. For example, a mathematics coach met with both teachers and school leaders during training sessions and meetings.

For the purposes of this study, I define a broker as a member of multiple communities who works to facilitate the work of the community. In Stein and Coburn (2008), the instructional coach served as the broker between the teachers and school leadership. In Cobb et al. (2003), members of the mathematics leadership community joined the professional teaching community as brokers to engage in inquiry and professional development to solve problems of practice. Members of the mathematics leadership community provided professional development based on the recommendations of the professional teaching community. Similarly, in Butler et al. (2003), study participants initially relied on brokers or “outsiders” for sustaining new learning opportunities (p. 453). By the end of the two-year study, participants moved away from a reliance on outsiders to a reliance on each other to co-construct knowledge and share ideas to solve problems of practice.

During participation in a community of practice, members create boundary objects. For example, in Cobb et al. (2003), mathematics leaders created a pacing guide during professional development with the teacher community. This guide served to represent the teachers’ change in
instructional practice “from focusing on mathematical procedures toward supporting students’ understanding of mathematical ideas” (Cobb et al., 2003, p.19). Stein and Coburn (2008) also found that boundary objects such as curriculum materials helped to align members of various learning communities within a school.

In all three studies, boundary encounters, or practices, served to engage participants to focus on the goal, or key boundary object. Development of new practices or ideas occurred over time through legitimate peripheral participation and reification. Brokers served as catalysts to encourage people within and across communities of practice to participate or not participate to enact change. During this process of participation, boundary objects were created to reify the abstract process of changing instructional practice during a reform.

In the following section, I describe how members of a community of practice may also engage in a joint enterprise and create a shared repertoire of strategies. Mutual engagement exists when members are focused on a specific domain of interest, or joint enterprise. The outcome is usually a shared repertoire of strategies. For example, several teachers may meet to discuss a new math program. The outcome may include a set of shared instructional practices.

**Mutual Engagement, Joint Enterprise, and Shared Repertoire**

One study analyzed the extent to which beginning teachers, who recently finished a pre-service teacher education program in the same cohort, developed a sense of connectedness and belonging during participation in a hybrid community of practice, whose work was primarily focused on becoming a teacher of secondary school mathematics (Goos & Bennison, 2008). To gain a sense of the members’ participation in the online community using Wenger’s (1998) framework, the researchers reviewed, coded and categorized messages posted to an online message board. They sought to understand the forms and the extent of mutual engagement
among participants, the way in which they engaged in joint enterprise, and the shared repertoire they created as being members of this online community of practice. After interviewing the participants and sharing their findings regarding the posts, the researchers found three distinct factors that characterized and traced the formation and continuation of an online community of practice as defined by the three elements of Wenger’s (1998) framework. Being voluntary, having a mixture of face-to-face and online interaction, and the convenience of using the online message board all contributed to a mutual engagement among participants who focused on assisting each other to develop a shared repertoire of strategies to teach secondary mathematics.

In three of the studies, a focus on shared expertise to support strategy development contributed to the learning community’s success in analyzing student data (Ebbeler et al., 2016; Marsh, Bertrand, Huguet 2015; Mindich & Lieberman, 2012). During meetings with learning community members, participants in one study shared how one teacher’s expertise in statistics assisted the team with data analysis (Ebbeler et al., 2016). In the same study, one teacher reported how she and her fellow colleagues in the professional learning community had developed strategies to support students who found some questions on an exam difficult to answer. In another study, three 7th grade teacher participants in the learning community used their expertise as a mediator for data use in the classroom which lead to change in instruction (Marsh et al., 2015). Data became a collective tool that informed “elective workshops” where teachers created for themselves and became a means to solve immediate problems (Mindich & Lieberman, 2012, p. 30). In each of these studies, teacher learning communities became a true collaborative culture where collective learning and shared understanding were realized.

Lave and Wenger’s (1991) conception of learning and Wenger’s community of practice framework have not been without critique. Not all researchers have found Lave and Wenger’s
work to be significant in explaining how individuals learn. In the following section, I highlight a few studies that delve into the controversies surrounding their community of practice framework.

**Critiques of Wenger’s Community of Practice Framework**

There exists a plethora of research examining how individuals may learn through participation within a community of practice; however, seeing learning as simply participation remains questionable (Edwards, 2005; Hager, 2005). Other research has tried to delineate learning as theoretical and guided by the researcher’s view of learning as either being distinctly influenced by “situation or situatedness” whereas a situation refers to the immediate context and situatedness refers to all historical, contextual, social, and political influences embedded within a context (Elmholdt, 2004).

The trajectory of learning has also been a point of contention among scholars causing Wenger (1998) to later revise his earlier work to identify many trajectories of participation including inbound, peripheral, insider, boundary, and outbound. Fuller, Hodkinson, Hodkinson, and Unwin (2005) added one’s identity formation to this debate. They theorized that learning through participation is not just a matter of trajectory but equally dependent upon members’ unique dispositions and backgrounds. Such characteristics may ultimately influence whether members of a community learn by working with others in-the-world and see a member’s participation as dependent on their relationship to the activity that has brought the people together (Hughes, Jewson, & Unwin, 2007, p. 17).

Another point of contention has been the designation of a community of practice as a structure within a school as opposed to one that crosses boundaries based on the activity, or practice-based learning of the group (Fuller, et al, 2005; Wenger, Trayner, & de Laat, 2011; Wenger-Trayner, Fenton-O’Creevy, Hutchinson, Kubiak, & Wenger-Trayner, 2014). All of these
findings from previous research collectively indicate that Lave and Wenger’s (1991) community of practice approach to teacher learning is not without reproach; however, using it as a unit of analysis to explore teacher learning during a reform may help to further expose mitigating factors that influence knowledge construction for teachers engaged in a specific activity and highlight the ways in which members of a community of practice engage with each other and a curriculum initiative and how, if at all, this process translates into their instruction (Farnsworth, Kleanthous, & Wenger-Trayner, 2016).

While there exists a plethora of educational research and policy on teacher collaboration in learning communities as an evidence-based means to improve student achievement (Borko, 2004; Darling-Hammond & Richardson, 2009; Dufour, 2004; Hord, 2009; Lieberman & Mace, 2008; McLaughlin & Talbert, 2006; Printy, 2008), there is a dearth of recent research regarding the examination of the nuances of a collaborative, teacher-initiated community of practice as explored and defined earlier through work by Lave and Wenger (1991), Wenger (1998) and Wenger et al. (2000) that prompt teacher initiated learning in a school context during a reform initiative (Little, 2002). Furthermore, using the community of practice framework as a unit of analysis to explore teacher learning during a reform may help to further expose mitigating factors that influence knowledge construction for teachers engaged in a specific activity and highlight the ways in which members of a community of practice engage with a curriculum initiative and how, if at all, this translates into their instruction.
Chapter Three: Methodology

Methodological Approach

Qualitative research focuses on “process, understanding, and meaning” and has many research designs (Merriam & Tisdell, 2016, p. 15). Because I truly wanted to investigate the nuances of collaborative and situated teacher learning and as a teacher educator wanted to understand how I could better serve as a district leader of teacher professional learning, I drew upon the traditions of case study and practitioner action research to expose insider knowledge of an experience. Researchers Lehman, Trubek, and Wong (2011) found in their own co-inquiry of teacher learning that such insider knowledge promotes “authentic understandings” (p.4) of a learning process. Exposing insider knowledge draws upon the traditions of case study research, where researchers may record activity and talk of participants “as it happens in the context being studied” (Lankshear & Knobel, 2004, p. 177). Investigating teacher learning in context, or in a natural setting, also draws upon practitioner action research. Since I was familiar with the school context, the findings from the investigation added to the understanding of the teacher learning process particulars within the focus school context; therefore, in the spirit of practitioner action research, generalizing to other school contexts may not be possible (Anderson, Herr, & Nihlen, 2007).

My positionality as an administrator who can influence large-scale change in the district made for a compelling reason to conduct it (Herr & Anderson, 2015). It also allowed me to do research with people and not on people (Merriam & Tisdall, 2016, p. 64), which may encourage others to embrace change. While being an insider has its strengths, my position as an administrator within the focus district creates an issue related to power. To mitigate this issue, I
sought the assistance from a co-researcher, whose position as a teacher minimized issues of power among the participants. This process will be discussed next.

**Mitigating Researcher Positionality**

As a school district administrator, I sought to investigate an issue in my own school district, which was the inability for some teachers to change their instruction when faced with a problem of instructional practice when a new initiative is imposed. Completing qualitative research within schools in my present district provided me with a unique opportunity to be an “insider” within a familiar context (Herr, 2017; Ross, 2017). This context held advantages such as an ease of access to familiar participants, an understanding of team norms and values, and a richness in the interpretation of the data in light of deep knowledge of the school district’s context (Ross, 2017). Studying a school within my school district also brought up the issue of positionality within research. My relationship as a former teacher, former team leader, and former direct supervisor could possibly create tension among participants and prevent discussion of key topics because of this insider/outsider role (Herr & Anderson, 2015; Merriam & Tisdall, 2016). In this case, I was in a position of power as a district leader.

At the suggestion of my former academic advisor, I found a co-researcher, Lynn, who was a teacher in my present district. It is noteworthy to mention Lynn’s motivation for agreeing to serve as a co-researcher for the present study. Having many years of experience as a grade level team leader and special education teacher in a middle school setting, Lynn questioned whether her approach to teaching mathematics aligned with the standards. Being a key member of the school’s intervention and referral team, Lynn also sought to understand how to motivate other team members to change their teaching practice to meet the needs of diverse learners. When I sought her assistance with the present study, Lynn was already engaging in her own
inquiry about teacher learning; therefore, she agreed to assist me and find out how teachers change practice when faced with a challenge or reform. Without a co-researcher, my chances of IRB approval for my study waned because of my position of privilege and power in the setting; however, with the co-researcher, my study was deemed exempt by the IRB. In the next section, I provide the processes I followed to ensure trustworthiness of the research findings.

**Trustworthiness**

Reflective practice is one way to manage subjectivity and maintain transparency at every stage of the research design and analysis of data (Holliday, 2016). To capture my thinking throughout the research study, I completed a reflective journal (Ortlipp, 2008). A reflective journal creates transparency and exposes the researcher’s “experiences, values, and positions of privilege in various hierarchies” (Ortlipp, 2008, p. 695). As a former vice principal and current director of curriculum in the research setting, keeping a reflective journal made visible to the co-researcher and participants, my decision-making processes during the analysis of findings. My goal in keeping a reflective journal was to make my “history, values and assumptions open to scrutiny, not as an attempt to control bias, but to make it visible to the reader” (Ortlipp, 2008, p. 698).

The reflective journal for the present study is a road map of my own journey to answer my research question. There is no algorithm for qualitative researchers to follow when investigating the social world. Instead, qualitative research into teacher learning is a heuristic task where the researcher designs, possibly inadvertently at times, the components of the study based on hunches and existing theories of teacher learning, creating an introductory road map for future researchers interested in the inquiry. See Figure 2 for an excerpt of this journal.
Figure 2. Reflective journal entry

To minimize the risk of “blinking a researcher’s observations and interpretations” (Lankshear & Knobel, 2004, p. 225), I also drew upon multiple data sources, used member checking with participants and sought the assistance of a co-researcher without issues of positionality. With such checks and balances in place, my familiarity with the context was necessary and worthy because I sought to bring forth sustainable improvement to my own practice to support a school district where all educational stakeholders including teachers and administrators share a “whole-village belief system” where everyone in the school feels empowered and “shares an obligation to build a great school” (Mitchell & Sackney, 2009, p. 191). After all, “the researcher’s familiarity with the context does not always guarantee that the research conducted will be any less hazardous to the participants than the research directed by someone stepping in from the outside for a brief encounter” (Tilley, 1998, p. 327). As a school administrator, I felt compelled to initiate change in the teacher professional learning process in
my present district by undertaking the task of exploring why there exists an inability for some teachers to change their instruction when faced with a problem of practice tied to a reform initiative. A problem of practice can be anything from developing more pedagogical content knowledge in mathematics (Hill, Ball, & Schilling, 2008) to implementing a new program to learning how to better serve one’s LGBTQ student population (Taylor, Meyer, Peter, Ristock, Short, & Campbell, 2016).

