A UNIVERSITY-LED BEGINNING TEACHER MATHEMATICS COMMUNITY

by

Beth McCord Kobett

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Abstract

The beginning teacher induction experience has been studied extensively, yet is still not fully understood. Teacher induction programs within and between schools vary widely as the number and types of induction services offered to beginning teachers contrast in quality and depth. This study examined the experiences of beginning teachers in a blended learning community provided by the beginning teachers former university. The beginning teacher mathematics community was intended to be a supportive community utilizing the Appreciative Inquiry Approach (AI) for teachers teaching standards-based mathematics; to engage beginning teachers in identifying and using positive experiences in the classroom to inform effective teaching practices; and to encourage and sustain new teachers' teaching efficacy during the beginning years of teaching. A mixed methods study was conducted to explore the experiences of a university-led learning community facilitated through face-to-face sessions and an online community. The 19 participants were beginning teachers from seven school districts in the mid Atlantic region. The Teachers' Sense of Efficacy Scale, Mathematics Pedagogical Beliefs Scale, interview transcripts, face-to-face session transcripts, and online community posts were used to understand participants' teacher efficacy and mathematics pedagogical beliefs. Although statistically significant differences were not found, participants maintained teacher self-efficacy and standards-based beliefs through the intervention. Qualitative data suggest that a university-led learning community supports and sustains beginning teacher efficacy and standards-based mathematics pedagogical beliefs. This study supports CAEP (2013) accreditation standards that require evidence of Program Completer satisfaction.

Dissertation Adviser: Dr. Stephen Pape

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Student: Beth McCord Kobett Adviser: Stephen Pape

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Required Signatures:

Dissertation Adviser Stephen Pape

Committee Member Tom Kane

Committee Member Linda Mustaski

Committee Member Deborah L. Kraft

Student Beth McCord Kobett

Dedication

This dissertation is dedicated to my husband, Tim for his love, endless support, and unwavering encouragement and to my daughters and role models, Hannah and Jenna for believing in me.

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This dissertation is all about building a community of support using Appreciative Inquiry for beginning teachers. Early in this dissertation process I began to understand that building this community through positivity was so important to me because I know that my own path has been sustained, supported, and moved forward by my own community filled with my family, friends, mathematics network, and university.

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Executive Summary

> Teaching takes courage. More courage than I thought I had. So many times I wondered how I could find my courage for the day to do what was right and good for the students …. Then I would realize that we gave it to each other. Lots of times it was just knowing you [the community] all were there, going through it too, you know? Just [knowing] that gave me courage. (I. Lori, personal communication, April, 2016)

The Beginning Teacher Dilemma

In his letter to new teachers, Featherstone (2003) wrote, "New teachers often don't realize that there are sides to take, and that they are called upon to choose" (p. 163). Navigating the process of becoming a new teacher has been described as "sinking or swimming" (Britton, Raizen, Paine, & Huntley 2000), being left "out on a limb" (Schockley, Watlington, & Felsher, 2013), and enduring a court case as if one were on trial (Jersild, 1955). More than 50 years ago, sociologist Dan Lortie (1966) described learning to teach as the Robinson Crusoe Syndrome, where teachers learn, hone, and practice teaching mostly in isolation, all the while fighting for survival.

Well studied and examined, new teacher survival and attrition is a national concern. Reports vary, but researchers estimate that between one-third (Darling-Hammond, 2012) to one-half of new teachers leave teaching within the first five years (Ingersoll & Preda, 2010; Ingersoll & Smith, 2004). Teachers in high poverty and rural settings leave the profession at greater rates (Ingersoll & Preda, 2010). While the public has argued that those teachers who leave must be ill-fitted for teaching or that this demonstrates their weak teaching ability overall, the research indicates that higher ability

teachers are more likely to leave the field (e.g., Lankford, Loeb, & Wyckoff, 2002). This was particularly true for mathematics and science teachers (Henke, Zahn, & Carroll, 2001). While these conclusions may seem dismal, there are many opportunities for hope.

Supporting the Beginning Teacher through Induction

In response to the multiple tensions that beginning teachers face, more than two-thirds of states mandate that school districts implement a new teacher induction program (Wang, Tregidgo, & Mifsud, 2002). Most of these efforts focus on general support such as classroom management and are most often facilitated by general mentors without connections to specific content and pedagogical knowledge (Wang & Odell, 2002) that target effective pedagogical practices (Ormond, 2011). Teachers who engage in a wide variety of induction options are happier and more likely to stay in the teaching profession (Ingersoll & Strong, 2011; Strong, 2009). A critical component of induction programs is the collective effort and positive communication between the university, teachers' association, and school districts (Fulton, 2005).

Teaching Is Complex

Teaching is a complex act reflecting hundreds of pedagogical, content, student, and administrative decisions in a dynamic classroom environment. Many, if not most, of these decisions, reflect a teacher's underlying teacher self-efficacy (Woolfolk Hoy & Spero, 2005), which is the confidence teachers' exhibit in making instructional and managerial decisions that support student learning (Woolfolk Hoy & Spero, 2005). Similarly, researchers have determined that teachers' pedagogical beliefs influence teachers' daily teaching practices (Wilson & Cooney, 2002). Even with new information

and pedagogical exploration in methods classes and field placement experiences, these newly-developed understandings about teaching mathematics may be threatened.

Exploration and experience in mathematics methods classes that espouse social constructivist perspectives is brief and may not reflect a realistic experience of "practicing the thinking of a mathematician" (Pape & Woolfolk Hoy, 2002, p. 201), rendering mathematics pedagogical knowledge tenuous. As beginning teachers' develop teaching practices, their previous and new mathematical learning experiences are reflected in their beliefs and instructional practices (Staub & Stern, 2002). While the national concern for the beginning teacher's plight is important, my POP was concerned with the real struggles of the beginning teachers from a small, private, Mid-Atlantic university, which for the purposes of the present study is fictiously named Mid-Atlantic University.

Supporting Teacher Candidates to Teach Mathematics: A Problem of Practice

This problem is set in a small liberal arts university in the Mid-Atlantic region that graduates approximately sixty early childhood, elementary, and middle school teachers each year. These students exit our program and enter the teaching profession possessing standards-based mathematics pedagogical beliefs about teaching. These beliefs are tenuous and may easily be influenced by traditional school contexts, pressure from colleagues, and the reemergence of the influence of their own experience in learning mathematics. This problem is complex and is linked to the beginning teachers' need for support, knowledge of standards-based curricula, and limited state preservice mathematics pedagogical preparation requirements.

Collecting Evidence through a Needs Assessment

To better understand the problem, I designed and conducted a mixed-methods study to explore the beginning teachers' standards-based mathematics pedagogical needs, current support for teaching mathematics, and need for support to teach mathematics. Thirty-five kindergarten through eighth grade, first- or second-year teachers completed surveys, and ten of these individuals participated in structured interviews. The participants taught in five states, and eight different school districts. Their student population reflected the full spectrum of poverty as well as the learning needs of English Language Learner, and students with disabilities. While participants largely held standards-based mathematics pedagogical beliefs, they also held traditional pedagogical beliefs reflecting teacher-centered practices. The beginning teachers reported that their beliefs were influenced by colleagues, school contexts, and student learning needs and described difficulties about how to teach struggling learners. These teachers sought and found general and mathematics pedagogical support from inside and outside the school and desired additional mathematics pedagogical support to buoy them through the uncertainties of the first years of teaching.

Designing an Intervention to Support Beginning Teachers

The needs assessment findings and literature review pointed to the development of a university-led induction program. Several important criteria from the induction literature informed the design of this intervention. First, the induction program needed to supplement the induction services these beginning teachers would receive from their schools and school districts. Second, participants would likely be hired in multiple school districts across the Mid-Atlantic region. Research indicated that several premiere induction programs integrated online technology to engage participants meaningfully

from multiple sites (e.g., DeWert, Babinski, & Jones, 2003). These programs reduced the beginning teachers' feelings of isolation, engaged beginning teachers in problem solving, and provided the teachers with a safe space to share worries. At the same time induction programs with face-to-face sessions engaged new teachers in developing personal connections, reducing feelings of isolation, and helping teachers to reaffirm their personal purpose for becoming a teacher (Cuddapah & Clayton, 2011). Notably, the research indicated that a variety of induction supports were important components for successful induction programs (Ormond, 2011). Thus, the decision was made to design an intervention that blended face-to-face and online components in a learning community that also included appreciative inquiry (AI).

What Kind of Learning Community Will Best Meet the Needs of Beginning Teachers?

Gathering knowledge and evidence about how learning occurs and operates in these communities was important to the intervention design. Learning communities for teachers may be characterized as Communities of Practice (CoP) and/or Professional Learning Communities (PLC). Learning in a CoP is situated in particular work contexts and is constructed collaboratively by the community members through social interaction around common interests or needs (Lave & Wenger, 1991). Participants' engagement in the community constitutes legitimate peripheral participation as one moves from observer to a fully engaged, contributing member. Alternatively, Senge's (1990, 2007) model of PLCs recommends integrating systems thinking, collaborative work, team learning, and a shared vision to produce organizational results. PLCs are generally implemented in

school settings, community membership is designated by school leaders, and the focus is on using school improvement data to inform the community's goals.

The induction program in the present study was developed as a blended CoP and PLC. Aligned with a CoP, novice teachers volunteered to engage in the community at various participation levels, initiated learning topics, and shared resources and ideas. More like a PLC, the community was designed with an established framework for learning about standards-based mathematics pedagogical practices and a shared vision to support and sustain the beginning teacher through the induction period.

Further, AI, which is a positive, strengths-based approach that focuses on using success to reimagine the future (Cooperrider & Whitney, 2005), served as a framework for the learning community to focus the beginning teachers on positive teaching experiences. Teacher sense of self-efficacy traditionally decreases in the first year as the beginning teachers navigate one challenging situation after another (Woolfolk Hoy & Spero, 2005). Combatting these challenges and threat to teacher self-efficacy required an examination of innovative strategies that could offer beginning teachers' opportunities to build capacity as a community construct a new way of approaching teaching problems. Although applied in education in limited ways, AI has been used with college students to develop successful pathways through college (He, 2013), teacher candidates to positively guide communication with diverse populations (He, 2013), and schools to promote positive teacher and student relationships. The AI process allowed beginning teachers to focus on identifying and examining positive teaching experiences to leverage new successful classroom and student experiences.

Implementing the Intervention

Informed by the needs assessment and literature, I designed a university-led hybrid, learning community with AI as the overarching framework named the Beginning Teacher Mathematics Community (BTMC). Nineteen kindergarten through eighth grade beginning teachers from seven school districts volunteered to participate in face-to-face sessions and in the online community from September 2015 to April 2016. The following research questions were asked:

RQ1: What are beginning teachers' experiences within an Appreciative Inquiry induction program?

A. What components of the intervention do participants report as having the greatest benefit?

B. What were the key factors that enabled or inhibited the beginning teachers from participating in the intervention components?

RQ2: How do beginning teachers' sense of self-efficacy change through participation within the Appreciative Inquiry Induction Program?

RQ3: How do beginning teachers' mathematics pedagogical beliefs change through participation within the Appreciative Inquiry Induction program?

Data were collected from participants' pre-and post-intervention Teacher Sense of Self-Efficacy survey (TSES), Mathematics Teacher Belief survey, and structured post intervention interviews. While no statistical differences were found in the teacher self-efficacy scores or standards-based mathematics pedagogical belief scores, participants maintained relatively high teacher self-efficacy and standards-based mathematics pedagogical beliefs through the intervention. As previously mentioned, the literature

indicates that beginning teacher sense of self-efficacy typically falls during the first years of teaching, therefore, maintenance of the beginning teacher's sense of self-efficacy suggests that the BTMC helped to prevent the typical teacher self-efficacy slide. In addition, the beginning teachers reported that the AI techniques supported positive feelings about their teaching, helped them to identify successful teaching experiences, and helped them connect those experiences to areas of growth. Participants reported that the BTMC offered them a space away from their schools to reflect, engage in deep conversations about students, share new ideas, and build on relationships they developed as teacher candidates. These beginning teachers also indicated that the flexibility of the face-to-face and online components supported and increased opportunities to participate.

The university also benefitted. The BTMC extended the support that is traditionally provided to preservice teachers. As program providers, we are required to collect evidence from our completers to determine satisfaction with their preparation in our program (CAEP, 2013). The beginning teachers requested that they continue their participation in the community indicating potential promise for completer satisfaction ratings.

This small, mixed methods study offered an opportunity to continue the support provided to beginning teachers from one university. While the results may not be generalizable to other universities, important information was collected about our graduates' experiences in the beginning years of teaching. Atypical of the traditional university and graduate relationship, this study offers evidence for the power of using a strengths-based approach to support beginning teachers.