Because I conducted my study with a teacher learning community, I see this inquiry as an authentic collaboration and one in which all members, including myself as a co-researcher, worked deliberately to build a community of inquiry. While I completed this research to satisfy part of my dissertation requirements for a teacher education and teacher development program, I also collaborated with members of my own school district to assist them with professional learning during a reform. My collaboration with them hopefully became a catalyst by enacting change based on our work and our findings (Herr & Anderson, 2015).

**Context**

The present study focused on a teacher-initiated community of practice within a suburban school district in the mid-Atlantic region of the United States. Both the pilot and present studies took place in this small suburban school district 20 miles from a large metropolitan area in the northeastern part of the United States. Some of the schools in the district received Title Ia federal funding through the Elementary and Secondary Education Act (ESEA) for targeted instructional practices designed to increase student achievement for disadvantaged students who fell below the poverty level. There were approximately 1800 students enrolled in the PreK-12 district during the study. In district reports to the state, the demographics of the school were described as 70%
White, 22% Hispanic, 6% Black or African American, 2% Asian or Pacific Islander. (Note that as of 2012, respondents are permitted to check more than one race or ethnicity category).

In 2012 and after several years of minimal success for targeted intervention programs designed to improve student proficiency in mathematics, elementary teachers were tasked to implement the *Eureka Math* program from Great Minds¹, which was available as a free, online open education resource. The mathematics program provides a logical scope and sequence based on standards and offers a student-centered approach to learning mathematics. Teachers in grades 3-5 were provided collaborative time by the school district’s administration to analyze student State standardized testing data, and explore the Great Minds program to implement *Eureka Math* modules as a means to mediate low student growth and achievement on New Jersey’s *Partnership for Assessment of Readiness for College and Career* (PARCC).

In 2016, after elementary students improved their math proficiency as measured by the PARCC assessment, the middle school mathematics department was tasked with piloting the *Eureka Math* program to improve student achievement. Historically, results on the 8th grade standardized assessment in mathematics fell below the State’s threshold of proficiency. Several elementary teachers and specialists volunteered to work with the middle school staff over the summer and during the following year as they learned how to implement the program. I chose to focus the present study on these teachers and specialists.

An ethical consideration throughout the research process for the present study was preserving the anonymity of the participants in the study. Both the co-researcher and participants themselves may feel the strain of not having anonymity during every phase of the inquiry. To

¹ Great Minds website: https://greatminds.org/math/about-eureka
prevent this strain, pseudonyms were used to identify both the school and participants who were
the center of my inquiry.

Participants

This present study focuses on an elementary teacher, one mathematics specialist, one
technology coordinator, who was the former mathematics specialist in 2016, and three middle
school mathematics teachers who were part of the implementation of the targeted *Eureka Math*
mathematics initiative. The elementary teachers in this study also volunteered to assist the
middle school teachers with their implementation of the *Eureka Math* program. One of the
middle school teachers was also dually certified as a special education teacher. All of the
participants were teaching or assisting in the school district as an instructional specialist for at
least 1 year and all earned at least a master’s degree in teaching. All had also received at least
one out-of-district training in the *Eureka Math* program either during or after the initial
implementation of the district initiative.

Aside from meeting together periodically and attending at least one *Eureka Math*
workshop, participants met to discuss various topics related to student achievement and the
socioemotional well-being of their respective students during district-provided monthly
curriculum meetings with their mathematics supervisor or school principal. Participants also
collaborated during common planning time periods to exchange ideas for lessons to improve
student achievement for at-risk students who did not meet with proficiency on the PARCC
standardized test in the previous school year. Additionally, all participants engaged in
professional learning with a learning consultant two times during the school year, attended either
a district-sponsored professional development workshop, or sought such experiences outside of
the district. Many of the participants also met at mutually agreed upon times outside of structured meeting times.

The following is a brief description of each participant whose names have been changed to protect their identities. A summary of the participants is shown below in Table 1.

Table 1 Summary of Study Participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>School</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynn</td>
<td>Goose Island Middle School</td>
<td>10+ Years of Experience in District Grade 6 Special Education Mathematics Teacher Co-Researcher</td>
</tr>
<tr>
<td>Alina</td>
<td>Dallas Elementary School</td>
<td>7 Years of Experience in the District Math Coach during Pilot Study District Technology Coordinator</td>
</tr>
<tr>
<td>Barbara</td>
<td>Dallas Elementary School</td>
<td>10+ Years of Experience in District Grade 5 teacher, Generalist</td>
</tr>
<tr>
<td>Christine</td>
<td>Goose Island Middle School</td>
<td>6+ Years of Experience in the District Grade 7 Mathematics Teacher</td>
</tr>
<tr>
<td>Ella</td>
<td>Dallas Elementary School</td>
<td>9+ Years of Experience in District Grade 5, Generalist Mathematics Coach</td>
</tr>
<tr>
<td>Geraldine</td>
<td>Goose Island Middle School</td>
<td>2+ Years of Experience in District 2 Years of Experience in New York City Grade 6, Mathematics</td>
</tr>
</tbody>
</table>

**Lynn**

When Lynn became the co-researcher for the present study, she was teaching 6th grade resource mathematics to students receiving special services due to a specific learning disability (SLD) in mathematics or who were diagnosed with autism. Lynn also served as a grade level
team leader and, later in 2017, and with 14 years of teaching experience, she became the vice president of the local educator’s union.

**Alina**

For most of her 7 years of working in the district, Alina worked as an elementary math teacher and coach. During the pilot study, Alina became the math coach in Dallas Elementary School, which served Pre-K - 5 students. For the 2018 school year, Alina transitioned to the district technology coordinator, working with teachers, technology coaches, specialists and administrators in two elementary schools, one middle school and one high school. Alina attended and/or facilitated numerous in-house and out-of-district professional development workshops on the Common Core State Standards (CCSS) and later the New Jersey Student Learning Standards (NJSLS) in Mathematics, the *Eureka Math* program, and various technology and STEM workshops. She was instrumental in the pilot and ultimate adoption of the *Eureka Math* program at the elementary level in the district.

**Barbara**

After completing a Master of Teaching (MAT) program at a New Jersey public university, Barbara began her 8-year career in the district as a 6th grade language arts leave replacement teacher. When an opportunity opened in Dallas Elementary School for a 5th grade teacher, Barbara was hired. Barbara attended numerous in-house and out-of-district professional development workshops focusing on the CCSS and later the NJSLS in both mathematics and English prior to and during the pilot and present studies. She attended many workshops facilitated by Alina during the implementation of the *Eureka Math* program in 2012. Barbara also taught in the Title I at-risk afterschool mathematics program during most of the study period.
**Christine**

Like Barbara, Christine finished her Master of Science (MS) degree program in mathematics at a New Jersey public university, and began teaching 7th grade mathematics at Goose Island Middle School in 2013. She immediately attended a series of workshops focusing on the implementation of the CCSS in mathematics. She also taught in the Title I at-risk afterschool mathematics program during the study. During Christine’s first 3 years in the district, she followed a mathematics program previously approved by the local school board and supplemented it with lessons from an online program called Kahn Academy. She piloted the *Eureka Math* program in 2017 with full implementation of the program in 2018 after it was formally adopted for the middle school level.

**Ella**

Ella was hired as an elementary teacher a few years prior to the implementation of the *Eureka Math* program at Dallas Elementary School. During her Master of Science (MS) program in mathematics at a public university, she met a professor who created her own professional development company focusing on mathematics and the Core Curriculum State Standards (CCSS). Ella attended many of these out-of-district workshops and encouraged colleagues from her school to attend. After Alina became the district technology coordinator, Ella was hired as the math specialist. She provided professional development to staff for the *Eureka Math* program, modeling lessons and collaborating with teachers to develop lesson plans and assist with the implementation of the new program.

**Geraldine**

Geraldine was hired as a 6th grade math teacher when the *Eureka Math* initiative was set to be implemented in the middle school. Having experience with the *Eureka Math* program in
her previous district in New York City, Geraldine fully understood the *Eureka Math* program. She also developed a collegial relationship with an elementary teacher at Dallas Elementary School.

In the following section, I describe the data that was collected for my inquiry into teacher learning in a community of practice.

**Data Collection**

In the summer and fall of 2016 and during the following school year, I implemented my pilot study to understand teacher learning. Participants met in July and September 2016 during two meetings scheduled by Lynn, my co-researcher. Meetings were transcribed and coded. After analyzing the codes for the pilot study, a theme of teacher agency emerged. As a result of this finding, I administered the Teacher Change Agency scale to further analyze this theme (See Appendix A). Continuing my work with the participants in my pilot study allowed me to analyze the group for an appropriate duration to see if changes in their participation in the community occurred over time. For my Dissertation Proposal, which was completed in March of 2018, the finding of teacher agency along with my desire to capture teacher learning over time influenced my decision to pitch a further examination of how members of a community of practice engage with a curriculum initiative, and how, if at all, is this depicted in their instruction.

In late fall of 2016, my co-researcher observed two mathematics lessons which took place in a 5th grade class at Dallas Elementary School and a 6th grade class at Goose Island Middle School, respectively. She wrote field notes for each. Throughout the year, middle school participants met weekly and before school during professional learning community meetings to discuss *Eureka* lesson plans and how students were responding to the new program. Participants summarized the discussions of these meetings by providing minutes of the meetings
electronically to my co-researcher, Lynn. Lynn also attended some meetings and completed field notes about the discussions. In the fall of 2016, she created a Google Classroom blog where teachers posted a problem of practice for others to consider and comment. Participants began using the Google Classroom application to share problems of practice associated with *Eureka Math* lessons. These postings continued until the end of both the pilot and present studies in 2018. All data for the present study were coded initially using basic coding (Saldaña, 2016).

After my dissertation committee accepted my dissertation proposal for my study in late March of 2018, the IRB committee deemed it exempt in October 2018. In December of 2018, my co-researcher conducted semi-structured interviews with participants and recorded the interviews using Apple Voice. (See Appendix B for interview protocols). The following is a description of each of the aforementioned qualitative data collection processes.

**Observation**

Observation fosters an in depth and rich understanding of a classroom setting and the actions of the teacher in that setting. Lynn observed two math lessons and recorded field notes. Writing field notes is one way to capture the nuances of the observations. She followed an observation protocol and wrote descriptive and reflective notes (Cresswell, 2007). Lynn followed up with fact checking by sharing the observation data with the participants.

**Artifacts**

Because the study focused on elements of the community of practice that impact a change in instructional practice among participants, I also collected and reviewed artifacts from the participants. Artifacts, which Wenger (1998) defined as “boundary objects” (p. 106), include physical material such as summaries of meetings, copies of Eureka lesson exemplars as well as visual documents such as participant postings in a scholarly Google Classroom blog. Visual
documents represent participant activities and events in real time while physical material represents the tools, protocols or teacher-created documents used in a school setting (Merriam & Tisdell, 2016).

For the artifacts, which are also known as institutional texts (Lankshear & Knobel, 2004), I used content analysis to understand what each artifact, or text, revealed about the participants’ enactment of the Eureka Math initiative in their classrooms. Content analysis was used to analyze the “manifestation” of change (Merriam & Tisdell, 2016, p. 180). Specifically, how conversations within the community of practice influenced change in various instructional texts used for mathematics instruction. As a qualitative process, I analyzed and coded the artifacts to understand how teachers changed their instructional practice after participating in the community of practice. For example, did a participant alter a teacher-created document or lesson plan after engaging with members in the community? Content analysis can also be used to understand latent, or inferred, meanings within institutional texts (Lankshear & Knobel, 2004). Manifest and latent meanings of institutional texts were captured either in my codebook or in my reflective journal and are discussed in Chapter 6.

The participant group met numerous times both in person and online via a Google Classroom blog throughout the pilot and present study because many participants wanted multiple perspectives regarding the implementation of Eureka Math at the elementary and middle schools, so such discussions and blog entries were analyzed and coded. The rest of the artifacts were collected during the interview process, which is described next.

Interview

I created inquiry-based interview protocols using the research of Castillo-Montoya (2016) who created the Interview Protocol Refinement Framework to strengthen the reliability of my
interview questions. (See Appendix B for interview protocols.) Interview questions sought information relating to the participants’ backgrounds, their experiences in the learning community regarding the type of conversations and “activities undertaken, professional learning and skills developed, support provided, types of learning activities undertaken, hindrances to professional learning, and concerns and areas of further need” (McCormack, Gore, & Thomas, 2006, p. 101). At the beginning of the pilot study in July 2016 and conclusion of the present study period in December 2018, Lynn conducted semi-structured interviews with each participant. She recorded the interviews using Apple Voice, and I later transcribed the interviews.

The next section provides a description of my data analysis process.

Data Analysis

Lynn, my co-researcher, recorded the interviews and I transcribed them. She was not interviewed for the study; instead, she embraced the role of critical friend as she read my codes and/or collected more data.

Codes

I initially used open coding (Saldaña, 2016) to present themes from the interview transcriptions, field notes from observations and content analysis of artifacts. Then, from January 2019 to the Fall of 2019, I used iterative coding methods including basic coding and in vivo coding (Saldaña, 2016). Because I wanted to “honor the participants voice . . . and capture the meanings inherent in the participant’s experience” (Saldaña, 2015, p. 106), I used in vivo coding during the second coding iteration. During the second round, I completed reflective journal entries to document my data analysis journey; such journaling allowed me to create, manipulate, and drill down the codes. As a researcher, I continuously questioned the codes to determine their
significance to the big picture, being my research questions (Clandinin & Connelly, 2000). My ultimate research goal was to capture “the process as well as the final findings” (Merriam & Tisdell, 2016, p. 235).

During this ongoing analytical process, I created a codebook to organize the extensive collection of data (see Appendix B for an excerpt). I shared the codes and my interpretations, or interim texts, with two critical friends. A critical friend is one who will “challenge assumptions and the meaning making of researchers” (Herr & Anderson, 2015, p. 140). I also shared the codes with the participants and my dissertation chair using the process of member checking. Member checking allows a researcher to present codes and findings during “validation meetings” to both the participants and dissertation committee members who are all part of my “research endeavor” (Herr & Anderson, 2015, p. 106 & 140). After sharing my codes with my dissertation chairperson, he recommended that I use the community of practice framework to organize my codes. Using Lave and Wenger’s (1991) community of practice framework with a lens of legitimate peripheral participation, I analyzed the codebook a third time to understand how members of a school community possibly engaged with a curriculum initiative in a social world.

**Themes**

After the third iteration of coding and a discussion with my dissertation chairperson, Dr. Douglas Larkin, to review my codebook, he introduced me to Halverson’s (2004) article on school leadership which included a discussion regarding Aristotle’s concept of phronesis to build a framework for sharing the practical wisdom of school leadership practice. After reading the article and a subsequent study by Korthagen and Russell (1999), I realized that most of the codes involved the participants’ creation, adaptation, and/or use of artifacts. With this in mind, I proceeded to group similar codes in my codebook into themes using Aristotle’s discussion of
phronesis as an analytical lens. Since my goal was to uncover the “black box” of teacher learning within a community of practice, I focused on how artifacts influenced or exposed teacher engagement with the *Eureka Math* initiative. I drew upon the concepts of legitimate peripheral participation and the community of practice framework to understand how artifacts reified the participants’ learning trajectories toward and/or possibly away from the domain. When I finished this analytical process, I was left with a trail or reification of the participants’ collaborative processes of engagement and learning, which may be interpreted as a phronetic narrative, or wisdom of collaborative teacher practice.

Thus, the themes that are shared in Chapter 4 and 5 serve to explain how teachers engaged with a reform initiative and how this learning was reified in their respective classrooms. As mentioned previously, these themes were developed dynamically through the lenses of phronesis, legitimate peripheral participation, and the community of practice framework. In Chapter 6, I analyze these findings, and in Chapter 7, I conclude with a discussion regarding the implications of the findings, specifically how they may impact the field of educational research and the focus district per my intentions for this study.
Chapter Four: Findings

Engaging with a Curriculum Initiative

Wenger (1998) defined practice in a community of practice as “a way of talking about the shared historical and social resources, frameworks, and perspectives that can sustain mutual engagement in action” (Wenger, 1998, p. 5). Mutual engagement around a domain eventually leads to a shared repertoire of practices and/or frameworks, which may change with further practice. Ultimately, these practices and frameworks belong to the community that is undertaking the implementation of the *Eureka Math* program. With this in mind, I provide my findings to my first research question which considered the following: In what ways do members of a community of practice engage with a curriculum initiative?

In the sections that follow, I share data to support the following themes: *moving toward co-constructing knowledge in context*; *engaging as agents, using technology to mitigate temporal constraints to learning*, and *brokering across multiple communities*, each of which helps to understand the ways that members of a community of practice engaged with a curriculum initiative.

*Moving toward Co-Constructing Knowledge in Context*

Because the research question points specifically to the ways in which community members *engaged* with the *Eureka Math* program initiative and views such engagement through the lens of Wenger’s (1998) idea of mutual engagement, the first theme that emerged from the data is the concept of *moving toward knowledge co-construction in context* as a key lever for engagement. Elements of *moving toward knowledge co-construction* as proof of engagement were previously investigated by researchers who also agreed with the collaborative nature of co-constructing knowledge around an initiative (see similar findings in Chen, Chang & Liu, 2012;
Jho, Hong, & Song, 2016; and, Lantz, Lundin, & Selwyn, 2018). As will be shown in this chapter, participants initially located themselves outside of the domain and were focused on learning the program individually. Most participants were novices learning how to implement the *Eureka Math* program. As the study progressed, properties of moving toward knowledge co-construction in context had emerged through participants’ conversations and collaborations. This shift seemingly moved all participants closer to understanding the *Eureka Math* program.

Initial conversations about the domain were inherently focused on individual concerns regarding learning the necessary knowledge to implement the new initiative. Participants, ranging from elementary teachers with a few years of experience with teaching the *Eureka Math* program to middle school teachers who generally lacked experience with the program, seemed to focus their conversations on how the district-mandated *Eureka Math* program impacted their own classroom instructional practice. The context helped frame, or ground, the participants’ thinking regarding the possibilities and obstacles associated with implementing a new initiative in their respective classrooms and within the existing district curriculum.

Data shared below reveals their initial insecurities about the mathematics initiative and their intentions for seeking more professional development to implement the *Eureka Math* program with fidelity.

I am learning information as a student. I do not feel that Eureka PD [professional development] was sufficient. We did not have any official *Eureka Math* PD. I think the problem lies not in how you are teaching the skills, but the fact that we as a district are not using a consistent curriculum. (Barbara; Interview, 2016)

Common causes of these expressed insecurities were two-fold; participants lacked
knowledge about the new program, and the district’s professional development plan lacked a clear direction. The following blog entry demonstrated Christine’s frustration with a lack of district provided professional development for the *Eureka Math* program:

I don’t feel that *Eureka* PD [professional development] was enough. At the middle school level, we participated in a webinar and then used two curriculum days to discuss/print/look over materials provided by *Eureka*. There hasn’t been much chance for us to implement lessons together or work through problems as a department. (Christine; Artifact, Google Classroom Blog, May 2017)

Interviews with participants regarding their intentions for seeking professional learning experiences also revealed their individual concerns. For example, in her first interview Ella said, “I want to understand the demands of the math curriculum” (Initial Interview, 2016).

Other singular attempts to learn the nuances of the *Eureka Math* program were mainly framed by the teachers’ perceived competency with mathematics instruction as expressed by Lynn who shared the following at one of the first meetings, “I did not like not knowing how far to go into a standard, where to stop, and what, specifically, to focus on” (Lynn; Meeting Field Notes, 2016).

As the study progressed, participants at the middle school used common planning time during the homeroom period to meet when classroom coverage was provided. Others met on their own time. During these meetings, participants embraced the social process of learning the nuances of the *Eureka Math* program collectively and collaboratively as indicated in the following example:

I think that by being in a group like this and talking about curriculum is an important step in bridging this gap. I think we need to continue to talk about which curricula we follow
that is best for student learning and progression. (Alina; Lynn’s Meeting Notes, November 2016)

Some participants found that collaborating with colleagues allowed them to focus on their own students. Lynn shared the following during a meeting in the Fall 2016, “I have found that collaborating with my colleagues has been more valuable than the Eureka professional development in-house workshops simply because I can focus on my grade, my lessons, my students and use my materials” (Lynn; Meeting Notes, November 2016).

The previous examples exemplify a paradigm shift which was occurring with the participants. They were beginning to realize the importance of their in-house professional learning experiences. The learning community’s goals for engagement now focused on meeting the participants’ needs in their respective learning environments as expressed in the following example:

As I talked with teachers, I was able to come up with more ideas for engaging activities to do with my students. (Christine; Interview, December 2018)

Some participants also created their own frameworks and shared these with members of the community as in the following examples. Alina created binders for K-5 teachers so they would have something for their September opening of school. Barbara created and shared manipulatives with the group. Alina and Barbara’s social processes engaged them to co-construct knowledge to develop meaningful instructional practices and artifacts specific to their classroom contexts. In Ella’s words, participants “[talked] about a product and [built] a common language” (Interview, 2018). Everyday math talk that focused on their lessons within the context of their classrooms, encouraged participants to eventually change the culture of math instruction. They began to use a common language when referring to math instruction, unpacked standards,
learned how to use manipulatives provided by *Eureka*, and “discussed what [they were] doing, what [they were] going to do with it, and how [they would] use it” (Ella; Interview, 2018).

Participants also shared their experiences with the *Eureka Math* program by posting field notes of classroom observations in a Google Classroom blog for others to view and comment. (See Figure 3 for an example of a Google Classroom blog post.). The blog was helpful to communicate how others implemented the domain into their own contexts. It also identified artifacts like whiteboards and exit tickets that were used or could be used by other participants.

Jan 20, 2017
Today in C’s class we did module 4 lesson 3. Before we started the new lesson the students had about 10 minutes to work on the exit ticket from lesson 2 independently. I was able to quickly assess whether or not the students understood yesterday’s Lesson by looking at the exit ticket as they were handed in. Next we practiced two different fluency activities with the white boards. Students wrote the responses and held up the board when they were complete. Another way to quickly assess skills that they previously learned in skills that they will be using in the future. Then I introduced a word problem that focused on today's lesson of understanding how to write division expressions as fractions in multiple ways. Students independently solved the problem on their whiteboard using numbers. Then I prompted the students to find two ways draw the division. Different students explain their thinking and drawings on the board. We looked at the problem set which had a table that required students to represent a division expression in five different ways. Students independently completed the problem set and would come to teacher to check their work for accuracy. I instructed her students to meet me at a table if they felt like they were struggling or needed some more help. For the students that finished early, they were told to either go on TenMarks or XtraMath.

*Figure 3.* Google Classroom blog entry

Aside from blogging, participants continued to meet either formally during scheduled meetings, or informally when time permitted. In the following examples, Alina captured the work of their meetings and how effective communication helped to clarify their understanding of the *Eureka Math* program:

Just wanted to say that I enjoyed today’s meeting. I think it is great to be able to talk about teaching and math. . . I am looking forward to our future discussions and the new opportunities that come from this. (Alina; Blog post, June 2017)
In Geraldine’s limited experience as a first-year teacher in the district, she initially relied on another participant’s knowledge of the program. She said, “I relied heavily on the other 6th grade math teacher to determine an appropriate sequence of topics and pace of lessons” (Geraldine; Interview, December 2018). As she invested time with the community, Geraldine came to understand the nuances of the program. She explained how she learned to modify a shape balance worksheet for her context when she said, “When it was presented with shapes, the students had a much easier time understanding it. And I kind of modified it based on what I thought would fit my students” (Geraldine; Interview, December 2018).