Chapter 1

The Beginning Teachers' Challenge

Unlike any other professionals, beginning teachers will likely carry responsibilities equal to or greater than their more experienced colleagues. The beginning teacher's teaching assignment, often including the most challenging students, room assignments, and schedules, is expected to be identical or even more difficult than the veteran teacher next door (Darling-Hammond, 2006). In no other profession will novices be immediately expected to perform at the same level as their veteran counterparts (Le Maistre & Paré, 2010). The probability of a beginning teacher leaving the teaching profession is concerning, as almost 50% of public school teachers are likely to leave the teaching profession within the first five years (Ingersoll & Preda, 2010; Ingersoll & Smith, 2004), and, contrary to logical reasoning, they are not always the weakest teachers (Ingersoll, 2010, 2012). Additionally, high-poverty, high-minority, urban, and rural schools have the highest rates of turnover in the nation, often surpassing the 50% average attrition rate (Ingersoll & Preda, 2010).

While it may be tempting to simply hope that beginning teachers just survive their first years of teaching in order to move on to more productive years, millions of K-12 students are impacted daily by these new teachers' pedagogical and instructional decisions. During the crucial early years of working in the profession, beginning teachers form their identities, develop teaching patterns, and reach decisions to stay or leave the profession (Ingersoll & Smith, 2004; Wang, 2002; Wang, Odell, & Schwille, 2008). Meanwhile, their students are learning or not learning mathematics, building their own notions about the role of mathematics in their lives, and developing internal dispositions

for their own mathematics attainment. These students of beginning teachers are more likely to receive less effective instruction (Darling-Hammond, 2000; Rockoff, 2004) setting in motion a perpetuation of the existing achievement gap and even future income disparities (Chetty, Friedman, & Rockoff, 2011; Friedman, 2000; Hanushek, 2011). Students, schools, school systems, universities, and the beginning teachers themselves cannot afford to wait until these new teachers' reach their fifth year of teaching to build mathematics teaching competency. Developing, sustaining, and supporting deep mathematics pedagogical knowledge for beginning teachers is essential to student success (Darling-Hammond & Richardson, 2009). Drawing on these critical perspectives, we turn to my Problem of Practice.

Problem of Practice

My Problem of Practice (POP) focuses on the early childhood, elementary, and middle school beginning teachers' mathematics pedagogical beliefs and practices. Though beginning teachers enter into the teaching profession with standards-based beliefs about teaching, they struggle to maintain effective pedagogical practices in varying school contexts and support systems (Kennedy, 2010). These struggles are represented in several ways and might include conflict with balancing the curricular and assessment demands of the school district and school, addressing student content needs, or parent pressure to maintain traditional teaching strategies. The beginning teachers may want to teach mathematics the way they were taught at the university, but the multiple pressures result in misalignment of their beliefs and practices.

Context of the Problem

This problem is set in a small liberal arts university in the Mid-Atlantic region and reflects deeper, underlying mathematic pedagogical needs of the beginning teacher more broadly. Increased need for support, standards-based curricula, and limited mathematics methods courses are all issues that contribute to the problem.

The university graduates, approximately sixty early, elementary, and middle school teachers each year. While the program is not designated as a cohort program, students attended classes together and report developing strong bonds with peers and professors (Weyforth, personal communication, 2013). Upon graduation and well into the first years of teaching, former students continue to seek support from the university faculty in addition to the official support arranged through the school district induction programs. For example, from August 2013 to October 2014, former students from this university initiated more than 300 informal contacts requesting varying types of support. They requested advice about teaching mathematics, student learning issues, and how to achieve successful family communication. This small university setting, cohort atmosphere, and continued engagement with alumni provide a unique context for this POP. Currently, beginning teacher queries and concerns are addressed on an individual basis while others' needs are not being met.

While it is an accepted practice for universities to dissolve responsibility to preservice education students upon graduation, recent national concern about teacher attrition rates has changed the tide of both the public perception and the reality of the long-term responsibility of teacher preparation programs (DeAngelis, Wall, & Che, 2013). The Council for Accreditation of Educator Preparation (CAEP, 2013) Standard 4,

Program Impact, requires teacher preparation programs to demonstrate impact of "completers on P-12 student learning and development, classroom instruction, and schools, and the satisfaction of its completers with the relevance and effectiveness of their preparation" (p. 14). The university must collect data regarding satisfaction of novice teachers' employers including these teachers' promotion and retention rates thereby extending the responsibility of the university to its graduates well beyond initial preparation.

These challenges from the accrediting organization for teacher preparation programs are further complicated by the unprecedented, historic standards-based reform and accountability movement aimed at moving student achievement forward. While not considered a national curriculum because each state decides whether to adopt these standards or not, the Common Core State Standards for School Mathematics (CCSSM; National Governors Association Center for Best Practices & Council of Chief State School Officers [NGACBP & CCSSO], 2010) are currently being implemented in forty-three states, District of Columbia, four territories and the Department of Defense Education Activity (Achieve, 2013). The CCSS-M (NGACBP & CCSSO, 2010) emphasize three instructional shifts including fewer topics per grade level, intentional coherence across grades, and higher levels of rigor. Students must be able to understand mathematical content as connected to other disciplines and demonstrate conceptual understanding of mathematics. The Standards for Mathematical Practice (NGACBP & CCSSO, 2010) identify the dispositions and habits of mind that students must be able to exhibit including the ability to: (a) problem solve and persevere, (b) reason abstractly, (c) construct viable arguments, (d) model with mathematics, (e) use and select appropriate

tools, (f) attend to precision, (g) look for and make use of structure, and (h) express regular reasoning, while learning rigorous mathematics content (p. 6).

With the implementation of the CCSS-M (CCSSM; National Governors Association Center for Best Practices & Council of Chief State School Officers [NGACBP & CCSSO], 2010), Maryland novice elementary teachers are expected to effectively teach mathematics with only a single required mathematics methods course as undergraduates. Novice teachers must be able to integrate complex theories such as social constructivism with deep knowledge of their students to plan effective student-centered lessons. Lesson and task development from a standards-based curricula must be written and implemented with the lens of the students' needs always in mind, noting possible misconceptions, learning trajectories and solution pathways, and continually reflecting a deep understanding of social constructivist mathematics pedagogies (Boaler, 2002; Gresafali & Cobb, 2006; Hudson, Kloosterman, & Galiendo, 2012).

Teachers' instructional practices should facilitate classroom learning opportunities for students that specifically elicit the student behaviors identified in the Standards for Mathematical Practice (NGACBP & CCSSO, 2010). The roles of a mathematics teacher as described by the *Professional Standards for School Mathematics* (National Council of Teachers of Mathematics, 1991) indicate four essential pedagogical areas encompassing planning, delivery, and assessment:

- Setting goals and selecting and creating mathematical tasks to help students achieve these goals;
- Stimulating and managing classroom discourse so that both the students and the teacher are clear about what is being learned;

- Creating a classroom environment to support teaching and learning mathematics;
- Analyzing student learning, the mathematical tasks, and the environment in order to make ongoing instructional decisions. (p. 5)

Teachers' instructional practices should align with the notion that "mathematical understanding is the ability to justify, in a way appropriate to the student's mathematical maturity, why a particular mathematical statement is true or where a mathematical rule comes from" (NGACBP & CCSSO, 2010, p. 4.) by demonstrating how their own content and pedagogical knowledge extends well beyond procedural knowledge of algorithms. In addition, pertinent mathematics pedagogy recommendations from the National Mathematics Advisory Panel (NMAP, 2008) include strengthening mathematics preparation by giving teachers numerous and varied ways to access mathematics content and methodology (NMAP, 2008) in university-based courses, professional learning opportunities, and continuous reflection. More recently, the Council for the Accreditation of Educator Preparation (CAEP, 2013) in their report, *Accreditations and Standards and Evidence: Aspirations for Educator Preparation Recommendations for the CAEP Board,* identify Content and Pedagogical Knowledge as their first standard and include the additional categories of Instructional Practice, The Learner and Learning, and Equity. Notably, CAEP reports that teacher candidates need a "background include[ing] experiences that develop deep understanding of major concepts and principles within the candidate's field" (CAEP, 2013, p. 13).

Underlying Theories of Standards-Based Mathematics

The university context provides an important backdrop for understanding these beginning teachers' mathematical pedagogical needs. As previously noted, these novice teachers have taken only one required mathematics methods course that is heavily rooted in social constructivist and sociocultural theories. They exhibit only an initial understanding of the theories that support standards-based mathematics instruction as defined by the CCSS-M (NGACBP & CCSSO, 2010), yet are expected to be able to translate theory and pedagogy into classroom practice (Murphy, 2008) amidst demanding school contexts and multiple mathematical topics. This section describes those theories that support effective standards-based mathematics teaching.

Social Constructivism

The underlying principles of social constructivism emphasize student construction of knowledge from prior mathematical understandings (Cobb et al., 1991; Kamii & Lewis, 1990). Students are challenged to create meaning by building a bridge from information already known to new information through their own personal development (Ertmer & Newby, 1993; Kim, 2001). Therefore, their knowledge is developing, evolving, and becoming enriched as new learning opportunities are presented. Learners are challenged to make sense of the mathematics and acquire their own mathematical identity as problem solvers and critical thinkers. Students in these classrooms are routinely engaged in tasks that stimulate connected and conceptual thinking (Boaler, 2002; Gresalfi & Cobb, 2006). Novice teachers must understand the trajectory of their students' developing mathematics content knowledge, student misconceptions, and the individual social, emotional, and cognitive strengths and weaknesses of their students (Kamii & Lewis,

1990). Social constructivist classrooms embody equal responsibility from teachers and students as teachers facilitate students' thoughts and ideas through rich, problem-based tasks (Boaler, 2002; Hills, 2007; Windschitl, 2002). Students stretch their own thinking by questioning, conjecturing, and making connections about the mathematics they are learning.

As beginning teachers interpret standards-based mathematics content and practices and implement these ideas in the classroom, they need to understand those underlying theories that support their curricular decisions. Social constructivism is rooted in social interaction that provides opportunities for students to internalize knowledge (Powell & Kalina, 2009). Student construction of knowledge through inquiry supports the notion of learning as a dynamic and transformative process (Borasi, 1992; Powell & Kalina, 2009). Social constructivism describes how students gain knowledge within the classroom context and provides a framework for how teachers may present and facilitate lessons that promote questioning, discovery, and understanding of patterns and relationships (Hills, 2007; Lave, 1988, 1996; Powell & Kalina, 2009). With the recent implementation of standards-based mathematics reform that emphasizes rigor including deep conceptual understanding, problem solving, and multiple uses of tools and mathematical representations, students are expected to engage in high-leverage mathematical tasks and need environments that support student-learning experiences designed to promote student questioning, connections, and reflection (Ball & Bass 2000; Boaler, 2002; Hills, 2007; Simon, 1995). The beginning teacher has often had limited experience implementing instructional practices aligned with social constructivist theory such as designing inquiry lessons in student-driven collaborative groups (Hills, 2007).

The social constructivist perspective is not just about how teachers design grade-level lessons, but also conveys that student learning is highly personal and actively builds on individual prior knowledge (von Glaserfeld, 2010). Crucial to this perspective is the notion that students learn more deeply when presented with problems in real-world contexts. In understanding the role of social constructivism in a mathematics teaching/learning environment, novice teachers need to conceptualize that children make sense of their world individually and enter into learning tasks from different perspectives that are distinctly different from the way adults approach learning (Confrey, 1994). When teachers have opportunities to reflect on social constructivist perspectives and their relationship to building mathematics meaning with depth, they understand the significance of social opportunities for all stakeholders including learners and teachers as they discuss, defend, and negotiate their ideas (von Glaserfeld, 2010). As teachers facilitate classroom environments that embody the social constructivist perspectives, they engage in thoughtful and intentional planning and reflection about the learner's role in the mathematics classroom.

Teachers are challenged to understand the conceptual underpinnings of constructivism as a perspective on learning as opposed to a perspective on teaching (Cobb, Yackel, Wood, Wheatley, & Merkel, 1988; Fosnot & Perry, 1996). They may implement pieces in isolation and may need ways to translate their understanding of the perspective into classroom practice (Windschitl, 2002). Teachers may use manipulative materials or have students work in groups, but without the explicit purpose of developing conceptual understanding by connecting the concrete representation to the algorithm, the students may not learn important mathematics concepts. Students become engaged in a

show and tell activity where they explain how they solved problems but without the crucial conversations that link solutions to mathematical conceptual understanding (Ball, Lubienski, & Mewborn, 2001; Stein, Engle, Smith & Hughes, 2008; Wood & Turner-Vorbeck, 2001). Teachers need deep content knowledge so they can assess student understanding and ask questions that push students to reflect on their own thinking (Ball, et al., 2001; Cobb & Jackson, 2011; Stein et al., 2008). Balancing students' needs to construct knowledge with teachers' understanding of learning can create a disconnection in classrooms as both participants struggle to make meaning of the mathematics as it is framed through instructional activities (Windschitl, 2002). This delicate balance can be further threatened by the needs of novice teachers as they strive to teach according to the expectations of the school's leadership, colleagues, parents, and even students.