As the community continued to meet or blog, participants within the community began to understand gaps within their own instruction because of their ongoing discussions with others in the community or through classroom observations. During these experiences, participants drilled down their frustrations, specifically tying their individual triumphs or tribulations with content to certain aspects of the *Eureka Math* program. In the first example, Christine shared how her work within the community confirmed her own instructional approach with a group of students:

> I used white boards like X used them in her class. I felt more confident about my decision to use my time in this way when I found out that X was also spending a decent amount of time on basic skills with her students. (Christine; Interview, 2016)

In the next example, Geraldine captured the systematic work of the community; the conversations within the community empowered her as a first-year teacher to co-construct new knowledge with them to learn the vocabulary associated with the *Eureka Math* program.

> It is concerning to me that students are at a disadvantage because of the lack of continuity or even consistency with vocabulary, if that makes sense. In one of my classes, students often make connections to “what they learned last year” so this [conversation] is helpful
to me. (Geraldine; Blog post, September 2017)

This experience of moving toward co-constructing of knowledge eventually influenced her approach to teaching math at the middle school. Geraldine implemented the entire *Eureka Math* program, ending her reliance upon an open-sourced, inconsistent approach to math instruction.

In the next section, I share findings related to how newer teachers, like Geraldine, became empowered by others to implement the *Eureka Math* program purposefully and with consistency. Their interactions with these other participants, who can be viewed as agents who somewhat orchestrated the work of the community, seemingly led Geraldine and others to learn new knowledge and, ultimately, develop a shared repertoire of practices. By the end of the study, participants articulated how such community relations eventually evolved into an integral professional learning component of the initiative’s implementation process.

**Engaging as Agents**

In my experience as a school and district leader, change is usually slow. Change within a district must involve educational stakeholders, which the research community supports. Yet, which educational stakeholders to involve has always been selected by someone or some entity with power such as a superintendent or State educational committee. The mathematics initiative at the heart of the present study is no exception. However, the way in which the initiative was implemented was an exception in the focus-district. Through scheduling and the hiring of educational support staff including instructional coaches and content specialists, school leaders created a context that was favorable to ongoing teacher learning. Teachers and specialists grabbed the reigns and moved the initiative forward; they were true agents of change.

For mutual engagement to be embraced and serve as a vehicle for empowerment and
change within a community of practice, it requires constant work and coordination by change agents to steward a shared history of learning (Wenger, 1998). When the community met for the first time in the summer of 2016, it was a convenient professional learning time. Participants were provided with time to meet during the summer enrichment program, and informal meetings continued during the rest of the summer break. When the new school year began, collaborating and ultimately, engagement with other participants became challenging. Yet, some participants seemingly embraced the role of teacher change agent, or one who was willing to initiate change with peers in spite of obstacles. These actors were responsible for maintaining mutual engagement throughout the study.

The first example of how participants became agents of change involves Alina whose willingness to work with other community members as a collaborator enhanced their understanding of the *Eureka Math* program. In her role as a math specialist, Alina was a master teacher who was knowledgeable, accessible, and committed to the *Eureka Math* program. She was also the individual who completed the research for the district when a new math program was needed due to poor standardized testing results at the elementary level. In the following example, she captured what I refer to as her agentive behavior:

> In the mornings, sometimes in the afternoons [we meet]. Sometimes it is as passive as in the hallway just catching up on something. Sometimes it is within the time of the class period that I am in there. Kids are doing center work, and the teacher and I discuss strategies to help. (Interview, December 2018)

Aside from Alina, other members of the community could be perceived as possessing the characteristics of a teacher change agent responsible for moving the initiative forward. Lynn facilitated the Google Classroom blog by posting questions to the group about the *Eureka Math*
implementation and by encouraging other participants to share. While she remained a key facilitator of this online community, other participants eventually assisted the group by posing their own topics or by sharing knowledge once they also felt an empowerment to contribute. The blog and subsequent meetings became an integral, online collaborative component of professional learning around the *Eureka Math* initiative. It serves as evidence to demonstrate how teachers were agents of change.

Participants within the present study were involved in meaningful work around the domain, which relied heavily upon the actions and expertise of the community members. These social actions were coordinated by participants who not only identified their roles within the community, but who became empowered as the actors responsible for coordinating the work of the community. In the following examples, Alina, the former math specialist, shared some of the perceived participant roles within the space, “I served as a leader in the aspect of being able to provide resources and guidance to teachers. She [Ella] is coaching other teachers.” (Alina; Interview, December 2018)

While Alina and Ella may be viewed as instructional coaches, or orchestraters, within the community, Lynn, who was a middle school special education teacher and grade level team coordinator during the study, evolved as the key facilitator for the group by scheduling meetings and supporting the community toward full implementation of the initiative. Lynn spearheaded classroom observations as one professional development method because she “want[ed] to get [their] opinions on how it has been going and what [they] are doing” (Lynn; Interview, July 2016). She tried to get into everyone’s classroom each session.

These examples not only divulge the content that was discussed, but they serve to
reveal the personal attributes, or soft skills, of the individuals within the community of practice. Alina and Barbara gently persuaded others to view the current curriculum as a barrier for change. Instead of attacking teacher practice, they move the initiative forward by exposing an overarching, district issue with student achievement in mathematics. Using the lens of the *Eureka Math* program, Alina and Barbara convinced participants within the community to examine the current curriculum and their own teaching practices associated with teaching mathematics at the elementary and middle school levels. This reflective piece occurred because participants were collegial and encouraging; they were teacher change agents who encouraged others to engage in meaningful, ongoing professional learning focused on their respective school contexts. Ella shared that she “view[ed] my staff as a community of learners” (Interview, December 2018). In the following example, Alina expressed how this professional learning experience with others who were also engaged in a collegial experience, had allowed for her own reflection and growth:

> It was really helpful to look at the program [Eureka] in a different way and see how it needs to be adapted depending on who you are teaching, what grade level, your time constraints, so it was a reflective experience hearing from everyone’s point of view. (Interview, December 2018)

As the online forum and in-person meetings continued, members continued collegial relations to guide each other along the implementation process through encouragement and empowerment, by drilling down content for each other, or by offering to collaborate for lesson planning around the domain. Alina said, “It comes down to the relationships that you have with people and it [the community] makes those connections work” (Alina; Interview, December 2018). Barbara shared that she relied on Ella because she was the math specialist. These participants exposed their own vulnerability regarding the initiative, and a willingness to engage
with others as a means to implement it with fidelity in their respective classrooms; however, it became clear from the data that time was clearly an obstacle to the implementation of *Eureka Math*. In the next section, I share some findings regarding how participants used technology to mitigate the temporal nature of implementing a new initiative.

*Using Technology to Mitigate Temporal Constraints to Learning*

Understanding teacher learning in response to a curriculum initiative also involves temporal analysis to reveal possible obstacles or other contextual factors related to time that may impede or allow the implementation process to flourish. Since teacher learning is usually viewed by some research scholars as existing on a continuum to strengthen and sustain teaching (Feiman-Nemser, 2001; Darling-Hammond, Hyler, & Gardner, 2017), understanding what this may look like may address how participants mitigate temporal factors that exist within their context.

According to Wenger (1998), members of a community of practice work together to influence each other’s understanding of a domain. For learning to occur in a community of practice, mutual engagement must be sustained (Wenger, 1998). Yet, this engagement is viewed as temporal as people may participate in a community in a combination of trajectories over time. Trajectories of participation around practice are situated in a dynamic social world where learning is cyclical and dependent on the unique needs of the participants (Lave & Wenger, 1991; Wenger, 1998). In the present study, participants at the elementary school were experienced with teaching mathematics using the *Eureka Math* program; however, middle school teachers were novices. To bridge gaps of time and experience for novices, the community of practice mitigated these temporal tensions through communication and adaptation.

In the beginning of September 2016, it became obvious to Lynn that the group, consisting
of members who taught in different school buildings, would need more time to meet and a place to organize communication around the *Eureka Math* program for middle school participants to continue to learn how to implement the program with fidelity once the new school year commenced. Because of a lack of common planning time and other scheduling obstacles, Lynn created an online Google Classroom blog in the fall of 2016 for the participants. She embraced the relatively new district implementation of the Google Classroom platform by creating a “classroom” for the learning community. Similar to how a teacher would use Google Classroom to post assignments or solicit questions from the student learning community, Lynn orchestrated the Community of Practice Google Classroom blog with this in mind.

In one of the first posts, Geraldine posted an invitation on the Google Classroom blog to observe her middle school lesson; she was seeking ways to adapt the packaged *Eureka Math* program, which originated at the elementary level, to her middle school’s bell schedule. *Eureka Math* lessons should last between 50-55 minutes per day; however, the math period at Goose Island Middle School was a 40-minute block. Geraldine sought the assistance from others to observe her lesson and provide feedback:

> I am doing an activity from Eureka in my 6th period class today if you have time and want to stop by. I really like the activity but probably need to adapt it to work better in the 40-minute time period. (Geraldine; Blog post, January 2017)

Lynn accepted her invitation and took field notes to capture it. She shared the notes with Geraldine who later posted a reflection regarding the lesson. (See Figure 4 for an excerpt from her reflection.)

*Figure 4. Excerpt of Geraldine's lesson reflection*

To adapt the lesson to the school schedule, Geraldine assigned the Problem Set as an
Students worked well in groups, but struggled with the tape diagrams. Most groups attempted to show each identity in one picture, when several pictures were needed. Due to timing, I altered the suggested lesson format. Instead of a gallery walk, when 15 minutes were up, I asked each group to record the identities that they came up with on the board. When all groups wrote their equations on the board, we examined them as a class. Students were able to see that although different variables were used, each group discovered the same relationship between multiplication and division: that is that multiplying by a number and dividing by the same number, and vice versa, resulted in no overall change thus showing that the operations were opposites.

To address the confusion with tape diagrams, I assigned numbers to the variables in each identity. As a class we then broke each identity into three parts and used tape diagrams to represent the changes in each part, the final picture matching the original picture which stressed the fact that there was no overall change. There was not enough time remaining in the lesson to complete the exit ticket. The Problem Set was assigned for homework and reviewed the next day in class.

exit ticket assessment, which she would review the following day. At the elementary school, there was usually time for this practice to occur during class; however, due to constraints with their bell schedule, it was slowly becoming apparent to the middle school participants that the existing *Eureka Math* program would need an adaptation if it were to be used effectively at the middle school. At the middle school, mathematics instruction occurs for 40 minutes; however, at the elementary schools, *Eureka Math* lessons tend to run for close to 50 minutes. Time became problematic at the middle school, so participants cross-examined classroom instruction at both levels to come to an agreement as to how to structure *Eureka Math* at the middle school level.

After this learning experience was captured in the Google Classroom blog, the blog became a key lever for participants to mitigate temporal constraints existing within the district. Because teachers did not have a common planning time to meet with others in the community of practice, several other teachers set up classroom observations and later posted their field notes in the blog for feedback. (See Figure 5 for examples of field notes from a few classroom observations.)
Middle School Classroom

Observation by Participant D of Participant A (PA): 12:02 PM

- Teacher directed question and answer
- Group lists on board
- Lesson: Addition/Subtraction Identities

PA asked: What is your identity? Is it a rule?

PA asked: What is the following rule? W+X-X=W This was a review from Friday’s class.

PA asked: What are the relationships between multiplication and division? Can we make any predictions?

Student asked: Can I give an example instead?