Sociocultural Influence

A sociocultural lens on mathematics pedagogy adds another dimension for consideration in designing and delivering effective mathematics instruction. Understanding how characteristics such as socioeconomic level and cultural background influence teacher development of mathematical identities and competencies in the classroom is essential to student mathematical proficiency (Jackson, 2013; Walshaw, 2013; Windschitl, 2002). The sociocultural perspective embodies the action and reaction of both the learner and environment by putting a lens on the "relationship between learners and their learning environments" (Gee, 2008, p. 76) for one to better understand the myriad factors that influence learning. Additionally, this perspective incorporates looking for evidence of opportunities to learn including instruction targeted at (a) the learner's Zone of Proximal Development and prior experiences; (b) function of speech;

and (c) social learning opportunities within a cultural framework (Gee, 2008; Vygotsky, 1978). Each learner in a classroom interacts and responds to the learning environment independently and thus creates meaning individually. The teacher's role is powerful as they select appropriate mathematics tasks to facilitate and scaffold every student's learning opportunities while keeping in mind their sociocultural influences (Walshaw, 2013).

Mathematics Pedagogical Knowledge and Beliefs

Deep understanding of the social constructivist and sociocultural theories can inform and influence the beginning teachers' daily teaching practices. Learning how to teach mathematics as a teacher candidate incorporates these theories, which is then translated to specific pedagogical knowledge and beliefs about teaching mathematics. This section describes the importance for understanding the beginning teacher's mathematics pedagogical knowledge and mathematics pedagogical beliefs.

Mathematics Pedagogical Knowledge

Developing mathematical pedagogical knowledge in teacher candidates is a complex task that requires integration of particular subsets of knowledge comprising knowledge of mathematics content, curriculum, and students. Teachers need to be able to integrate knowledge of pedagogy into their lessons to effectively develop student conceptual understanding and thus support achievement. Selecting mathematically rich tasks, designing complex questions that prompt students' thinking, and implementing formative assessment techniques necessitates a deep understanding of how to develop student conceptual understanding.

Shulman (1987) identified pedagogical content knowledge as "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (Shulman, 1987, p. 8). While Shulman identified content knowledge (or subject matter knowledge) and teaching pedagogy as two separate entities, Ball and Bass (2000) discussed the essential need for integration of mathematics content and pedagogy because teaching requires extensive and appropriate knowledge of both facets in order to teach effectively. A working definition of pedagogy should include those aspects that advance student understanding and achievement; it should describe what the teacher should know, acknowledge the interaction of teacher and learner, and identify how learner knowledge is used in lesson design, instructional decision making, and assessment. Further refining this description of mathematics pedagogical content knowledge, by incorporating subject matter knowledge and pedagogical content knowledge for teaching in concert, Ball, Thames, and Phelps (2008) distinguish six additional types of knowledge that teachers would need to demonstrate effective subject and pedagogical content knowledge. The subsets include a) Common Content Knowledge; b) Specialized Content Knowledge; c) Knowledge of Content and Students; d) Knowledge of Content and Teaching; and (e) Knowledge of Curriculum (Ball et al., 2008).

Each of these subsets of knowledge includes highly specialized teaching skills, knowledge, and practices that combine to create a robust definition and understanding of mathematics pedagogy. Common Content Knowledge and Specialized Content Knowledge require not only deep understanding of the mathematical content for the students' grade level but knowledge of subject matter specific to content categories for

varying levels of students. Development of this type of knowledge occurs simultaneously in mathematics courses, methods courses, and in teachers' classrooms. Teacher candidates and beginning teachers' mathematics knowledge can be strengthened with explicit work in developing conceptual understanding. Knowledge of Content and Students is pedagogical knowledge that integrates knowledge of mathematics and students (Ball et al., 2008). As teachers design lessons for students, they must also know about their students' prior mathematics knowledge and anticipate their misconceptions. Teachers who possess Knowledge of Content and Students understand the mathematics beyond procedures and can represent this concept using visual and manipulative models and connect the concept to relevant contextual examples that students experience in real-world settings. They also understand how students will naturally assimilate their constructs of prior mathematics understanding and can build interesting and rich tasks that illustrate multiple and meaningful representations for the mathematics they are teaching.

Another important type of mathematics knowledge for teaching includes Knowledge of Content and Teaching as a "knowledge that combines knowing about teaching and knowing about mathematics" (Ball et al., 2008, p. 9). While this domain may sound quite similar to *Knowledge of Subject Matter Content*, it focuses on the interrelationship of mathematics content and teaching including lesson planning, sequencing of topics, responding to student questions, and other instructional decision-making opportunities that occur within the context of instruction. For example, when deciding how to design a lesson on place value, teachers need to make instructional decisions about whether to use single cubes or base ten blocks for place value

manipulative materials and choose a number line or a place value chart as the representation that should be introduced first. They also must be able to respond to specific student questions about place value when facilitating meaningful learning opportunities with these representations. As these examples suggest, mathematics pedagogy requires vigorous discussion, clarification, insight, experiences, and opportunities to develop rich understanding for both teachers and students. This multi-faceted knowledge may be challenging for novice teachers who have just completed their certification. Additional opportunities are needed for them to build this complex pedagogical knowledge as they develop and hone their mathematics teaching practices. To plan instruction aligned with standards-based curriculum and social constructivist perspectives, teachers engage the mathematics pedagogical knowledge as they adapt to the students' developmental needs. Lesson and task development from standards-based curricula must always be written and implemented with the lens of the student needs in mind, noting possible misconceptions, learning trajectories, and solution pathways that continually reflect a deep understanding of pedagogy informed by the social constructivist perspective (Boaler; 2002; Gresafali & Cobb, 2006; Hudson et al., 2012). Furthermore, novice teachers must be able to support the development of their students' mathematical identities in safe and equitable environments that promote risk-taking in solving problems and sharing mathematical ideas (Jackson, 2013).

As teacher candidates transition into their initial teaching placements, their ability to enact this complex pedagogical knowledge in their classrooms may deteriorate because of their effort to maintain classroom management within particular classroom contexts and environments and result in more traditional types of teaching (Kennedy, 2010).

While the beginning teacher may receive support from induction programs that initially focus on pedagogical knowledge, they more often offer humanistic support such as classroom management or emotional support. This type of support is provided because induction programs are often general and facilitated by generalists (Wang & Odell, 2002) rather than content-specific experts.

Mathematics Pedagogical Beliefs

Underlying a teacher's mathematics pedagogical practices is a belief system for teaching mathematics that is built from a history of learning mathematics as well as university classroom and field placement experiences. A crucial factor in my study is understanding and determining the mathematics pedagogical beliefs of novice teachers because of the influence those beliefs have on their teaching practices. Many times when teacher candidates are learning about mathematics pedagogy, they often express excitement and shock about the social constructivist perspective that enhances their own mathematical conceptual understanding. At first, they often call out, "Why didn't we learn this way?" exclaiming frustration at lost opportunities to learn mathematics in depth and then sadness over the loss of opportunities to learn conceptually and how that knowledge might have shaped their academic mathematics achievement. Initially teeming with excitement about their newfound pedagogical knowledge and armed with novel strategies, teacher candidates enter their field placements to test these new methodologies for teaching mathematics. They marvel at the conceptual mathematical understanding students can develop when given rigorous tasks and proudly proclaim their students' thinking is remarkable when solving problems. They apply theory to practice, constructing their mathematics pedagogical knowledge, simultaneously breaking down

prior beliefs about how mathematics should be taught and building new reform-minded dispositions.

Given that prior schooling experiences are so influential, teacher education programs must consider the powerful impact more than twelve years of observational learning has on teachers' beliefs (Lortie, 1975; Kennedy, 1999, 2010). This can be particularly problematic when teacher candidates are learning standards-based mathematics pedagogy. When teachers were asked to respond to various reform and traditional classroom situations, researchers found that while they claimed to believe in standards-based ideas, their actual practices were often characterized as traditional, teacher-centered practices (Kennedy, 1991; Kennedy, 2006, 2010). These reported teaching beliefs are complex and consist of ideas about students, resources, teaching, knowledge, and standards (Handal, 2003). The belief statements may reflect more traditional responses as teachers make many decisions instantly and with minimal reflection, relying heavily on past experiences to inform present decision making (Kennedy, 1999, 2010). Teacher candidates often avoid altering their beliefs about teaching mathematics because of the strong influence of their traditional learning experiences (Kennedy, 1999; Hudson et al., 2012). They struggle to implement the pedagogical practices in their classrooms even if they observed another teacher model them repeatedly and report that they need to be able to try the pedagogical practice with supervision and support (Hudson et al., 2012).

The problem of transferring newly learned mathematics pedagogy to the classroom is documented in research. Gainsburg (2012) observed and interviewed middle and high school beginning teachers in mathematics classrooms to examine whether recent

graduates implemented university program-emphasized teaching practices and the factors that support or constrain the implementation of the practices. As he observed the teachers, he rated their teaching against previously identified effective teaching practices such as posing questions with high cognitive demand. Interviews were conducted after the conclusion of lessons to explore factors that influenced the implementation of these particular practices. Despite a strong emphasis on reform mathematics in the preservice program of these recent graduates, most of the beginning teachers taught using traditional teaching methods. Many of the new teachers lacked the confidence to translate the concepts learned in the university classroom to their secondary classrooms unless they had opportunities to try out the concepts with school mentor or university supervisor support. Additionally, the beginning teachers were worried about taking risks in the classroom, finding resources to support standards-based mathematics, and the time it takes to implement student-centered lessons.

Beginning teachers' prior experiences can permeate every instructional decision they make from grouping practices to lesson design (Staub & Stern, 2002). If teachers' beliefs and the standards-based beliefs do not correspond, then daily mathematics instruction is compromised (Handal, 2003; Kennedy, 2010). To support student achievement through effective teaching practices, beginning teachers need to be able to recognize students' ideas and to respond and support the development of those ideas by listening, observing, and reacting appropriately to students (Kennedy, 1999, 2010) and possess deep mathematics conceptual understanding to offset the overarching influence of prior beliefs on their instructional decision making.

Factors Associated with Learning to Teach

There are several additional, crucial factors that affect teacher candidates and beginning teachers' development. Teaching mathematics should embody complex knowledge about the interplay of social constructivism and sociocultural influences at work in the classroom. These theories should inform the beginning teachers' standards-based mathematics teaching practices, but there are other factors that can influence the teaching and learning of mathematics. The section includes a discussion of the underlying cultural factors and teacher factors that reveal how the delicate dynamic between teachers and students unfolds.

Cultural Factors

An important factor associated with my POP focuses on understanding the role of cultural contexts in novice teacher mathematics pedagogical practices. The graduates from Mid-Atlantic University are likely to be hired to teach in high poverty schools. Over the past three years, 80% of our graduates were hired to teach in schools with 60% or higher poverty rates. Students in grades K-12 who live in the highest poverty and those with great academic needs are most likely to be taught by beginning teachers (Rivkin, Hanushek, & Kain, 2005). Additionally, novice teachers are more likely to teach less effectively (Darling-Hammond, 2006; Rockoff, 2004), perpetuating existing achievement gaps and reducing future income wages for their students (Chetty et al., 2011).

Students of differing cultures enter classrooms with teachers of varying backgrounds, educational levels, experience, and expectations. Together they unite or muddle through an educational experience that results in resounding success, dismal failure, or something in between. While teacher preparation programs focus on lesson

planning and understanding standards, teacher candidates may not have had sufficient experiences teaching economically diverse populations and may not be required by state certification programs or individual universities to enroll in courses that focus on culturally responsive teaching practices. Technically, a beginning teacher could be teaching pedagogically sound lessons but not within a culturally responsive teaching framework that "is defined as using the cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for teaching them more effectively" (Gay, 2002, p. 106). This cultural and pedagogical dynamic is not only problematic but could signal the demise of the K-12 students' mathematics success. Novice teachers need opportunities to learn how to support student success by attending to student strengths and validating student culture (Gay, 2002, 2010). Unfortunately, "it is not likely that teachers will spontaneously develop forms of practice that support African American students to learn mathematics with understanding" (Jackson & Wilson, 2012, p. 363), and, therefore, schools must take time, make an effort, and consider pedagogical implications for African American students and other students of color.

While teachers may not be able to effectively change their students' socioeconomic status, they can design and implement teaching practices that support, engage, and stimulate students' learning. Beginning teachers must understand that "pedagogical actions are as important as (if not more important than) multicultural curriculum designs in implementing culturally responsive teaching" (Gay, 2002, p. 109) and must be able to include cultural scaffolding to build success-oriented opportunities for all students. As these beginning teachers navigate culturally and economically diverse classrooms, they will need explicit mentors as well as school leadership and induction

support to develop effective teaching practices that will build success for all learners. Simply implementing instructional activities without an understanding of the complex interaction of school culture and students' cultural backgrounds often means that the mathematics instruction and student learning will suffer (Ladson-Billings, 2000, 2009).