Communities of Practice: Connecting and Making Sense

Google Classroom Math CoP Post to Participant D

Participant A

Jan 20, 2017 Today in C’s class we did module 4 lesson 3. Before we started the new lesson the students had about 10 minutes to work on the exit ticket from lesson 2 independently. I was able to quickly assess whether or not the students understood yesterday’s Lesson by looking at the exit ticket as they were handed in. Next we practiced two different fluency activities with the whiteboards. Students wrote the responses and held up the board when they were complete. Another way to quickly assess skills that they previously learned in skills that they will be using in the future. Then I introduced a word problem that focused on today’s lesson of understanding how to write division expressions as fractions in multiple ways. Students independently solved the problem on their whiteboard using numbers. Then I prompted the students to find two ways draw the division. Different students explain their thinking and drawings on the board. We looked at the problem set which had a table that required students to represent a division expression in five different ways. Students independently completed the problem set and would come to teacher to check their work for accuracy. I instructed her students to meet me at a table if they felt like they were struggling or needed some more help. For the students that finished early, they were told to either go on TenMarks or XtraMath.

Figure 5. Sample excerpts of field notes of two classroom observations

It is noteworthy to mention that participation in the Google Classroom blog was not forced upon participants. Nor was their involvement consistent. Instead, participation occurred when teachers were negotiating instructional practice related to teaching Eureka Math. Alina said, “I did not want to make it a big deal and force everyone to use it. So, it was whoever
wanted to get involved in that time” (Alina; Interview, December 2018). Christine expressed that the “blog became a place for sharing my ideas, bouncing ideas off other people, learning new ways to get new ideas from other people in the community” (Christine; Interview, December 2018). When discussing their blog posts during the interview in December 2018, Alina, who was the math specialist at Dallas Elementary School during the pilot study, and Lynn, a special education teacher at Goose Island Middle School, shared how the blog also featured discussions about problems of practice associated with implementing a mathematics program that relied on a consistent cross-grade level scope and sequence. While the middle school teachers were charged with learning the *Eureka Math* program, they initially lacked enough background knowledge to know certain terminology associated within the program. While the sixth and seventh grade students were familiar with the *Eureka Math* terminology, the middle school teachers were not using it in their lessons. To solve this problem of practice, they used the blog to find possible answers. In the following example, Lynn’s post captured this problem of practice:

Hey everyone! Here is an issue that Alina and I came across while reviewing multiplying fractions with the 6th graders. We found that students had no idea what cross-canceling meant and how to use it to easily multiply across the numerators and across the denominators. They looked at us like we had 5 heads! It was seriously confusing to them. Any ideas as to why this is happening? (Lynn; Blog post, November 4, 2016)

A few days later, Barbara read and responded to Lynn by offering a possible explanation as to why her lesson generated some confusion for her students. She shared the following:

I totally hear what you are saying about the frustration level you are experiencing. The *Eureka Math* program has the students learning the skills in a very specific, though-
provoking way, and they simply do not use the ‘old’ ways that we learned, so it is no wonder that they looked at you as if you had 5 heads. (Barbara; Blog post, November 8, 2016)

Participants generally embraced their online conversations within the Google Classroom blog possibly because the platform provided them with a convenient, collaborative space to examine the Eureka Math program in real time and make necessary adaptations. It is noteworthy to mention that not all participants engaged in social practice with each other on a consistent basis. Nor was time a mitigating factor for all collaboration. In some cases, a few participants sought the expertise of outside sources, and later, returned to the community blog or subsequent meetings with new resources and information to share with the community. This finding revealed that some members of the community required more information. Compelled to find answers to problems of practice, these participants relied on outside assistance to fill their own gaps of knowledge in understanding the Eureka Math program. As a result, they can be viewed as brokers, or members of the community of practice who can be perceived as being members of multiple communities (Wenger, 1998). This theme will be discussed next.

**Brokering Across Communities of Practice**

While most of the participants relied on the community for learning about the Eureka Math, some members of the community sought the assistance from outsiders. Wenger (1998) referred to these interactions as boundary relations where brokers “serve to introduce one practice into another” (p. 105). For the present study, data supported how some participants engaged in brokering across multiple communities.

In the middle school where one person teaches an entire grade level, mathematics teachers do not always have the opportunity to plan with teachers who cover the same standards
and content. For these teachers, seeing out-of-district professional development was a viable solution. For participants in this study who engaged in brokering, they can be viewed as belonging to multiple communities of practice around the domain of *Eureka Math*. They orchestrated a system of providing resources or other information to others. Once information was shared, participants decided which to use in or adapt to their existing contexts. Evidence from the data will show how Geraldine, Christine, Alina, and Ella were members of multiple communities who sought content and expertise from others who were outside of the study’s community of practice unit.

The first example from the data shows how Geraldine shared the value in attending an out-of-district workshop with a mathematics consultant:

In the downtime, you just talk with the teachers at your table and hear about what they are having a hard time with. Or what is working with them. It [the workshop] provides ideas of what you can do in your own classroom. (Geraldine; Interview, December 2018)

In another example, Christine shared how her experience with an out-of-district learning consultant exposed her to how some of the aspects of the *Eureka Math* program, such as the prescribed scope and sequence of standards, would not align with the New Jersey Student Learning Standards in grade 7. Because she was the only 7th grade teacher in the school and community of practice, she lacked a collegial partner who taught pre-algebra or who could recognize the temporal issue with the *Eureka Math* program. By attending an out-of-district workshop, she learned to adapt the *Eureka Math* lessons to align with her schedule without compromising the inherent value in the *Eureka Math* program, which was its alignment with standards and the state testing platform. She shared the following about here experience with a representative from an out-of-district mathematics workshop:
X is so knowledgeable about State testing and curriculum. So that was really helpful to adapt it [*Eureka Math*]. Just talking with other teachers who actually teach 7th grade and learning what they are teaching in their district and the activities that work for them was helpful. (Christine; Interview, December 2018)

In Dallas Elementary School, Alina, who was a math teacher when the *Eureka Math* program was piloted, transitioned to the district technology coordinator, yet remained a key broker within the existing community of practice around the initiative. In her new role, she shared resources from external sources as a means to introduce technology into teaching practices. She explained her process of brokering:

I use a lot of social media from Twitter to Facebook groups and stuff like that and doing things on my own to find PD [professional development] for those things and how to be effective in using them - the tech[nology] piece in the math classroom. (Alina; Interview, December 2018)

Ella also sought the expertise of a mathematics consultant whose experience with the implementation of existing State standards added to the community’s discussions of how to plan their lessons to align with the standards, and eventually, the New Jersey Student Learning Assessment in mathematics. Ella and the consultant met at a local university where Ella was continuing her education. She explained how Tara assisted her with the implementation of *Eureka Math*. “Something I learned from Tara was getting the teachers exposed to it at a slower pace” (Interview; December 2018).

In the next example, Geraldine shared how her previous teaching experience in New York City assisted her with the implementation of *Eureka Math* in her present district. She discussed how she created lessons and handouts with teachers from her former district and now
uses them with her 6th grade students. She said, “I take other things from my old school that I created with other teachers” (Geraldine; Interview, December 2018). Geraldine also shared how she, too, worked with Tara who can be viewed as a member of a community of practice outside of the present district. Geraldine shared the following about her experiences with Tara:

She [Tara] shared a shape balance worksheet. And I kind of modified it based on what I thought would fit my students. (Interview; December 2018)

As the findings from the present study demonstrated, not all participants engaged in social practice with each other on a consistent basis. In some cases, a few participants sought the expertise of outside sources, and later returned to the group with new resources and information. A reminder that these participants can be viewed as brokers, or members of a community of practice who remained as members of multiple communities and also worked to facilitate the work of the community (Wenger, 1998, p. 105). Alina, Christine, Ella, and Geraldine were members of multiple communities of practice; each had worked previously with others such as an Great Minds trainer, an expert for the New Jersey Student Learning Standards in Mathematics, and other district teachers. Even though Geraldine was new to the district, she had previous teaching experience in New York City where the Eureka Math curriculum was originally piloted.

**Summary**

This chapter presented themes to answer the question of how teachers within a community of practice engaged with the Eureka Math initiative to learn the program’s nuances. Participants constructed knowledge together through classroom observations, meetings, and blogging in the shared Google Classroom blog. Teacher brokers facilitated some of the work of the community of practice by being members of multiple communities of practice. The study’s
findings also support community and cross-community experiences of engagement. As a district leader and teacher educator, these findings provide a better understanding as to how ongoing teacher learning can be implemented with fidelity in spite of contextual and personal constraints, such as time and a lack of content knowledge, that may impede progress. The next chapter provides data to answer the second research question for this study, which focused on how these collegial experiences of shared learning and engagement were, if at all, depicted in classroom instruction.
Chapter Five: Findings

Changes in Classroom Instruction

Conceptually, the community of practice framework supports that learning exists through mutual engagement and mutual relationships. In the present study, participants developed relationships around the domain of Eureka Math. Without this topic at the center of their discussions, participants would remain as mathematics teachers and not as members of a community of practice for Eureka Math. Nor would some seek the assistance of others by engaging in multiple communities of practice to learn the nuances of the program. By the definition of *community* in Wenger’s (1998) community of practice framework, which is a matter of engaging with others around a specific domain, the participants were indeed involved as a community of practice; they engaged with others to collaborate to learn the nuances of the Eureka Math program. Participants expressed how they had adapted their own thinking through their work with others and how this collaboration translated into classroom instruction. Such changes within a social sphere are part of the participants’ learning trajectories (Lave & Wenger, 1991), and classroom instruction may be viewed as the reification of this learning trajectory. With this in mind, this chapter provides data to answer the following research question: How, if at all, is engagement around a new initiative depicted in their instruction?

To present findings regarding how the community’s work was depicted in classroom instruction, I included evidence from field notes from Lynn’s two classroom observations, interview transcripts, emails and meeting minutes. The following themes summarize the pedagogical shifts in instructional practices that are seemingly supported by the data:

*Transitioning from Teacher-Centered to Student-Centered Instruction*; and, *Developing Shared Practice and Common Artifacts.*
Transitioning from Teacher-Centered to Student-Centered Instruction

In the present study, participants discussed their perspectives regarding their respective instructional practices, specifically how they would implement the *Eureka Math* program with fidelity. Geraldine shared how the community’s perspective of the implementation of the *Eureka Math* program shifted from designing teacher-directed to student-centered lessons. She said, “A lot of us in this community have the same belief that ...shifting to more student centered is what something across the board is what we agree [upon] and support” (Geraldine; Interview, December 2018).

In the next example, Alina shared a problem-based lesson that a few teachers created during one meeting:

We came up with a hands-on lesson that we found online, and they had to make their own geometric city. That was a fun lesson that came out of meeting with people and talking about what they were noticing and skills that were not being addressed in their curriculum. (Alina; Interview, December 2018)

In traditional, teacher-directed lessons, the teacher’s role situated them as all-knowing. They are viewed as those who impart information onto their students. The hope is that such information is received and absorbed. In progressive, student-centered classrooms, the teacher serves as the facilitator, crafting situations where students themselves are learning the material through inquiry, collaboration and engagement (Murray, Higgins, Minderhout, & Loertscher, 2011). The student-centric *Eureka Math* program seemingly encouraged a change regarding how teachers designed and implemented their lessons, and more importantly, how they viewed their students within their classrooms. As teachers participated in the community of practice, they changed into facilitators of learning; students were taught how to solve mathematical problems through inquiry and collaboration. This was a key insight as to how collaboration as a
community seemingly exposed a somewhat macro instructional issue across the schools. To implement the *Eureka Math* program with fidelity, teachers needed to eventually change their instructional practice to support student-centered activities.

Participants also realized that their assessments and classwork assignments needed to be modified based on student needs. In the following examples, Alina shared how she modified lessons or tests:

For the lower grades, we tried to use different strategies to modify their tests whether it be color-coding or giving more space on the page, so all of those things were team efforts to really try and adapt what we had to meet their [students] needs. (Alina, December 2018)

In the next example, Geraldine shared how she modified a lesson to create a lesson that engaged students with the lesson. To highlight this process, she said the following:

I altered the suggested lesson format for the tape diagram activity. Instead of a gallery walk, when 15 minutes were up, I asked each group to record their identities that they came up with on the board. When all groups wrote their equations on the board, we examined them as a class. (Geraldine, January 2017)

As the teachers engaged in discussion about their practice, they were seemingly learning how to modify it to fit with the *Eureka Math* program. These conversations led to a change in their lesson planning. Lessons were impacted by students, data and time. Ella said, “Our approach to data has changed. We are now giving kids a choice of what strategies to use” (Ella; Interview, December 2018). Geraldine also mentioned that due to time constraints at the middle school, she had to alter the suggested *Eureka Math* lesson format.
After working with the community of practice, participants modified lesson plans to match temporal issues within their unique contexts including the school schedule, and to include lessons reflective of student abilities within their respective schools. Changes in lesson planning evolved into changes in classroom instruction. In the next examples, Geraldine framed the problem as one of basic skills enhancement and Barbara made an efficiency argument:

A Eureka lesson usually takes me at least 3 days because I infuse the basic skills and practice into the lesson. I can’t just let them do the problem set for homework and move on the next day - they need a lot of reinforcement. (Geraldine; Blog post, January 2017).

The best thing about *Eureka Math*, for me, is that it helps me narrow down the standard to exactly what part/parts I should be teaching. This way, I can deliver the essential skills to my students. (Barbara; Blog post, January 2017)

After a while, changes in lesson plans and instructional practice led to the development of “consistent vocabulary, strategies and pacing” (Lynn; Meeting Notes, January 2017). In the next example, Ella expressed how the community helped to develop a common language to unify their practice and assist with the implementation of the *Eureka Math* program, “We can talk about a product and we are building a common language. That is a huge tool.” (Ella; Interview, December 2018).

All participants within the community developed a common language associated with the *Eureka Math* program. For example, lesson plans and actual lessons included references to common *Eureka Math* terminology such as *tape diagram, counting by tens, gallery walk, sprints,* and *fluency.* (Lynn’s field notes; January 2017; Alina’s field notes, January 2017). Moving forward, they would each attend to precision by using the same mathematical terms and embrace
similar, mutually agreed upon instructional practices for *Eureka Math*. In the next example, Ella captured how this process led to a change in teaching mathematics:

> I am a participant in the group. Learning the vocabulary and getting it into everyday math talk is a big part of the change and essentially is changing the culture of math. (Ella; Interview, 2018)

Changing the culture of math from teacher-centered to student-centered instruction was evident in the present study. Participants developed a common vocabulary and used their co-constructed knowledge to create new or use existing artifacts to implement student-driven lessons. Such processes allowed participants to sustain their mutual engagement around *Eureka Math* and demonstrate this common bond in student-centered lessons in their respective classrooms. Their development of this shared practice and their use of common artifacts around the *Eureka Math* program will be shared next.

**Developing Shared Practice and Common Artifacts**

As teachers implemented the *Eureka Math* program in the respective classrooms, they continued to engage with members of the community of practice. It became a system of discussing a topic, trying it out in a classroom, reflecting, and sharing these practices with the group as described in the following examples:

> We met and were talking about geometry and where it fit into the school year. So, the teachers were noticing that some of the basic things of geometry their students weren’t understanding. So, we came up with problem-based learning types of lessons. I piloted it out in different classrooms and with teachers to see if they worked [to solve the issue]. (Alina; Interview, December 2018)

See Figure 6 as an example of a problem-based activity and corresponding student self-
assessment rubric that was created by and shared among participants.

Figure 6. Sample problem-based activity and corresponding self-assessment rubric
In the next example, Ella shared how the community maintained their engagement with the initiative by creating and sharing artifacts, such as calendars, as a way to organize and share instructional practices. She said, “Things we make are calendars, especially in 5th grade. We love our calendars, but kind of where we are going and what our pace is, leaving catch-up days. It just gives teachers a target” (Ella; Interview, 2018).

The shared calendars provided participants with a scope and sequence that managed the initiative with particular consideration for the idiosyncrasies of their particular context. While the *Eureka Math* program provides a suggested scope and sequence for lessons, the community found that by creating their own calendars, they were giving their teachers a road map to also learn the program and adapt it to the needs of their students. (See Figure 7.) The calendar also served as a model for the middle school teachers who were learning to adapt the *Eureka Math* program to their bell schedule and students.

<table>
<thead>
<tr>
<th>Monday 11/30</th>
<th>Tuesday 12/1</th>
<th>Wednesday 12/2</th>
<th>Thursday 13/5</th>
<th>Friday 12/4</th>
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<tr>
<td><strong>Lesson 23</strong></td>
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<td>O-SWBAT Divide three- and four-digit dividends by two-digit divisors</td>
<td>O-SWBAT Divide decimal dividends by multiples of 10</td>
<td>O-SWBAT Use basic facts to approximate decimal quotients with two-digit divisors, reasoning about the placement of the decimal point</td>
<td>O-SWBAT Divide decimal dividends by two-digit divisors, estimating quotients, reasoning about the placement of the decimal point, and making connections to a written method</td>
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<td>Topic: Partial Quotients and Multi-Digit Division</td>
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<td>Technology: Internet Resources, Mobi, Standards: 5.NBT.2</td>
<td>Technology: Internet Resources, Mobi, Standards: 5.NBT.2</td>
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<td><strong>Lesson 28</strong></td>
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<td>O-SWBAT Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown.</td>
<td>O-SWBAT Solve division word problems involving multi-digit division with group size unknown and the number of groups unknown</td>
<td>Review</td>
<td>Review</td>
<td>End of Module Assessment</td>
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<tr>
<td>Topic: Word Problems with Multi-Digit Division</td>
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</tbody>
</table>

*Figure 7. Sample fifth grade calendar*

Aside from creating and sharing calendars as a community, some participants developed...
lesson handouts for their students. While handouts and workbooks were available for purchase, participants, like Christine, elected to create their own lessons. She said, “I have adapted the Eureka lessons. I have made my own papers instead of printing them from the [Engage NY] website” (Christine; Interview, December 2018). (See Figure 8.). Others like Geraldine and Alina created handouts and shared them with each other via email as in the following example:

I attached 3 homework assignments that is similar to the classwork that we discussed. Take whatever you think will be helpful and let me know if you need anything else. (Geraldine to Alina; email communication, December 2016)

![Teacher-created handout for students](image)

*Figure 8. Teacher-created handout for students*
When the *Eureka Math* program was implemented in the elementary school, the principal shared the *Eureka Math* website with parents at the annual parent night meeting in early fall. As a supplement to this meeting, Alina created and shared the *Eureka Math Parent Resources* website where parents could gain access to grade-specific resources to assist their child. The parent resource page contained parent resources for all grade levels.

**Summary**

Changes in instruction from teacher-centered to student-centered resulted from the discussions within the community of practice regarding the *Eureka Math* program. The previous examples provide a snapshot of the community’s repertoire of instructional practices and artifacts that were developed in the community around *Eureka Math*. For those in this study who collaborated to create artifacts such as a handout or lesson plan or adapt such resources to their own classroom contexts, the collection provides a rich history of its creation and serves as proof of learning through participation where the teachers in this present study negotiated and re-negotiated meaning to fully understand the *Eureka Math* program and how to best implement it within their respective contexts. Calendars, handouts and other artifacts that were created, shared, and used by participants within the present study serve as reifications of this learning experience. Some were shared with parents. In the following chapter, I provide an analysis of these findings. I conclude this paper with a brief discussion regarding the limitations and implications of the findings for the present study.
Chapter Six: Analysis of Findings

Aristotle (trans. 2001, IV) explained how the “work of man is achieved only in accordance with practical wisdom” (p. 1034) and how practical wisdom, or phronesis, “makes [people] take the right means” when they set out to achieve a certain goal (p. 1034). In my analysis of findings for the present study, adding Aristotle’s discussion of phronesis to the concepts of legitimate peripheral participation and the community of practice framework was key to opening the “black box” of understanding and representing how teacher practice evolved during a school initiative. In the following sections, I analyze my findings, focusing on how artifacts reified the development of teacher learning, exposed the participants’ relational skills and learning trajectories, and highlighted teacher agency as participants engaged with the Eureka Math reform initiative to develop instructional practice.

Artifacts as Reifications of Teacher Learning

Artifacts serve as distinct “tokens of human meanings” specific to the teachers’ classroom contexts (Wenger, 1998, p. 61). For example, meeting agendas and minutes, a teacher-created handout for students, or a lesson plan, could be perceived as meaningless to outsiders, but for those involved in a community of practice understand that these tokens serve as reifications of their participation in the community and of the collaborative discussions that ensued. In this study, the following artifacts were analyzed: teacher-created materials such as student handouts and curriculum calendars, Google Classroom blog entries, and lesson plans.

Analyzing the tokens of meaning, or artifacts, of the present study initially revealed that while the community of practice was focused on the domain, the participants’ unique classroom contexts drove the discussions. Elementary teachers who had more experiences with the program shared their previously developed calendars, lesson plans, and handouts that were utilized to
implement the *Eureka Math* program in their respective classroom contexts. Middle school teacher participants examined these artifacts and either used them or modified them because they were either too long to fit the shortened middle school bell schedule or not applicable to their grade levels. Geraldine and Christine, who were middle school teachers, had limited experience, but as members of multiple communities, shared handouts created in another community of practice when their lessons were seemingly too long or not appropriate for their students.

Collectively, the artifacts captured how such varying degrees of knowledge and experience existed and impacted participation within a community of practice. The artifacts represented a snapshot of a learning experience for one or more participants who created them in response to some “aspect of an environment that is worthy of action” (Halverson, 2004, p. 100). When the artifact is shared with and explained to others, the recipients may use it, discard it, or adapt it, resulting as some “thing” that may evolve or remain stagnant. The movement or lack of movement of these artifacts signifies a learning process for participants within and/or across communities of practice.

Certain artifacts, like the Google Classroom blog, represented a viable context for teachers to share artifacts, discuss problems, reflect on teaching, and post achievements of their practice. Having an online collaborative space builds on Halverson’s research by offering an example of how researchers can utilize technology to develop a *phronetic narrative* that captured teacher learning and served as a history of how teachers set about on “divergent paths based on interest” (Halverson, 2004, p. 114). The blog also represented the cyclical nature of a community of practice whereas participation waxed and waned depending on the need of its members, and served to validate the work of the participants. As the community co-constructed knowledge, scheduled classroom observations, posted reflections of these observations in the blog, attended
out-of-district workshops and shared resources within the Google Classroom blog, their phronetic narrative was shaped and represented by what Halverson referred to as their phronetic practice (p. 114), or practical wisdom. Their actions in the blog allowed the co-researcher to see what teachers were actually doing and not what they said had occurred. Posts often substantiated what was observed during classroom visits or shared during the interview processes. Halverson (2004) concluded that “capturing the relation of espoused theories and theories in action shows how phronetic cases can provide powerful learning opportunities” (p. 105). In the present study, the Google Classroom blog represented the work, or action, of the community of practice. The lens of phronesis allowed for the artifacts to become visible sources of collaborative teacher learning within various contexts and showed how they influenced classroom instruction.

**Artifacts as Reifications of Relational Skills**

Artifacts such as interview transcriptions, Google Classroom blog posts, email communication, and field notes from meetings revealed that teachers themselves may be responsible for mitigating new learning experiences within collaborative structures. Having certain “soft skills” such as a social spirit as suggested by Dewey (1904) and engaging in the recreation of knowledge with others using dialogic practices (Freire, 1970; Alles, Seidel, & Gröschner, 2018) are necessary relational skills for engagement and learning. Previous research has also coined these skills as character strengths (Lim & Kim, 2014), the “X” Factor (Berube, 2010), or simply, soft skills (Tang, 2018). Other research also explored the necessary dispositions, knowledge, and practices of teachers and other members of learning communities best suited for capacity-building interventions which support a new initiative (see, for example, similar claim in Marsh & Farrell, 2015).
In the present study, artifacts revealed that several of the participants demonstrated soft skills that were necessary for the relational conditions that support teacher learning. For example, interviews documented how participants were eager to meet with each other to develop their practice around *Eureka Math*. Participants described the community as consisting of people who were mutually engaged around a specific domain, or topic of interest, to learn its nuances. In one participant’s view, community was “where you give and receive and a place where a group of people share ideas in an open environment” (Geraldine; Interview, 2018). The community consisted of people and their openness for communication, a shared language, and ongoing engagement around the domain as a means for learning its content and clarifying practice. For social practice and learning to be sustained, Wenger (1998) believed that a community of practice must “become invested in what [they] do as well as in each other and [their] shared history” (p. 89). Artifacts served to reify their shared learning history.