As beginning teachers enter their new classrooms, they leave behind their preservice preparation structure that was informed by methods courses, content classes, and field placement experiences. During their preservice preparation, they taught in classrooms with mentor teachers, were supported by university faculty, and participated in perhaps hundreds of classroom discussions about students and teaching. The transition from learning to teach to becoming a professional teacher includes a shift from mostly social and collaborative to largely isolated learning (Ingersoll & Strong, 2011; Johnson & Birkeland, 2003). The beginning teachers were likely to have been encouraged to reflect on their lesson planning, students, assessments, and engagement with other professionals and peers. They are then hired in school systems with varying types of induction, mentoring, and opportunities for reflection. They still need consistent support for developing content and pedagogical knowledge that is standards-based (Wang & Odell, 2002) because the standards-based mathematics instruction ideal is often fundamentally different from what they experienced as students in their own learning environment and university school settings. Even when schools or districts offer induction supports, they are often weak, uneven, and do not reflect the immediate needs of the beginning teachers (Ormond, 2011). This is often because mentors are not taught how to guide their mentees in developing effective pedagogical practices (Ormond, 2011).

Teacher Factors

The prior section described the importance of recognizing the role of culture in the classroom. Particular teacher factors may also influence daily decision making and ultimately change beginning teacher progress and student mathematics conceptual knowledge. These include the beginning teachers' development of (a) teacher identity, (b) teacher self-efficacy, and (c) mathematics and mathematics pedagogical beliefs.

Teacher identity. Another important factor influencing novice teacher development is how they shape and develop their identities as mathematics teachers. Defining identity, however, is somewhat elusive and may be described using narratives (Sfrad & Prusak, 2005), metaphors (Hunt, 2006), and types and kinds of teacher talk (Cohen, 2010). Additionally, various aspects of the teaching context including the "school environment, the nature of the learner population, the impact of colleagues and of school administrators, can all be influential in shaping a student or new teacher identity" (Beauchamp & Thomas, 2009, p. 184).

One of the issues that novice teachers face is the complex relationships they build in their new school contexts. Their identities as teacher candidates have been shaped by their experiences, and they must now try to align the former identity with the new identity as they integrate into new school environments. While beginning teachers are attempting to assimilate into new environments, they are co-constructing their identities, which are continually being shaped through classroom and school experiences (Hong, 2010). Teacher professional identity "provides a framework for teachers to construct their own ideas of 'how to be', 'how to act' and 'how to understand' their work and their place in society" (Sachs, 2001, p. 15). These three facets of professional identity illustrate a

flexible and dynamic opportunity for novice teachers to negotiate their own understandings of who they are as teachers.

The development of teacher professional identity is also influenced by the emotional climate of the educational environment and can affect daily and long-term decision-making (Flores & Day, 2006). Over the course of a short time span, teachers can experience the positive emotions of love, care-taking, joy, pride, and job satisfaction. They also experience negative emotions "when control of long held principles and practices is challenged, or when trust and respect from parents, the public and their students is eroded" (Flores & Day, 2006, p. 221). This multitude of emotions can wreak havoc on self-perceptions, create vulnerability, and impact instructional decision-making. These teachers are subjected to pressure through socializing factors that exist in varying school contexts and may be heavily influenced by the micropolitics of school environments (Ballet & Kelchertmans, 2009). They may make mathematics instructional decisions that do not reflect their true beliefs because they feel pressured to satisfy their colleagues' expectations resulting in another misalignment of mathematics pedagogical beliefs and practices.

As the novice teacher begins teaching, factors including differing leadership expectations and peer or co-teacher philosophies, which are often different from those they experienced as teacher candidates, influence identity development. Beginning teachers often find that their new roles conflict with their perceptions they had as teacher candidates and they must reconcile these perceptions with their actual practices (Flores & Day, 2006). As teacher candidates, they have identified their strengths based on feedback they have received and prior teaching successes. They then bring these self-perceptions to

their new classrooms, which may be challenged by contexts they have not experienced (Flores & Day, 2006; Hong, 2010). Furthermore, novice teachers may shift these identities in response to change in standards-based teaching environments where expectations and uncertainty may be high (Stronach, Corbin, McNamara, Stark, & Warne, 2002).

Beginning teacher identity development is individual and is often connected to particular environments. These multiple contextual factors influence how teachers conceptualize and often reconceptualize their identity and teaching practices because they may hold several identities that can fluidly change from moment to moment in reaction to these varied contexts (Akkerman & Meijer, 2011). Novice teachers build identities that reflect multiple perspectives and teaching practices that are influenced by these contexts that may or may not align with their pedagogical beliefs (Beijaard, Meijer, & Valoop, 2004).

Teacher candidates build their teaching identities by assimilating university classroom theories in classroom contexts and then designing and implementing lessons under the pedagogical constraints of their cooperating teachers' classrooms (Britzman, 2003). These teaching identities incorporate past experiences as students, their current experiences in field placement classrooms, and their newly developed pedagogical beliefs about teaching and, consequently, they are likely to be reflected in their teaching practices. Therefore, teacher candidates are expected to learn complex subject matter in the same context and at the same time in which they will be expected to develop and hone new teaching skills (Darling-Hammond & Berry, 2006; Flores & Day, 2006). They experience social constructivist pedagogical ideas, yet have very little opportunity truly

learn mathematics in the same way they will be expected to teach (Pape & Woolfolk Hoy, 2002). This newfound knowledge and identity are tentative as teacher candidates often have idealized notions about teaching and base their perception of the teaching and learning process on their own experiences as students (Kennedy, 1999; Murphy, Delli, & Edwards, 2004). These personal beliefs can serve as "barriers to change by limiting the ideas that teacher education students are able and willing to entertain" (Feiman-Nemser, 2001, p. 1016). In fact, many teacher candidates believe they understand and know what teaching entails because they view their own schooling as a type of apprenticeship, learning to teach as observers (Lortie, 1975). They are likely to believe education courses are simply a hurdle through which they must jump to fulfill their expectations, self-beliefs, and professional identity (Britzman, 2003).

Teacher self-efficacy. A component of the more global description of teacher identity and an important factor in my study is teacher self-efficacy. Albert Bandura pioneered work in the concept of teacher self-efficacy that he defined as "beliefs in one's capacity to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Teacher efficacy may also be described as a judgment about one's ability to teach and produce particular student learning outcomes (Armor et al., 1976; Bandura, 1977). Teacher efficacy has multiple classroom implications as it contributes to the degree of labor beginning teachers are willing to devote to planning and delivering instruction (Tschannen-Moran & Hoy, 2001). Examining beginning teachers' self-efficacy is important because they often do not accurately assess their own ability to teach and to balance the demands of the classroom, and this may weaken their daily instructional decisions (Woolfolk Hoy & Spero, 2005). The complexity of the classroom

often challenges beginning teachers' previous notions of teacher self-efficacy as they tend to engage in defensive discourse by providing multiple reasons to explain the tension between their actual teaching practices and what is required to be an excellent teacher (Rushton, 2010). Additionally, teacher self-efficacy is connected to stress and burnout as novice teachers who have high teaching efficacy are more satisfied with their teaching and reported less overall stress (Woolfolk Hoy & Spero, 2005). The threads of teacher's sense of self-efficacy can be found in practically every realm of the classroom environment and are relatively stable once established (Tschannen-Moran & Hoy, 2001). Therefore, teacher efficacy must be monitored and addressed as soon as teachers enter the classroom. The level of teacher's efficacy beliefs related to classroom management appear to be an important indicator of teacher burnout (Brouwers & Tomic, 2000).

Teacher efficacy is positively correlated with six classroom behaviors: (a) learning to use novel teaching strategies, (b) using classroom strategies that focus on building student self-regulation, (c) providing targeted teaching to struggling students, (d) building student perceptions of their own academic strengths, (e) setting attainable goals, and (f) demonstrating persistence even when students are failing (Ross, 1998). Educators who feel efficacious about their instructional techniques, classroom management, and ability to develop relationships with students may have more cognitive and emotional skills and strategies for supporting student engagement in rigorous tasks and deep conceptual learning (Woolfolk Hoy & Davis, 2005).

Conclusion

The problem of supporting beginning teachers' mathematics pedagogy is a complicated interplay of context and underlying teacher factors. These contexts shape

their belief systems and include the beginning teachers' learning of mathematics as elementary students, the way they learn to teach mathematics as undergraduate students, and their experiences teaching mathematics in an era of standards-based reform. One beginning teacher might learn mathematics in traditional classrooms and then move to the university classroom to learn about teaching mathematics using instructional practices that align with the social constructivist perspective. This same teacher might then be hired to teach elementary or middle school mathematics but be mentored by a teacher who holds traditional views. Equipped with a fragile understanding of the social constructivist and sociocultural perspective, the beginning teacher's mathematical pedagogical practices may falter under the competing contexts.

At the same time, particular underlying factors also influence the beginning teacher's mathematical pedagogical beliefs and practices. Their teacher identity and teacher self-efficacy is continually being shaped by their experiences and perceptions of those experiences. Underlying, long-held beliefs about learning and teaching mathematics and complex cultural contexts also contribute to their current beliefs. Finally, the kinds and types of induction support they receive for teaching mathematics as they enter their first classroom experience is profoundly significant to their development.

Chapter 2

Assessing the Needs of Beginning Teachers for Teaching Mathematics

As the literature revealed, the beginning teacher's journey in understanding mathematics instruction is complex and is influenced by a complicated interplay between beliefs about teaching mathematics and the underlying factors that influence those beliefs. To understand these beliefs and underlying factors within the university community, I conducted a mixed methods study to explore the changes in the beginning teachers' mathematics pedagogical beliefs and practices in their first years of teaching. I also wanted to determine the kinds of support they were receiving and whether the beginning teachers felt this support was aligned with their beliefs and were a valuable contribution to their mathematics teaching.

I designed this mixed-methods need assessment study as an exploration of the beginning teachers' needs and to acknowledge the significance and importance of using both types of data in the research process. This study was conducted using a pragmatic paradigm approach to mixed methods to support including "a combination or mixture of methods and procedures that work best for answering research questions" (Johnson & Onwuegbuzie, 2004, p. 17). My needs assessment study was designed to answer the following research questions:

RQ1: What are beginning teachers' pedagogical beliefs about teaching mathematics?

RQ2: To what extent do beginning teachers' pedagogical beliefs about teaching mathematics change during the first year of teaching?

RQ3: What support do beginning teachers receive for teaching mathematics in elementary and middle school settings?

The purpose of this chapter is to describe the context of the study, participant selection, data collection, data analysis, findings, and study limitations.

Context of Study

My POP identifies the beginning teachers' struggle with aligning their beliefs about teaching mathematics as they adjust to the demands of their first year of teaching. All of the beginning teachers in this study graduated from the same university with teaching certification in early childhood, elementary, or middle school education. Our School of Education graduates are typically hired in school districts in the same state, but a few move to teach in other states.

For many years, our graduates continue to make contact with the university as they look for various kinds of mathematics pedagogical and emotional support. Between fall 2013 and March 2014, graduates from the university in the study, now third year teachers, made 137 contacts with their former mathematics methods professor through email, phone calls, and social media requesting supports including, but not limited to, advice for communicating with parents as well as ideas for (a) mathematics lessons, (b) interpretation of CCSS-M (NGACBP & CCSSO, 2010), (c) curricula, and (d) ways to access mathematics materials. Many expressed enormous concern about their daily instructional decisions regarding lesson planning and implementation. Some identified themselves as being in desperate trouble and needing a great deal of support, while others desired just a few moments of my time to direct them to a resource or help them think

about a complex student misconception. Clearly some were faltering, but I did not know why.

Method

A convergent mixed method research design was used to inform this needs assessment study (Creswell & Clark, 2012). The quantitative and qualitative data were concurrently gathered in different forms using parallel questions that were initially analyzed separately and then compared for triangulation. The convergent mixed method research design used qualitative data to elaborate, explain, or further clarify the quantitative findings to provide a more in-depth understanding of the data (Creswell & Clark, 2012; Martinez et al., 2006).

Participants

The participants for this needs assessment study included 35 first- or second-year teachers who were all graduates of a private, liberal arts university located in the Mid-Atlantic region. These early career teachers were located in five states and eight school districts in the Mid-Atlantic region. The school districts' student populations ranged from 26,778 to 146,459 in suburban and urban settings. The teachers' schools reflected Free and Reduced Meals (FARMS) programs rates from less than 10% to 100%. Ten teachers were selected from the survey respondent population to complete interviews. These participants included eight elementary and two middle school teachers. Participants' ages ranged from 22 to 24 years old with a mean age of 22.7 (SD = 0.82). The school FARMS rates ranged from 5% to 93.5%. The mean FARMS rate was 49.472% (SD = 843.87). The eight elementary teacher participants included six Caucasian females, two Asian females, and one African American female. The middle school teacher participants

included one Caucasian female and one Caucasian male. These novice teachers were teaching mathematics in kindergarten through eighth grade, representing almost the full spectrum of elementary and middle school teaching levels.