*Artifacts as Reifications of Learning Trajectories*

Artifacts supported that as newcomers learned more knowledge and developed their instructional practice through experience, their positions and contributions changed within the community of practice. In his community of practice framework, Wenger (1998) referred to this learning trajectory as “catching up” for some participants within the community of practice (p. 102). As they learned new knowledge and realized that their unique contexts may present a problem for implementation, some participants became empowered to mitigate the contextual issues by facilitating the Google Classroom blog or producing adapted lesson plans and corresponding handouts for students. For certain community members, like the elementary teachers, who had more time to learn the *Eureka Math* program, their reasons for participation in the community became seemingly more altruistic when they began to facilitate the work by
scheduling meetings, observing, posting questions or answers in the Google Classroom blog, or by seeking more knowledge from an out-of-district learning consultant for the benefit of others. These findings are aligned with Lave and Wenger’s (1991) theory of legitimate peripheral participation whereas participation within a community of practice always exists in multiple levels and constitutes multiple trajectories of participation.

The participants’ learning trajectories also included boundary crossing as signified by the participant’s use of some artifacts that were created outside of the community. Such artifacts are defined as boundary objects. As discussed previously in Chapter 2, boundary objects serve as a reification of the abstract learning process and interconnection that may exist across multiple communities of practice. Originally coined by Star and Griesemer (1989), boundary objects usually serve to standardize some process among individuals who come from diverse backgrounds and are charged with its implementation. Star and Griesemer (1989) found that boundary objects such as standardized forms helped mobilize amateur collectors, scientists and administrators who were charged with creating the new Museum of Vertebrate Zoology at the University of California, Berkeley. Similarly, the Eureka Math program featured in this present study provides standardization through its scope and sequence, online mathematics program and corresponding student workbooks. The program can be viewed as a boundary object that unites multiple communities of practice. In another example of a boundary object, Geraldine, who previously taught in New York City which was the original implementation site for the Eureka Math program, developed classroom resources with a former colleague after receiving training from EngageNY. She shared these handouts with members in the focus school district. Geraldine’s teacher-created handouts and the Eureka Math program served as boundary objects that were used by multiple communities of practice. The use of boundary objects is not a new
phenomenon; it supports previous research by Wenger (1998) whereas participants in a community of practice utilize boundary objects to organize their interconnections.

For participants who shared boundary objects, they are viewed as belonging to multiple communities of practice. This boundary crossing does not eliminate their participation in any one community of practice; instead, it serves as a reminder that participants within a community of practice share histories of learning with others (Wenger, 1998). A community of practice is not a fixed structure within one context. Rather, its members’ trajectories are dynamic and may cross multiple contexts; these are connected by the participants’ willingness to engage around a domain. Participants either have or develop boundary relations that serve to provide more knowledge and/or locate more resources for the community of practice. This study also found that boundary relations existed and assisted with the implementation of *Eureka Math*. For example, Alina and Ella had greater access to more professional learning opportunities outside of the school district because of their flexible schedules, histories of learning the nuances of *Eureka Math*, and positions within the school district as instructional specialists. While the rest of the participants in the study were classroom teachers, Alina and Ella’s schedule allowed for more flexibility to find resources or seek further professional development for *Eureka Math*. They crossed boundaries for the good of the community and as part of their roles in the district. Regardless, Alina and Ella can be viewed as brokers, or members of a community of practice who were members of multiple communities and shared a “duality of boundary relations” to facilitate the work around the domain (Wenger, 1998, p. 104).

*Artifacts as Reifications of Teacher Agency*

In the present study, the findings support that several participants, like Alina and Ella, were members of multiple communities of practice and served as brokers, or agents. With the
creation of the Google Classroom forum, Lynn also served as a broker. Because the blog was online, Lynn was able to provide virtual instructional support even though her schedule was not as flexible as the other brokers’. She did not have to be physically present in a meeting with the other participants to offer support. For middle school teachers, like Geraldine, finding someone with grade-specific knowledge and resources in *Eureka Math* was problematic resulting in her desire to seek outside professional development from a district-provided mathematics consultant. Geraldine, Christine, Alina, and Ella can all be viewed as brokers, or change agents. According to Wenger (1998, p. 109) these brokers, or agents, “transfer some element of one practice into another”. Each broker shared knowledge with other members of the community. Yet, this knowledge may have been learned outside of the community. Nevertheless, members with little knowledge of the *Eureka Math* program were able to fully participate in the community of practice around the *Eureka Math* program because of brokers who initiated change.

Findings from the present study supports previous research where brokers serve not only as a capacity-building resource but as a key member of the community of practice. Brokers serve as a reminder that a community of practice is a partnership with specific characteristics for learning and not simply a generic group (Lave & Wenger, 1991). Brokers own certain knowledge and share it with the members of the partnership. This intentional exchange of knowledge becomes a learning resource. The exchange is also cyclical; members of the community of practice seek the assistance of the broker when they require more learning to implement a reform initiative. Brokers may also share new knowledge with members. And, in time, some members become brokers.

For newcomers, like Geraldine, having previous experience with the *Eureka Math* program in her former district, seemingly acclimated her quickly into her new teaching position
at the middle school. She identified with participants within the community of practice because of their shared understanding of the nuances of the program. While she may have been a newcomer to the district, she quickly became a vested member of the community of practice by sharing artifacts from her previous district with participants. Here, shared learning regarding the *Eureka Math* program has no boundaries and further supports Wenger’s (1998) claims that a community of practice is not a fixed structure like a group, team, or network.
Chapter Seven: Conclusion

Summary of Findings

To turn now and answer the first research question, it is suggested that teachers engaged with the new initiative by developing their *phronetic practice* over time. This practice was shaped not only by their epistemic knowledge about a topic and through their collaborations with others in a community of practice to learn new knowledge, but it was dependent on the development and use of artifacts within and across their respective communities and contexts. Artifacts served to demonstrate what exactly transpired after members collaborated around the domain. Artifacts documented the ways in which participants negotiated and re-negotiated meaning about *Eureka Math* within their specific contexts and how they became seemingly more encouraged, or empowered, to participate in the community over time and in many roles to develop their practice. Artifacts like the calendars and problem-based lessons also embodied the participants’ understanding of the impact of temporal and student influences on instructional practice. And, artifacts that served as exemplars of boundary objects supported previous research where learning occurs within and across multiple communities of practice. Ultimately, participation within the community of practice seemingly led participants to a closer understanding of the *Eureka Math* program and how it could be implemented within the demands of their unique contexts.

The second research question asked whether teacher learning around a new initiative was evident in classroom instruction. Artifacts also served as a reification of learning and represented the implementation of the *Eureka Math* program in the classroom. Through observation and by completing field notes, the co-researcher, Lynn, captured these reifications of learning. In Lynn’s notes, she wrote how Geraldine responded to a temporal contextual issue by modifying the 55-
minute *Eureka Math* lesson into a 40-minute lesson. During observations of both elementary and middle school teachers, Lynn and the researcher noted how teachers used common vocabulary terms associated with the *Eureka Math* program and teacher-created handouts. These examples are not exhaustive; however, as individual tokens of learning, they provide a trail of past practices (Halverson, 2004). Artifacts, then, contributed to data analysis in that they provided some proof that participation within a community of practice may influence a change in instructional practice. In the next section, I will share what these findings mean for the educational research and school leadership communities.

**Implications for Educational Research**

The findings from the present study add to recent research regarding the examination of the nuances of a collaborative, teacher-initiated community of practice that prompt teacher learning in a school context during a reform initiative. Previous research by Papay and Kraft (2015) along with the findings from the present study support teacher professional learning as mitigated by several conditions. In their work, Papay and Kraft (2015) discounted the theory that teachers reach a certain performance plateau after their first few years on the job. By examining 10 years of standardized testing data from a large U.S. school district, they found that many teachers improved their instructional practice after their first years of teaching (Papay & Kraft, 2015). Teachers improved because they were in environments that supported collaborative professional learning. Likewise, the findings from the present study suggest that organizational supports in a school or district, such as providing teachers who engage in a community of practice with common planning time or another collaborative space, allows the negotiation and re-negotiation of meaning to flourish, leading to a successful implementation of a new initiative.
In viewing teacher learning from a viewpoint of legitimate peripheral participation as indicated in my methodology, the community examined in the present study were certified teachers who certainly possessed the technical knowledge to participate in the community of practice. They developed an understanding of the *Eureka Math* program through relations with others, the activity, and the surrounding context. Observing their classrooms, examining their discussions, and speaking directly with them throughout the implementation process paints an image of teachers deeply engaged in improving their craft. Yet, the lens of legitimate peripheral participation as the sole analysis of this approach may have been insufficient. Lave and Wenger (1991) defined any knowledge that was generated through practice as “an epistemological principle of learning” and social practice as being influenced by power relations and “conditions for legitimacy”. Yet, they did not define these conditions specifically. Through analysis, I realized that context was a condition that may have impeded or encouraged the development of knowledge through practice. Applying Aristotle’s concept of *phronesis* supplemented the analysis as a more applicable and authentic analytical lens to make sense of how context played a role in the participants’ engagement around the *Eureka Math* initiative. More research using the lens of phronesis could hopefully lead to further understanding as to how teachers mitigate context to develop their instructional practice to meet reforms. Such findings are necessary for the decision-making process that drives professional learning in any school district. Such findings may also lead to conversations about legitimate teacher practices that aim to close the achievement gap for marginalized populations and add to the growing narrative of what works to improve teacher effectiveness.

Previous empirical research has captured processes significant to teacher collaboration, particularly strategies central to developing communities focused on learning (McLaughlin &
Talbert, 2010; Horn, 2010). Yet, such research had not focused on whether the reform effort was met with success. Measuring the effectiveness of this type of teacher learning around a reform initiative also escapes the intentions of the present study. Instead, this research study sought to expose examples of how teachers engage around a new initiative and how this was translated in their classroom instruction. The findings presented in this study may serve as an additional narrative to explain how engagement within a community of practice occurs. Wenger (1998) explained that practice involves mutual engagement, joint enterprise, and the development of a shared repertoire. In this study, these three characteristics of engagement allowed participants to negotiate and re-negotiate meaning around Eureka Math and foster an understanding to implement it purposefully and with fidelity in their respective classrooms. While they learned the program through collaboration, they also adapted it to their contextual needs by creating, sharing, and implementing artifacts. Wenger (1998) referred to this cyclical process as a process of shared learning. And whatever allows engagement to occur is key to any practice (Wenger, 1998). In the present study, artifacts served to reify teacher engagement.

The trajectory of learning has also been a point of contention among scholars causing Wenger (1998) to later revise his earlier work to identify many trajectories of participation including inbound, peripheral, insider, boundary, and outbound. This study possibly contributes to the discussions regarding this controversy in education research by demonstrating how learning trajectories vary and may be dependent on the personal attributes of the participant. For example, the participants’ relational skills were contributing factors to their respective learning trajectories. Wenger also referred to these attributes of the community members that enabled engagement. He called them “dedicated” and “attentive” (p.75). To extend the research to include how relational skills impact the work of a community of practice may reveal the nuances
that explain how individual teachers respond to specific contextual obstacles during a reform. Narrative inquiry may be a viable research method for understanding such experiential phenomenon in education. It addresses its history and development as a methodology and as a means for understanding educational experience as always in relation to other people, places and things (Craig, 2010). It may also be suitable for understanding *phronetic practice* and perhaps the equitable participation of teachers in the production of practical wisdom, which is something that is not always included in educational research literature.