Instruments

Two instruments were used in this needs assessment study to collect quantitative and qualitative information to support a description of the POP within this university: a beliefs survey and a ten-question interview protocol.

Teaching mathematics beliefs survey. The 34-item Teaching Mathematics Beliefs Survey (Appendix A) consisted of items from an existing survey, The Prime Online Teacher Beliefs Scale (Pape, Griffin, & Dana, 2012), and additional 11 researcher-constructed items. This survey was designed to capture the extent to which the teachers held standards-based or traditional mathematics pedagogical beliefs. I use standards-based mathematics pedagogical beliefs to describe a way of thinking about teaching mathematics that is student centered with a focus on problem solving, reasoning, and student collaboration (Goldsmith, Mark, & Kantrov, 2000; McGee, Wang, & Polly, 2013). I use traditional mathematics pedagogical beliefs to describe a way of thinking about teaching mathematics that is teacher-centered with a focus, among others, on speed and single solution pathways.

The Prime Online Teacher Beliefs Scale (Pape et al., 2012) is a 23 item survey that assesses beliefs about teaching mathematics. On this self-report survey, participants respond by indicating their personal views about teaching mathematics using a five point Likert scale ranging from 1 *strongly disagree* to 5 *strongly agree*. Examples from this survey include "Being able to memorize facts is critical in mathematics learning" and

"Teachers should provide instructional activities that focus on problem situations for learners to solve."

An additional seven items constructed by the researcher were added to this measure using the same scale and anchors. These questions relate specifically to beginning teachers' beliefs about implementing standards-based curriculum. An example of these questions include "Students need to be able to represent their mathematics solutions using representations" and "The role of the mathematics teacher is to design mathematics lessons that provide opportunities for students to engage in productive struggle." Finally, four questions about the teachers' perceptions about the quality of the instructional support they receive are included in the survey. An example of a support question includes, "The support I receive for teaching mathematics matches my own beliefs about the best way to teach mathematics."

Mathematics teacher beliefs interview. The interview protocol included three demographic questions, one question about general teaching experience, seven questions about teaching mathematics, and two questions about support for teaching mathematics (Appendix B). Two constructs were targeted for exploration within this interview: (a) beliefs about designing and implementing mathematics lessons and (b) types and quality of support provided to beginning teachers. The questions invited participants to describe their mathematics teaching, and, in particular, those practices they found effective or challenging. Participants were also asked to discuss and describe the kinds and quality of support they receive for teaching mathematics. Finally, participants were invited to discuss how their mathematics pedagogical beliefs and practices have changed since they graduated from the university.

Procedure

This section discusses participant selection, data collection, and data analysis for the needs assessment study.

Participant Identification and Selection

The career service office at the university was contacted to gather current contact information including email addresses for all recent graduates who are teachers of mathematics at the elementary or middle school level. From this pool of approximately 75 candidates, 36 functioning email addresses were identified. Social media was used to collect additional email addresses and contact information. The final list included 51 functioning emails for teachers who had recently graduated from the university and were currently first- or second-year teachers. The teachers were employed in public and private elementary and middle schools across Maryland, Virginia, and Pennsylvania and taught pre-kindergarten through eighth grade.

Data Collection

During March and April of 2014, an online version of the 34-item Mathematics Belief Survey was administered to all 51 beginning teachers with viable emails. The survey was distributed via email with a link to SurveyGizmo for their response. Of this group of 51 individuals, 35 beginning teachers responded. All 35 respondents were teaching mathematics with the majority of the teachers (n = 24) teaching mathematics and two other content areas. Five teachers taught mathematics and one other content area, and seven teachers were only teaching mathematics.

Following the survey, an email was sent to this sample of 35 graduates requesting volunteers for an interview; 23 teachers agreed to be interviewed. From this initial pool,

10 participants were randomly selected and interviewed beginning in April and extending to late May. To encourage participation and to maintain confidentiality, teachers were not asked to identify their school system or race. As the participants' former professor, procedure were implemented to ensure that that these beginning teachers would answer the questions openly, particularly because one of the questions inquired about the level of interest in support from the university. First, I thoroughly explained that the goal for the interview was to collect information to make the program stronger for teacher candidates. Second, I gave the participants the option of skipping questions. Participants were reassured that their honest perspective would inform the preservice experience. The interviews were conducted in person at the university or at the teachers' school sites and lasted approximately 90 minutes each. Livescribe pen technology was used to capture audio and visual recordings of the notes. Audio could then be connected to specific notes made during the interviews.

Data Analysis

Descriptive statistics including mean, range, and standard deviation *SD* were computed for participants' responses to the Beliefs Survey reflecting standards-based and traditional beliefs. The number of items the participants responded with agree or strongly agree was calculated to reflect their overall agreement with the two perspectives. Finally, the percentage of standards-based to traditional responses was determined.

To analyze the Mathematics Teacher Beliefs Interview data, I used an inductive or grounded theory (Glaser & Strauss, 1967) approach. The purpose of the inductive coding was to identify emerging themes related to (a) mathematics pedagogical beliefs, (b) mathematics teaching practices, (c) types and kinds of instructional support received,

and (d) perceived value of that support. I used a multi-step process to develop themes by first examining the data holistically and recording overall impressions (Glaser & Strauss, 1967). The open-ended responses from the interview were then analyzed by dividing the responses into small chunks of information including phrases and assigning a label to the data (Creswell & Clark, 2011; Seidman, 2012).

Next, I coded the data line-by-line and organized the relational codes into categories and then themes related to the research questions. I continually compared the codes to create new or combine categories. Corbin and Straus (2008) emphasize that "this type of comparison is essential to all analysis because it allows the researcher to differentiate one category/theme from another and to identify properties and dimensions specific to that category/theme" (p. 73). Finally, each participant's data including open-ended survey responses were examined to determine emerging themes by comparing quantitative data and qualitative responses recognizing that coding is not just labeling, it is understanding how to connect data because "it leads you from the data to the idea, and from the idea to all the data pertaining to that idea" (Richards & Morse, 2012, p. 137). To examine the overall perspective of standards-based mathematics pedagogical and traditional views held by the participants, interview transcripts were analyzed by tallying the pedagogical statements.

Findings

This section is organized to reflect the three research questions and describes both quantitative and qualitative responses.

Pedagogical Beliefs and Practices

To respond to the first research question relative to beginning teachers' pedagogical beliefs about teaching mathematics, the teachers' responses on the mathematics pedagogical belief survey were analyzed descriptively. All 35 (100%) of the survey respondents indicated having a standards-based perspective by agreeing or strongly agreeing with all of these statements that reflected this perspective. Yet, 54% of those same beginning teachers also agreed or strongly agreed with at least one statement that reflected a traditional perspective of teaching mathematics. Therefore, to further analyze the survey results, individual participant's responses were analyzed to determine whether a beginning teacher might simultaneously hold standards-based and traditional beliefs. Two responded positively to standards-based views only (0.6%). No participants responded positively participants to traditional views only. Finally, 24 of the 35 participants' (69%) responses reflected a combination of standards-based and traditional views reflecting an overwhelming inclination towards standards-based beliefs (2.1)

Table 2.1

Participant Rates of Standards-Based and Traditional Perspective Responses

Mathematics Pedagogical Perspective	Number of Strongly Agree and Agree Responses	Total Number of Responses	Percent	Mean	SD
Standards-Based	162	198	.82	4.63	.59
Traditional	31	198	.16	1.46	.58

During the interviews, all 10 beginning teachers described their beliefs using social constructivist concepts by using descriptors such as: (a) student-centered, (b) problem-based, (c) student discussion, and (d) productive struggle. For example, one teacher described her beliefs by saying, "I believe my students should learn math through

problems. I want them to work in groups together to solve them" (Participant 4, Interview[1]). Another stated, "I think they don't learn unless they struggle a little bit solving problems. If I just have them copy what I am doing, then I don't think they are learning" (Participant 8, Interview). Additionally, two teachers described teaching mathematics lessons by using words and ideas that reflect more traditional concepts including: (a) model, (b) telling the students, (c) showing, and (d) controlling the ways manipulative materials and tools are used. One participant's statements reflected traditional beliefs by saying, "The only way some of them are going to learn it is if I just model it for them" (Participant 7, Interview) while another shared "My students are so low that when I put them in groups to solve problems, it always ends up with me telling them what to do" (Participant 6, Interview). One teacher indicated that she made particular mathematics pedagogical choices because she worried about the learning levels of the students. She said that her classes had been homogeneously grouped for mathematics and she had been assigned the class with the highest number of students with Individualized Education Plans. Finally, these beginning teachers raised standards-based comments 88 times compared to 29 traditional comments. Overall, 25% of the comments stated by teachers reflected a traditional view of teaching mathematics. Eight of the ten participants raised standards-based belief statements at a rate of 75% or higher (Table 2.2). Each individual percentage varies because it depends on the number of individual comments made by the beginning teachers in describing their beliefs. Therefore, the denominator varies with each participant.

[1] Survey and Interview participants identified by identification number, instrument, and date.

Table 2.2

Interview Participant's Percent of Standards-Based Belief Statements, Percent FARMs, Mentor Support, and School District

Participant ID	Percent of Standards-Based Belief Statement (%)	FARMs (%)	Mathematics Mentor Support (Yes/No)	School District
1	.77	.05	Yes	A
2	.75	.94	No	B
3	.73	.12	No	C
4	.91	.09	Yes	A
5	.75	.39	No	B
6	.67	.68	Yes	D
7	.56	.39	No	E
8	.73	.41	No	E
9	.83	.42	Yes	A
10	.85	.75	Yes	A

Because the beginning teachers described their own beliefs and teaching practices, the percentages may reveal more accurately their underlying beliefs about teaching mathematics effectively. The beginning teachers described how they combined their beliefs about standards-based mathematics and traditional mathematics pedagogical beliefs. For example, Participant 2 explained, "I try to teach problem-based lessons as much as possible because the students are so much more engaged. If they start to get wild, then I just pull out worksheets to settle them down" (Interview, April 12, 2014) indicating both standards-based and traditional beliefs. In these interviews, beginning teachers often explained their teaching practice decisions by recalling specific student needs or a colleague's advice. Notably, the two lowest rates of standards-based belief statements are from the same school system. Overall, with the exception of one participant, the teachers who had an assigned mentor represented the teachers who made the highest percentage of standards-based statements. The interviewed teachers' school FARMs rates did not seem to be associated with the number of standards-based belief statements raised by the teachers.

Support for Beginning Teachers

To respond to the second research question relative to beginning teachers' support for teaching mathematics, the teachers' responses to the Mathematics Pedagogical Beliefs support survey questions were analyzed descriptively and qualitatively. The Mathematics Pedagogical Beliefs survey and interview data indicated that the level of support greatly varied for individual beginning teachers. Some teachers reported receiving very little help while others reported receiving many types and levels of support. Sixty percent of these teachers reported the belief that it was very important to receive continued support for teaching mathematics. This significant percentage indicated an inherent need of the beginning teachers and could be connected to the fact that more than half reported that they were receiving *some to no* support for teaching mathematics. These data indicated a discrepancy between their desire for support and their actual support. When asked whether the support they received matched their own beliefs, the beginning teachers responded equally between *strongly agree* and *strongly disagree*. Furthermore, more than 97% (n = 34) of the participants indicated *some* to *large interest* in relation to support from the university.

The participants were asked on the open-ended survey questions to describe the types and kinds of support that would help them teach mathematics more effectively. While all of the participants' responses might be linked to professional learning, three themes emerged: (1) accessing and developing better lesson plans, (2) collaborating over lesson plans, and (3) acquiring specific resources to create specific learning opportunities in the classroom. Twenty percent of the teachers indicated a need for support to engage their students with manipulative materials. For example, one teacher responded, "I need

different manipulatives for fractions. I keep using the same fraction circles for everything" (Participant 1, Survey). More than half of the beginning teachers who referenced manipulative materials as important indicated a lack of enough manipulative materials to use with an entire class. One participant responded, "I really want to use manipulatives, but I don't have enough for all the students to use them at the same time. They (the administration) promised me some, but they never showed up" (Participant 29, Survey). They also requested more professional learning for particular manipulative materials such as fraction bars. For example, one teacher noted, "I have access to many manipulatives, but I don't really know how to use them" (Participant 6, Interview). Notably, not one beginning teacher requested professional learning in mathematics content. Perhaps a specific question should have been asked in the survey that would isolate the specific content that is more problematic to teach. Anecdotally, these are often the types of phone calls, emails, and other communication that I receive on a regular basis from graduates.

The types of general support beginning teachers seek and receive seem to be highly individualized. Interview responses revealed that these beginning teachers receive support from other teachers, former professors, websites, mathematics specialists, and administrators. They identified that some of the most helpful forms of support came from outside the school such as other beginning teachers or other experienced teacher contacts. The teachers indicated that they often checked with beginning teachers in different schools or contacts that they had from their university training before they would ask questions that could be particularly embarrassing. For example, one beginning teacher said, "I always check with [another beginning teacher] at [a different school] first so I don't look like an idiot. Also, they [school leadership] seem to tell her more stuff"

(Participant 1, Interview). Only one of the 10 beginning teachers who were interviewed indicated that she felt she had absolutely no one to turn to at her school. She reported, "When I asked questions in the beginning, they seemed annoyed so now I just try to figure out things on my own" (Participant 8, Interview).

Regarding support for mathematics pedagogy, seven of the 10 teachers interviewed reported that their mathematics pedagogical conversations focus on immediate planning and are often not particularly deep. One said, "I know you are asking if we talk about math like we did in school [university] and, no, we just talk about doing the activity." Another shared, "We are always rushed in meetings. The team leader just hands stuff out. No one wants to talk about how to make lessons better. It is so weird. Everything feels like we are racing and it is exhausting." Another reported,

> We just talk about the students all the time. How they don't know anything. I hate it. One day, one of the teachers started talking about a student and calling him, Cray, Cray [crazy]. I had enough and told them all we couldn't talk about a child that way, and we were here to help this kid. I lost so much respect for them. (Participant 4, Interview).

Two participants indicated that they were regularly engaged in (PLCs) that did talk about teaching mathematics regularly. One said, "We all do the task and then talk about what happened with the students. I love the discussions. It reminds me of school [university]" (Participant 4, Interview). Another beginning teacher discussed a county-wide mathematics gathering sponsored by the school district mathematics office offered for teachers: "We can pick the topics that are interesting to us and then attend the workshop and then talk with other teachers that [sic] are interested in the same things we

are" (Participant 9, Interview). Both of these teachers expressed value in talking specifically about the mathematics teaching on several other occasions during the interview.

A common induction procedure is to assign beginning teachers to a mentor teacher as the main support for questions or concerns. All ten of the beginning teachers were assigned a mentor, although not all of them specialized in mathematics support. When asked if they found the mentor helpful, however, only two responded positively. Regarding a helpful mentor, one teacher said, "She is so nonjudgmental, and I feel like I could say anything to her" (Participant 10, Interview). Another teacher was assigned the assistant principal and said, "I can't talk to the assistant principal – it is too awkward. I just tell her everything is great, even when it is not" (Participant 8, Interview).

The beginning teachers expressed a desire for additional professional learning support related to teaching mathematics and identified many potential professional learning topics including "how to use particular manipulative materials for teaching fractions" (Participant 6, Survey), "differentiation strategies for the mathematics classroom," (Participant 14, Survey), and "how to develop and design problem-based tasks" (Participant, 17, Survey) for their students. They wanted to seek other types and kinds of support other than school-based faculty and resources because they felt that other communities, people, and resources could provide a safe forum to ask questions.

Do Beginning Teachers' Beliefs Change?

To respond to the third research question relative to beginning teachers' beliefs about teaching mathematics, the teachers' responses to the Mathematics Pedagogical Beliefs survey questions were analyzed descriptively and qualitatively. Participants

indicated many reasons for why beliefs were strengthened or did not change. Three overarching factors associated with maintaining standards-based beliefs about teaching and learning emerged from the survey and interview data including: (a) student evidence, (b) reflection from work with students, and c) rigor. Three factors related to changing beliefs emerged including: (a) student struggle, (b) curriculum, and (c) school district expectations.

Rationale for sustained or strengthened beliefs. Teachers discussed the needs of their students and how this motivated them to sustain their beliefs towards standards-based view of instruction. The beginning teachers reported that they cared a lot about what students said to them about their teaching and often described in great detail particular triumphs with students. These stories were often accompanied by an emotional response from the participant. For example, one participant described her students' response to her lessons by explaining, "My students are so excited to come in my mathematics classroom because they know they are going to learn something applied to their real world. They are so proud of themselves, too!" (Participant 10, Interview). Another participant shared with visible tears in her eyes, "My students actually thank me for teaching using tasks. They seemed to get that I spend a lot of time creating interesting problems for them to solve. One time, they even spontaneously clapped for themselves" (Participant 9, Interview).

Three beginning teachers explained that their standards-based beliefs were strengthened during the year because the students themselves were so appreciative of their mathematics teaching. One middle school mathematics teacher said,

> They (students) really fought me in the beginning of the year. They complained that it was too hard and why wasn't I teaching like their math teacher last year. Then after about two weeks, one student came up to me and thanked me for teaching him like he was smart. Well, that was all I needed to keep going. (Participant 10, Interview)

Another beginning teacher shared that her student said, "You teach like you care about us learning math" (Participant 4, Interview). Several beginning teachers explained that their beliefs did not change or were even strengthened because particular students needed lessons to be highly engaged, student-centered, and rigorous. For example, one beginning teacher stated, "I plan my lessons thinking about how to make sure I can keep [student] and [student] involved in the lesson. If I start passing out worksheets, they aren't going to be interested and will probably start misbehaving" (Participant 2, Interview). Another beginning teacher stated, "My students need to see the real-world connection. It is so important to them so I make sure that is part of every lesson and I tell them that I am planning for them, which they really like" (Participant 10, Interview). Another novice teacher explained, "Students need to explore and problem solve while learning mathematics or they aren't going to remember anything. So many of my students have retention issues because they learned math in some boring way that just wasn't memorable" (Participant 9, Interview).

Teachers also explained that while their beliefs had not changed, they often had to change their standards-based teaching practices to traditional practices. Participants explained that they are making adjustments to their teaching practices within certain school decision constraints such as homogeneous grouping, curriculum, and even certain

lesson plan models that promote extensive teacher-centered practices. An example included,

> My beliefs have not changed, but I must try and implement my beliefs in a very restrictive lesson plan model that my team uses. I am forced to plan with them so I just try to adjust the lessons after we plan to make it work better. (Participant 4, Survey)

These novice teachers also discussed the difficulty of sustaining a belief system when the support system is limited by explaining, "I know what I should be doing, but it is hard to keep it up when no one else seems to believe this. I will keep trying though" (Participant 1, Interview).

Impetus for changing beliefs. As stated previously, factors related to changing beliefs emerged including: (a) student struggle, (b) curriculum, and (c) school district expectations. Participants' responses to the open-ended and interview questions revealed that some beginning teachers identified multiple influences on their beliefs as they balanced their own needs and desires with leadership expectations. The teachers worried about how to support struggling students with their limited background knowledge of student mathematical learning. They also expressed deep frustration with a prescriptive curriculum that expected them to adhere to rigid assessment timelines. Others also struggled with the school district's CCSS-M (NGACBP & CCSSO, 2010) implementation. Specific student concerns were mentioned, which indicated that these teachers worried about teaching differently than how other teachers were teaching. One teacher described:

> I believe that teaching mathematics is an evolving process and is hard for you, as the teacher, to change everything a student has learned for several years in an academic year. In addition, as a first-year teacher it has been challenging to stick to my beliefs and what I was taught at [university] as my administrators and colleagues tend to challenge them. (Participant 3, Survey)

Those teachers whose beliefs changed dramatically described concerns about students' mathematical needs. One teacher responded, "I hate teaching math, the students are on too many different levels. It is a nightmare" (Participant 22, Survey).

Participants described many concerns with school and district CCSS-M (NGACBP & CCSSO, 2010) implementation. Many of the participants' school districts have implemented the new standards to varying degrees with some districts in year four of implementation and others in the first year of implementation. One teacher summed up her experience by writing:

> Either you are in a system where you have to plan a lot of the content yourself and how to teach it with very little practical support. Or you are in a system where there is a detailed curriculum; however, it rarely matches well with the state standards/Common Core. And then you feel like the lessons you are teaching are not that valuable to the students. (Participant 33, Survey)

Another participant explained,

> Our [the] school district is not transitioning well to common core and I don't even think some of the people who are writing it [curriculum] understand it. It seems like we are making the kids confused by forcing them to do certain representations. (Participant 6, Interview)

Another participant commented, "I did not think teaching common core math would be so complicated. There are too many resources to choose from and it is very confusing" (Participant 31, Survey).

Several interviewees discussed their school districts' slow response to curriculum changes as a result of CCSS-M (NGACBP & CCSSO, 2010). One beginning teacher expressed, "Because of Common Core, we don't have any real curriculum. We just get little ideas. I spend hours searching ideas for reading and I don't have time for math" (Participant 7, Interview). Another explained,

> We adopted a textbook series that is supposed to be aligned with common core, but it really isn't. So then they started sending out all these clarifications. By the time I weed through that, I am pretty confused about what to teach. (Participant 3, Interview)

Participants indicated school and district curriculum decisions, lesson plan designs, and grouping models all contributed to teachers' mathematics pedagogical beliefs. Sixty percent of the participants indicated their beliefs had changed to some extent naming (a) curriculum, (b) school contexts, (c) leadership, and (d) student issues as reasons for the changes in beliefs. For example, several novice teachers shared responses that indicated they were waiting for the school system to catch up with current curriculum and pedagogy. An example includes:

> My beliefs about mathematics have not changed much at all. I still believe that the way that I was taught at [former] University would be the most beneficial way for my students to learn. However, I do feel constricted in how much I can alter assignments that are provided for my students. It is my hope that our county will

evolve more in order to accommodate for the change in curriculum and academic rigor. (Participant 17, Survey)

The interviews provided context for deeper explanation of the novice teachers' perspectives related to these changes. These teachers explained that school leadership was a big factor in shifting their belief systems. One particular teacher felt tremendous pressure to enact the mathematics model espoused by the school leadership and explained,

> If I am not teaching at least four small mathematics groups every day, my administrator will tell me I am not differentiating. I can't use any problem-solving tasks like we used at the university because I only have a few minutes to teach each lesson. Our county is obsessed with differentiation and they believe the only way we can meet the needs of the students is to teach them in small groups. They never think about the fact the kids are on their own for hours during the day because of this. (Participant 7, Interview)

These beginning teachers expressed concern about their observations and evaluations and openly stated that they would sacrifice their beliefs to get a good evaluation. For example, one beginning teacher said, "I am scared to death over these observations. I keep hearing horror stories from other teachers. In the end, I just gotta [sic] do what he wants me to do even if I don't like it" (Participant 2, Interview). Another stated, "If they [administration] start making me teach direct instruction, I don't know what I will do. I guess I will do what they want and then try and leave in a few years" (Participant 1, Interview). One teacher related a more positive response from his leadership: "When my principal walked in, I got so nervous about what he was seeing,

but he sent me a note and said he had never seen kids talking like that before. Later, he told me that I was going to be a change agent in the school (Participant 10, Interview).

In summary, some interview participants reported that their core beliefs about teaching mathematics had not changed since they graduated, but their ability to enact their beliefs depended on contextual factors. As the beginning teachers considered their daily mathematics teaching they made instructional decisions about how to perform for observations, choose school district materials or lesson plans, and decide how to adhere to expectations from mathematics leaders. They admitted that these factors directly influenced daily teaching practices even when they did not match their pedagogical beliefs (Kennedy, 2010). Both the survey and interview data reveal this phenomenon of a disconnect between beliefs and teaching practices as these beginning teachers described their struggle with reconciling their mathematics pedagogical beliefs with the expectations of their leadership, colleagues, and parents.

Conclusion

This needs assessment study provided an opportunity to explore beginning teachers' mathematics pedagogical beliefs. Participants' responses to surveys and during interviews revealed that a majority of the teachers held standards-based beliefs. To a lesser extent, they also agreed with traditional instruction. Beginning teachers may hold both beliefs and execute particular teacher practices depending on important contextual factors such as student needs or administrative expectations. They explained their pedagogical beliefs and practices by depicting contexts that influenced their decision-making in the classroom. They described different kinds of support for standards-based teaching and indicated varying levels of satisfaction with the support received. They

attributed changes from standards-based beliefs to traditional practices to many contextual factors including concerns about the implementation of Common Core State Standards (NGACBP & CCSSO, 2010), district policies, and evaluations.

There are several limitations to this needs assessment study including the role of the researcher because the participants know my beliefs about teaching mathematics and may be influenced by knowledge of my beliefs. Additionally, careful consideration must be made to clarify the connection between beginning teachers' beliefs and practices. Certainly, the relationship between beliefs and practice is complex because "teachers' beliefs do influence their instructional practice; however, a one-to-one causal relationship cannot be asserted because of the interference with contingencies that are embedded in the school and classroom culture" (Handal, 2003, p. 54). Furthermore, measuring beliefs is an intricate process that can be influenced by events or circumstances and word meanings (Ambrose, Philipp, Chauvot, & Clement, 2003).