**Implications for School District Leaders**

Feiman-Nemser (2001) concluded that teacher learning must be designed as a continuum to “strengthen and sustain teaching” (p. 1013). Similar to these findings, participants in the current study were open to collegial, collaborative, and long-term partnerships whose goals were to design and implement a new curriculum initiative as a response to improve student achievement in mathematics. As an iterative, social process, the evidence shows that many teachers were engaged in collaborative experiences to improve instruction to meet student needs within their respective classrooms. This social practice is a fundamental form of learning (Lave & Wenger, 1991). It is important for school district leaders to understand why and how social practice within a community of practice may ultimately lead to internalization, transformation and change in instruction for teachers.

As the present study has found, teachers who are part of a community of practice will negotiate and re-negotiate meaning to develop a shared understanding. During this joint enterprise, they share and create a repertoire of practices and may possibly change their instructional practice. Understanding the nuances of social practice is key when trying to implement a new instructional initiative with fidelity. Relations in the community of practice
featured in the present study were collegial and goal-oriented; teachers collaborated to impact change in their practice by moving from teacher-centered to student-centered as a way to meet a reform initiative. Lynn facilitated the Google Classroom blog and essentially created a pattern of communication and collaboration for the community of practice. She accomplished what Dewey (1910) referred to as nurturing “a positive intellectual force” that encourages change (p. 27).

In the present study, the findings demonstrate that participants created and shared numerous lesson plans, schedules, and *Eureka Math* worksheets. They engaged in discussion in the Google Classroom blog. The creation of artifacts, or *classroom tools*, within a community of practice also aligns members of a school (Stein & Coburn, 2008). These reifications created a common language and a cross-grade level scope and sequence for the new math program. These experiences and documents became part of their shared history to implement the *Eureka Math* program. Wenger (1998) characterized communities of practice as shared histories . . . (p. 103).

Moreover, the artifacts created during the community of practice united the teachers and provided evidence of their collaborative learning experiences.

Shared histories supported time and context as critical factors for the implementation of the initiative. As time passed, participants became experts in the *Eureka Math* program. It also became a recorded history of the implementation of the *Eureka Math* initiative. The latter is especially important for district administrators who must ensure accountability whenever a new district-sponsored initiative occurs. The presence of checks and balances substantiates both the need and outcome of any district-sponsored initiative. A community of practice approach to teacher learning provides a district leader with such evidence, or a shared history of the process, making it a desirable approach for ongoing and embedded professional teacher learning.
For school leaders and educational researchers, analyzing the phronetic narrative from the present study will hopefully add the importance of collecting and analyzing artifacts created during the implementation of a new initiative as a means to bring to life an intangible process. While some researchers may argue that it is impossible to capture a teacher’s learning process by tracking the development and use of artifacts, “the distinguishing characteristic of phronesis is the ability to effectively size up novel situations that cannot, by definition, be specified in advance” (Halverson, 2004, p. 96).

Teachers often discuss common obstacles such as time, buy-in, and a lack of quality standards-based math programs that prevent the successful implementation of a new initiative. The findings from the present study suggest a different approach. It is recommended for school leaders to identify those individuals who are the brokers within the teaching community. These brokers should be given opportunities that serve to bridge multiple communities of practice in the spirit of ongoing professional learning. Through brokering, a participant’s impact on new teacher learning may widen across multiple communities of practice. Such brokering may also reveal an underlying agentive force within the community of practice. Agency has been studied by educational researchers who explored how a teacher or group’s agency influences a change in a course of action (Freire, 2000; Bandura, 2001 & 2006; Butler, Schnellert, & MacNeil, 2014). This openness to change may be the key to transformation and the necessary disposition of beginning and in-service teachers.

A final implication for school district leaders to consider is an online community of practice approach for ongoing teacher learning, especially when implementing a top-down district initiative. The findings from the present study show how an online community of practice allowed participants to engage with each other to develop a repertoire of best practices to
improve instruction and it served to mediate temporal obstacles. Likewise, in their study regarding teacher learning in a Malaysian Smart School, Murugaiah, Azman, Thang and Krish (2012) investigated how teachers used an online community of practice as a tool to improve their growth as English teachers. English teachers in the Smart Schools were charged with preparing students for their future in a technology-literate workforce; however, the existing training programs designed to prepare teachers with the necessary pedagogical instructional skills were problematic. Time constraints and a heavy workload prohibited teachers from continuing their learning to improve their professional practice (see Murugaiah et al., 2012). When scheduling constraints prevent face-to-face collaboration in schools, district leaders could seek to implement collaborative models using blogs like Google Classroom or social media like Twitter as viable forms of discussion and collaboration around a new district initiative.

Limitations

The sample size for this study was a tremendous limitation. As stated previously, there were only six teachers who volunteered to participate. Several other teachers in the school district were tasked with the implementation of the Eureka Math program; however, when approached to participate, these staff members elected not to participate in the study. While six teachers do not make a very large sample, each teacher needed to implement the Eureka Math program per the district initiative.

This study is limited by time. To avoid having the researcher’s position of power influence the present study and ensure participants’ rights were protected during the data collection process, a co-researcher, who was not in a position of power, volunteered to collect the data. Because the researcher had to work within the co-researcher’s schedule of availability and existing organizational structures, the amount of data collection opportunities was possibly
impacted.

The context of the study was also selected out of convenience as the researcher intended to use the findings to improve professional learning experiences within the school district; therefore, the findings from this study are suggestive and cannot be generally applied to another context or population.

It is noteworthy to also mention the role of curriculum materials in teacher learning during instructional reform. This study featured the *Eureka Math* program by Great Minds. Curriculum resources like the one featured in this study tend to be well positioned to influence teacher practice and possibly shape how teachers learn (Ball & Cohen, 1996). Yet, some packaged resources may not impact teacher learning because of other factors such as teacher buy-in and a lack of district supports such as time. In this study, I sought to understand how teachers engaged with a top-down *Eureka Math* program initiative and how learning about the new curriculum initiative in a community of practice specifically had influenced their instructional practice, or enactment, in the classroom. It was not an investigation into whether the *Eureka Math* curriculum resource itself influenced teacher learning; instead, it was an investigation into whether teacher practice changed as a result of engaging in a community of practice approach to learning a new district initiative. As a result, the findings from this study may be limited due to the possibility of the influence of the *Eureka Math*’s program design on teacher learning.

**Final Comment**

A journey of inquiry usually leads one on a path of discovery. Such paths can be defined as algorithmic where one follows a single pathway to one conclusion. Or, a heuristic path where no algorithm exists. Instead, one must solve problems with creativity and drive. (Pink, 2009).
Likewise, in this qualitative study, the researcher provided the reader with a narrative of her work to explore of a group of elementary and middle school teachers as they grappled with a heuristic task to implement a new mathematics initiative. The findings from this study are intended to provide specific examples of how teachers and school leaders participated in a teacher-initiated community of practice to improve student achievement in mathematics in response to a reform initiative. Such findings will hopefully add to discussions regarding Wenger’s (1998) community of practice conceptual framework and Aristotle’s phronesis as lenses to further investigate and clarify the nuances that contribute to collaborative teacher learning within a workplace.
References


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Ross, L. E. (2017). An account from the inside: Examining the emotional impact of qualitative research through the lens of “insider” research. *Qualitative Psychology, 4*(3), 326.
doi: [10.1037/qup0000064](http://dx.doi.org/10.1037/qup0000064)


doi: [10.1086/589315](http://dx.doi.org/10.1086/589315)


## Appendix A

### Teacher Change Agent Scale (Lukacs, 2015) Results from Pilot Study

(n=4)

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I value working collaboratively with others</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>If I feel it necessary, I will speak out and express my views to my colleagues.</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I am known as a person who is not afraid to take risks.</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I can adapt to the needs of my students when necessary.</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I am able to assess/evaluate student understanding using a variety of techniques.</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I know how to influence my colleagues.</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I invest time in understanding my students' learning styles and interests.</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I can help other teachers with their teaching skills.</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I prefer to work alone.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>I am reluctant to rely on others.</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I believe when teachers work together, they are able to influence practice in their schools.</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I know how to motivate my colleagues.</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I am resistant to suggesting changes.</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>
Appendix B
Interview Protocols

Overarching Research Question

In what ways do members of a community of practice engage with a curriculum initiative, and how, if at all, is this translated into their instruction?

Semi-Structured Interview #1

1. Describe your experience as a mathematics teacher in the middle school.
2. When a new curriculum initiative is instituted, describe your process of learning about the new instructional expectations. How do you then learn to transform your instructional practices in the classroom to meet these requirements?
3. Regarding the same initiative, is it helpful to collaborate with others when learning to teach a new curriculum or mathematics program?
4. How and why did your teacher learning community form?
5. What are your expectations for the community?
6. What individual traits allowed you to work with other members of the community?
7. Describe any obstacles or allowances that may impact your work in the community.
8. In the past year, did you complete any professional development regarding Eureka Math with others who were or were not members of your learning community? If yes, please describe.
9. What are the instructional practices in mathematics that you wish to enhance/improve during your work in the learning community?
10. Other:
Semi-Structured Interview #2

1. Describe/define the word *community*. Do you feel your group is a community?

2. What is your role in the learning community today?

3. What individual traits have allowed you to work with other members of the community?

4. Describe any obstacles or allowances that have impacted your work in the community.

5. In the past year, did you complete any professional development regarding Eureka Math with others who were or were not members of your learning community? If yes, please describe.

6. Describe any instructional artifacts such as protocols or lesson plans that were created.

7. Describe a lesson where you utilized an artifact created during your participation in the community of practice. Why did you choose to implement this artifact?

8. Describe where and when your community of practice met to discuss instructional practice in response to a reform initiative, which was to implement Eureka Math in the middle school. How often did your community of practice meet?

9. One of the tasks of the learning community was to use data from the PARCC assessment to drive instruction for the summer enrichment program. From beginning to the end of the summer enrichment programs, did your beliefs change about using data to drive instruction because of your participation in the learning community? Explain.

10. During your participation in the learning community, what influenced your pedagogic decisions in the classroom?

11. Why do you think the learning community continues to meet?

12. Other:
## Appendix C

### Codebook Excerpt

<table>
<thead>
<tr>
<th>Round #1: Basic Codes</th>
<th>Round #2 In Vivo Codes</th>
<th>Definitions of Round #1 Codes</th>
<th>Round #3 Community of Practice Codes</th>
<th>Data type (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System, social world</td>
<td>Trying to move forward as a unit - E (Dec 2018)</td>
<td>The system (possibly a CoP, Wenger, 1991)</td>
<td>Community as empowerment (mentor and teacher agent); roles and goals are fluid, in flux, and dependent on a number of factors; system/social world has a protocol, norms</td>
<td>Interviews, Summer 2016 &amp; December 2018</td>
</tr>
<tr>
<td>Group empowerment; knowing</td>
<td>Want to progress - E (Dec 2018)</td>
<td>Move forward the situated learning activity (initiative) toward knowing (teacher)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual empowerment knowing</td>
<td>Understand demands of math curriculum - E (Summer 2016)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drilling down content Knowing</td>
<td>Approach math - E (Dec 2018)</td>
<td>Tuning one’s understanding of math content during an initiative</td>
<td>Practice: Drilling down mathematical content and pedagogical strategies (situated learning activity) to progress toward knowing</td>
<td>Interviews</td>
</tr>
<tr>
<td>Drilling down pedagogical decision making (PDM)</td>
<td>Foundational things - E (Dec 2018)</td>
<td>Tuning one’s method of instruction, or practice, during an initiative</td>
<td>Mutual Engagement</td>
<td></td>
</tr>
<tr>
<td>Drilling down content</td>
<td>Divulge strategies - E (Dec 2018)</td>
<td>Shared repertoire</td>
<td>School context: Time</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Time is always a factor - E (Dec 2018)</td>
<td>Space in one’s day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Time to teach a teacher - E (Dec 2018)</td>
<td></td>
<td></td>
<td></td>
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