As demonstrated in these teachers' statements and responses, the teachers' needs for support are substantial. The power of context over mathematics teaching practices was evidenced by many of the participants' responses. Chapter 3 explores the literature for the design of the intervention that will best meet the needs of these beginning teachers to support their development.

Chapter 3

Beginning Teacher Support

The participants in the needs assessment study revealed that they hold standards-based beliefs but struggle to align those beliefs and teaching practices within varying school contexts. Several key findings from the participants' responses highlight several important factors that must inform the design of the intervention. First, these novice teachers reported struggling to garner and maintain positive support in their schools and reticence to share specific needs. Seventy-six percent of the participants indicated that it is *very important* to receive support for teaching mathematics; however, 62% were only receiving some to no support for teaching mathematics, indicating a discrepancy between their need for support and the support they actually received. Second, when they receive support, they described varying types and levels of support from their colleagues, school leadership, and school system. Third, they expressed frustration over confusing messages from leaders and reported hesitancy in sharing authentic concerns with leadership about their transition to teaching, fearing they would be penalized if they admitted they were faltering. Finally, they shared that they don't have opportunities for collaboration, and they felt isolated. While they still primarily hold beliefs about mathematics instruction that reflect a standards-based approach, they reported struggling to implement daily classroom practices that matched their standards-based beliefs.

The goal of this chapter is to provide an overview of the research related to interventions developed to support the beginning teacher to negotiate the various constraints and influences within his or her first year of teaching in response to their stated needs. Interventions for beginning teachers most often focus on formal site-based

induction opportunities afforded the novice teachers. Therefore, this review will explore the research as it relates to the transition teacher candidates make to novice teaching and identify the elements of programs that will best support them in practicing their standards-based beliefs in varying school contexts.

From Teacher Candidate to Novice Teacher

As the needs assessment indicated, making the transition from teacher candidate to teacher requires an ability to balance competing demands. Weighing student needs, school expectations, and administrative requirements can be a challenge for teachers to prioritize. As teacher candidates transition to a novice teacher, they may change their focus on specific teaching practices perhaps illustrating the challenge to maintain these multiple teaching priorities. Understanding how teacher candidates' views change may provide unique insight into the intervention design. Additionally, an examination of situated learning theory framed within the CoP and PLC may inform novice teacher induction design and delivery.

Understanding the Teacher Candidate's Perspective

Examining how teacher candidates' views change about the importance of the teacher role during the internship experience provides critical information about those experiences that influence perspectives about teaching. In a study of teacher candidates, Edwards and Protheroe (2003) surveyed 125 candidates as they entered and exited their internship by asking them to rank 17 descriptors about how teachers support student learning using words such as (a) encourage, (b) differentiate, (c) use effective questioning, (d) listen to children, and (e) create a safe working environment and atmosphere. Teacher candidates entered the internship ranking *encourage* as most important and exited

ranking it in the eighth position. *Listening to children* was initially ranked third but fell to fifteenth by the time they completed the internship. The teacher candidates were initially focused on the students' needs but became primarily focused on curriculum delivery during the course of the internship and only briefly began to understand the importance of connecting curriculum delivery to individual student learning needs demonstrating the struggle to maintain an effective balance.

Learning to balance the complex demands of the classroom may be connected to how teacher candidates are prepared. In a study examining preparation paths of beginning teachers from traditional programs, professional development schools (PDS), and teacher-in-residence programs, researchers found that the beginning teachers reported that their teaching practices were most influenced by their teaching colleagues (Sandoval-Lucero et al., 2011). The three groups identified important influences on their teacher practices from their teacher preparation programs such as university courses, field placement experiences, and mentor teachers. The PDS and traditional teacher groups reported beliefs that teaching was something that could be learned and improved upon through instruction, mentoring, and experience as opposed to a natural ability. The PDS group aligned most with the preparation program the beginning teachers experienced. All three groups worried most about classroom management. Their concerns centered on how to better manage their students' behavior rather than develop a classroom community of learning. Teachers from all three preparation programs voiced concerns about standardized tests and discussed how they influenced their teaching practices.

The best teacher education programs highlight opportunities for teacher candidates to learn in practice with multiple means of reflection (Darling-Hammond,

2012; Feiman-Nemser, 2001; Flores & Day, 2006). While beginning teachers have been learning about teaching in an environment that combines traditional teaching with field placement experiences, their perception of learning is often grounded in the more conventional experiences typical from university professors, supervisors, and their mentor teachers, which is often characterized as receiving knowledge (Feiman-Nemser, 2001). Paradoxically, their learning as novice teachers becomes almost entirely experiential and "embedded in the context in which the individual is co-participating" (Felstead et al., 2005). Learning about what works in the context of teaching becomes the daily and long-term challenge and must be embedded in the induction support the novice teachers receive. As these novice teachers develop, they experience teaching through and within a school context and make daily teaching decisions that inform their present and future practice, which are largely influenced by the school culture, climate, and context (Hargreaves, 2003).

Learning to Teach: Situated in Contexts

Chapter 2 provided a discussion of the social constructivism learning theory as it relates to beginning teachers' standards-based mathematics pedagogical beliefs and practices. This section briefly explores how learning to teach illustrates a form of situated learning in various ways including virtual learning and problem-based contexts.

Situated learning. Similar to social constructivism, situated learning is rooted in social, active, and purposeful learning. Learning is actually a result or function of the activity or is situated in particular work and social environments and is co-constructed by the participants (Lave & Wenger, 1991). Situated learning is enculturation (Hendricks, 2001) and is the consequence of complex social interactions in varied social spaces that

alter prior knowledge and belief systems within a community of learners (Brown, Collins, & Duguid, 1989). First developed by Lave and Wenger (1991) through their study of apprenticeship learning, situated learning integrates knowledge within contexts and through social interaction. In their examination of adult learners, Lave (1988) examined study participants' mathematics skills in a classroom environment compared to a real-world context. Interestingly, the participants demonstrated vastly different competencies in the two settings, illustrating the power of learning in real-word contexts. Lave and Wenger (1991) argued that learning is much less likely to occur in isolation and out of context because learning is accessed through participation in a community and occurs through the learner moving from peripheral participation to fully engaged member. That is, as learners engage within the community, they gradually take on small tasks that reflect their level of understanding and ability within the context of the whole. They slowly move from performing these smaller tasks, or peripheral participation, to being able to take on larger parts of the whole, or full engagement. Furthermore, knowledge that was gained elsewhere is co-constructed with others in new contexts increasing learning through meaningful exchanges (Hill-Jackson, 2007) thereby building collective and independent knowledge (Wenger, 1998). Participant access to knowledge, activities, and even products may all progress along a continuum as members of the community gain expertise and extend meaning as they engage in new learning and develop content expertise (Lave & Wenger 1991).

Learning to teach illustrates situated learning because teacher candidates and novice teachers are engaged in apprenticeship learning (Lortie, 1975) and begin learning about teaching through observation in what Lave and Wenger (1991) would call

legitimate peripheral participation. Legitimate peripheral participation refers to learning as an observer, much like a teacher candidate might experience in early field placement experiences and throughout their histories as learners.

Virtual learning contexts. While situated learning theory was first developed and analyzed in the context of learning within particular physical spaces outside of traditional school environments (Cobb & Bowers, 1999), new contexts such as virtual environments have broadened the scope of situated learning. Virtual environments can also be considered a situated learning environment when learners co-construct their knowledge (Herrington & Oliver, 2000; Herrington, Oliver, Herrington, & Sparrow, 2000). Herrington et al. (2000) developed an online support for student teachers in which they solved problems collaboratively and communicated in provocative professional dialogue. Small groups of student teachers were formed within the larger cohort to develop technology-enhanced products. The student teachers worked together to develop web-based units with input from the community. The study examined the participants' engagement as the student teachers solicited and responded to online comments. The participants' interaction revealed that the virtual experience supported student learning because the student teachers constructed new knowledge together to develop the product. This example highlights how teachers may gather together to create new and unique products through a shared experience. Alternatively, other beginning teachers may join together to solve problematic challenges that occur in school-based contexts.

Problem-based contexts. As beginning teachers transition to their classrooms, they may often note problematic situations and challenges. Learning to teach through problem-based contexts is aligned with a situated learning perspective because these

problems provide authenticity and motivation for learning (Hung, 2002). These problems can be discussed and debated in virtual formats giving participants time to explore multiple solutions. In essence, these new technology platforms and access to web search engines as other examples of situated learning can engage participants in solving contextual problems initiated by the learner's desire to gain new knowledge or achieve a goal (Collins & Halverson, 2009). As participants seek solutions to their problems, they can engage others in collaboratively solving authentic problems in virtual learning environments. The virtual space increases opportunities to discuss ideas and provides access to other like-minded teachers, which provides the space for learning communities to develop. As these learning communities emerge, teachers may participate in various ways and with different purposes. The next section provides a brief explanation of beginning teacher learning in communities, CoPs and PLCs.

Learning in Communities

While many novice teachers are assigned to participate in induction programs to work with specific groups of learners, they may seek or be assigned to work with other teachers to engage in learning, discussion, and reflection about their teaching practice (Feiman-Nemser, 2001). Participation in these communities may take the form of a CoP or a PLC. These communities originate differently, vary in membership, and have different purposes (Figure 3.1). While on the surface these appear similar, the following discussion describes each type of community and related research.

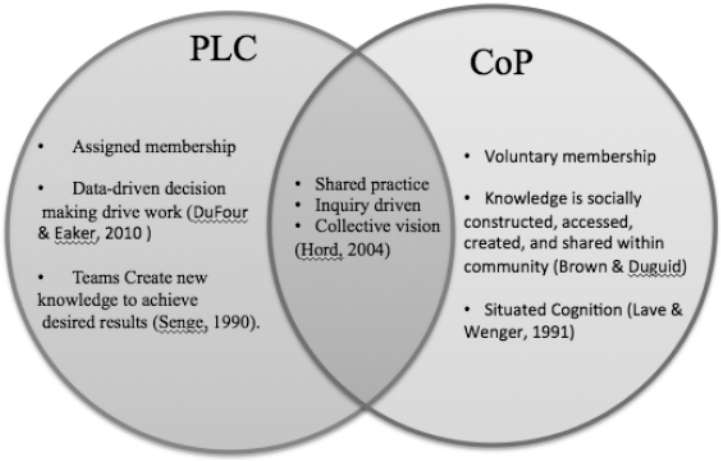


Figure 3.1. Comparison of PLC and CoP.

Communities of practice. Informed by situated learning theory, CoP form as the result of a shared desire to learn within social interaction and in particular contexts (Wenger, 2007). This learning occurs by broadening the view of apprenticeship learning from 'learning by doing' to learning with others (Fuller, Hodkinson, Hodkinson, & Unwin, 2005; Lave & Wenger, 1991; Wenger, 2007) in specific contexts or situations. Wenger (2007) identified three elements that separate CoPs from other types of learning communities: domain, community, and practice. Members of the community must share a common vision and identity that separates them from others as they pursue knowledge in a shared domain of interest (Wenger, 1998; Wenger, McDermott, & Snyder, 2002). As members seek information in their domain, they participate in common discussions and activities that build and strengthen community relationships to support learning. As practitioners, novice teachers share everyday experiences and begin to build a repertoire of strategies for solving problems within contexts of practice (Wenger, 2007). All three characteristics are crucial for determining the legitimacy of the CoP and learner engagement.

A qualitative research study using Wenger's CoPs as the framework for a beginning teacher induction program analyzed observational data about the types and kinds of support that the participants provided each other over one school year including 16 two-hour sessions (Cuddapah & Clayton, 2011). Data collected from observations was coded using Wenger's four components including community, practice, meaning, and identity. The formal observation field notes provided evidence of the cohorts delivering support to each other including (a) exchanging resources, (b) providing affirmation, (c) solving problems, (d) offering assistance, and (e) listening as a sounding board. Data also illustrated how the novice teacher cohort supported each other in constructing meaning from their experiences by (a) affirming their personal purpose, (b) exploring classroom management, and (c) discussing ways to connect with the students. The group functioned as a CoP because the professional roles presented an urgency for discussions about pressing needs and concerns.

Another important function of a CoP is the emergence of identity. Cuddapah and Clayton (2011) observed a novice teacher group over one year and collected qualitative evidence. The researchers collected field notes and analyzed the novice teachers' interactions within Wenger's (1998) CoP social learning framework. Through the examination of themes, the data revealed that the novice teachers grappled with their teacher identities concerning their prior expectations about teaching and relationship to and with students. This research supported Wenger's (2007) work that found participants build their identities within and through the varied discussions, activities, and social interactions within the CoP. They interact as a community to solve problems, seek and share resources, and create new innovative ideas and strategies particular to their shared

contexts. Although the teacher cohort was made up solely of novice teachers, the participants were able to provide support to one another suggesting that they may simultaneously be learners and teachers as they enter into the community. Additionally, the novice cohort became a third space to "complement mentoring and induction programs to provide a more multidimensional support experience" (Cudapah & Clayton, 2011, p. 73). The CoP builds collaborative opportunities for collective and individual learning in a situational context that may include physical and virtual environments.

An example of this shared learning is illustrated by a study that examined inquiry instruction that was supported by professional learning experiences that were developed and delivered through a CoP (Yow & Lotter, 2014). This study paired teachers and instructional coaches to participate in a two-week mathematics and science inquiry professional learning experience with four follow-up sessions. The goal of the CoP professional learning design was to build collective trust and bolster content knowledge of and a common understanding for standards-based teaching. Teachers and coaches participated together in pedagogical and content sessions and then taught together in the follow-up sessions. The teachers completed three surveys to determine understanding of inquiry, perspective on the coach relationship, beliefs about student learning, and program impact. Participants increased mathematics and science content knowledge and understanding of the pedagogical underpinnings of inquiry instruction. The researchers suggested that further research be conducted to explore alternative forums for professional learning CoPs such as virtual communities (Yow & Lotter, 2014).

Professional learning communities. While CoPs are initiated by the participants in response to a need to learn more about concepts and ideas through professional

learning, PLC topics are driven by school leadership. A PLC or Network (PLN) is derived from Senge's (1990) early work examining how learning organizations build desired results from collaborative work efforts. Similar to a CoP, PLC's rely on strong and visionary leadership to build a school culture that cultivates and sustains effective, results-driven efforts (Blankenship & Ruona, 2007) and may be adopted by school districts as a framework for implementing school improvement efforts (DuFour & Eaker, 2010). PLCs incorporate five dimensions including (a) supportive and shared leadership, (b) shared values and vision, (c) collective and applied learning, (d) supportive conditions, and (e) shared personal practice (Hord, 1997, 2004; Morrissey, 2000).

Effective PLCs can help beginning teachers feel supported in their schools. A New Zealand Teacher of Promise study analyzed the experience of 57 new teachers as they transitioned to their schools (Lovett & Cameron, 2011). The researchers administered surveys to determine individual and common experiences among the teachers as they shifted to their new teaching contexts (Lovett & Cameron, 2011). Within this larger study, five teachers were identified for deeper analysis through case studies. The experiences of the five novice teachers varied widely from learning in schools that provided sustained and rich professional learning experiences to schools that offered scant opportunities to learn in PLCs. Only one of the beginning teacher's experiences reflected the five dimensions of the PLC. The other four novice teachers expressed a strong desire for regular, sustained quality professional learning time (Lovett & Cameron, 2011). All of the novice teachers communicated a desire to engage in shared leadership opportunities in their schools.

As the novice teachers adapt to their school contexts, they look to leadership to establish expectations for professional learning. School administrators may represent a key factor in designing the quality and support for beginning teachers using the PLC as a framework. Brown and Wynn (2009) interviewed twelve principals in a district with a 42% novice teacher attrition rate to determine their perspectives on providing support to beginning teachers. Interview transcripts were analyzed to determine several key themes including (a) desire for collaboration, (b) supportive conditions, (c) supportive and shared leadership, (d) shared norms and values, and (e) deprivatization of practice. The principals identified finding shared values, support by supplying needed resources, and opportunities to build learning communities as the three main themes for retaining quality beginning teachers and reducing feelings of isolation. They were attuned to their teacher's needs and were able to steer them to the kinds of learning and activities that were most beneficial.

Beginning teachers enjoy collaboration (Brown & Winn, 2009) and need to be able to ask questions in an environment that supports questions of practice. Additionally, supportive efforts provided by others, such as fostering emotional support or providing physical resources, are highly valued by beginning teachers (Brown & Wynn, 2009). Principals and beginning teachers described supportive and shared leadership as situational leadership because principals adapted and adjusted to particular contexts and needs. Beginning teachers want to be in schools where they are participating in a collective vision that focuses on the value of student learning where all understand the shared mission of the school and teaching. Opportunities for peer collaboration, observations, and occasions for sharing teaching practices in PLCs foster collegiality and

reduce isolation (Brown & Wynn, 2009). They also found that the collaboration needed to be free of competition, which is a critical consideration for effective PLCs (Hord, 1997; Kruse, Louis, & Bryck, 1995; Louis & Marks, 1998). The development of practicing PLCs that are overlapping can affect change from different viewpoints because they utilize members with different expertise, particularly when networks are developed (Coburn & Russell, 2008).

Beginning teachers may be assigned to formal learning communities or seek informal learning communities through a school or school district's induction program. Determining the induction practices that best support beginning teachers in their new contexts is key to developing an effective induction program. The next section provides a discussion of beginning teacher induction programs including the goals of induction and a review of traditional and virtual beginning teacher induction programs and components.

Inducting the Beginning Teacher

Before discussing beginning teacher induction, it is important to recognize that some form of induction typically occurs in most professions. Le Maistre and Paré (2010) investigated the kinds of induction programs in physiotherapy, occupational therapy, social work, and teaching to examine the path from university to the first year in the profession. They interviewed 32 students and their immediate supervisors twice, during their university internship and during the first year in the profession. There was a stark difference in how the professions inducted their beginning professionals. The physiotherapy, occupational therapy, and social work professionals were all given extensive support through explicit teaching, mentoring, and modeling while teachers were given little or no support. Le Maistre and Paré noted that the novice teachers bring a

finite number of problems and solutions to their new positions and struggle to make "spontaneous decisions needed when responding to unpredictable situations–situations that are not included in their 'script' " (p. 561). The researchers also examined a construct called satisficing, which is related to problem solving. Economist, Herbert Simon (1987) describes satisficing as the phenomena of settling on a decision that is good enough given the constraints and conditions at the time of the decision. These decisions often represent the selection of a satisfactory option even when better options exist. Data revealed that the novice teachers struggled with satisficing because their expectations were either unreasonable or they couldn't identify the next best option. Even when they did select a reasonable alternative, they were often disappointed in themselves (Le Maistre & Paré, 2010). Novice teachers need to incorporate multiple opportunities for the teachers to solve immediate classroom problem situations. They also need many occasions to discuss alternative solutions with mentors and other experienced teachers.

Induction terminology is used as if all stakeholders have a common understanding about what induction entails. In fact, novice teacher induction programs can range from a two-hour orientation session to an assigned school or district mentor or an entire year-long program (Ingersoll & Smith, 2004). Novice teacher induction is separate from preservice and inservice professional learning and is uniquely designed for the newly minted teacher. The goal of these types of induction services is to offer support and guidance to the teaching professions' newest members, but often the induction offered is fragmentary and of poor quality (Ingersoll & Smith, 2004; Ingersoll & Strong, 2011).

In 2008, about 91% of novice teachers reported involvement with some form of induction program (Ingersoll, 2012). In an analysis of induction programs implemented

in the 2002-2008 school year, schools and districts often offered different types of programs that integrated various induction components; however, only 5% of the beginning teachers received what Ingersoll considered a comprehensive induction package with more than three types of support. These types of support might include mentoring, specialized inservice programs for beginning teachers, comprehensive curricula, opportunities to regularly plan with colleagues, access and regular communication with school leadership, and formative evaluation processes (Ingersoll, 2012). Interestingly, the most common type of induction activity was regular communication with a designated leader within the school (Ingersoll & Smith, 2011). About 80% of the novice teachers received support from a mentor teacher and about 50% of the new teachers were provided common planning time with other teachers. Induction is clearly a factor in supporting the new teachers with the most effective programs providing the greatest number of support components (Ingersoll & Strong, 2011).

Ingersoll and Strong (2011) conducted a review of empirical research on teacher induction to determine whether beginning teacher support improved retention. After establishing distinct review criteria including requiring outcome data for control and treatment groups, the researchers found 15 research studies to include in analysis from the initial 500 studies identified. Overall, the studies provide evidence for the positive influence of induction on teacher retention, classroom instructional practices, and student achievement. Additionally, the beginning teachers who participated in multiple types of induction had higher rates of job satisfaction. The types of induction components included orientation programs, professional development, mentoring, and collaborative team planning. The researchers reviewed five studies that described observational and

interview data related to how beginning teachers implemented teaching practices including pedagogy, classroom management, instructional planning, and student questioning practices. Most of the studies reviewed demonstrated that these inductees were better able to execute effective teaching practices such as supporting a positive classroom environment, differentiating instruction, and asking higher-order questions. Induction components that were found to be most influential included having a mentor in the same field, common planning time with teachers who teach the same content, and regular opportunities for focused teacher collaboration.

Induction Program Recommendations

Director, Ellen Moir (2009) of the New Teacher Center's (NTC) twenty-year national model for induction, offers important lessons for other induction programs. Several of the recommendations incorporate the need for high quality mentorship and leadership to provide a culture of learning that respects and builds on the value of adult learning. The NTC found through the study that it was critical for induction programs to foster discourse related to standards-based teaching practices that are driven by classroom evidence. This discourse highlighted the need to help the novice teacher identify strengths and challenges to build reflective teaching practices. The NTC found that the most effective induction programs provide opportunities for new teachers to participate in inquiry-based CoP that focus on questions that arise from their classroom experiences.

Several premiere induction programs highlight opportunities for collaboration among schools instead of having to rely on each school to implement an induction program, which ultimately supports a greater variety of collaboration and recognizes that "people crave connection," "want more than a job" (Wong, 2004, p. 50), and need to

build relationships during this critical time in their lives to be successful. The National Commission on Teaching and America's Future Report (NCTAF), Induction into Learning Communities (Fulton, 2005) highlighted two successful teacher induction programs. The NTCAF identified the Strengthening and Sustaining Teachers project because it provides comprehensive support to teachers from the preservice to novice level. The central focus of the program is to develop better collaboration and communication among the university, teachers' association, and school systems. Networks were created among all the participants to foster open discussions about teaching practices, classroom decision making, and content standards. The other recommended program is a comprehensive state-wide program in Georgia. One of the central components of this induction program is the development of the Georgia Building Resources: Induction and Development of Georgia Educators. This initiative is an online resource and mentoring program designed to provide an extensive library of resources and individualized online mentoring support. Based upon a comprehensive review of induction programs in the country, NCTAF described key components for successful 21st century learning community induction programs. The first key finding describes the importance of induction as the first stage in the trajectory of the teacher development continuum. Second, the induction should provide an entry into a learning community and establish a practice of learning and collaborating because "novice teachers have gaps in skills and knowledge, but also areas of expertise" (Fulton, 2005, p. 5). Mentors should be strategically selected, trained, and provided time to develop relationships with mentees. Finally, NCTAF found that external supports were critical to enriching beginning

teachers transition to the classroom. Both professionally guided networks and informal learning communities are instrumental in increasing support to teachers.

By building small groups of collaborative beginning teacher teams, induction programs can reduce isolation by creating a safe environment outside of the school so that the teacher can talk freely about concerns (Meyer, 2002). A large study examining the professional learning of over 1000 kindergarten through 12th grade mathematics and science teachers, found that the teachers reported that they learned more in collaborative networked groups than in one-on-one mentoring programs (Garet, Porter, Desmoine, Birman, & Kwang, 2001). The study was designed to examine the relationship between professional learning opportunities and teachers' knowledge and classroom practices. Participants completed pre and post surveys to determine their self-reported changes as a result of participation in professional learning. Workshops, peer observations, and study groups were examples of the professional learning activities.

Professional learning experiences such as study groups and collaborative lesson writing required more time to complete and developed a sustained community culture of learning. Teachers who engaged in these types of professional learning activities reported higher knowledge gains and transfer of learning to their classrooms (Garet et al., 2001). Another compelling lesson learned by the NTC is that online communities provide timely, cost effective mentoring because they support collegial teacher relationships and develop an expectation for life-long professional learning. This virtual platform offers new and creative opportunities for delivering induction support to beginning teachers.

Virtual Induction Programs Offer New Opportunities

The previous discussion illustrated the potential of providing online induction opportunities. Traditionally, induction is provided as a site-based program that utilizes school or school district personnel to provide mentoring and support (Wang et al., 2008). More recently, alternative approaches that utilize virtual platforms are developing to enhance school-based induction programs. As programs for beginning teachers are developed, several key factors may inform the induction design and implementation. Many beginning teachers reflect the Generation Y demographic and were raised in a technological world (Rebore, 2009). They have developed into adulthood as participants in social media and online gaming communities. The following section briefly describes these characteristics as they relate to the beginning teacher.

Generation Y beginning teachers engage virtually. Virtual support appears to be a key factor in engaging Generation Y teachers, which are those teachers born between 1982 and 2005 (Rebore, 2009). Generation Y teachers as a group bring numerous strengths to schools and classrooms, view teaching as a vocation rather than a job, and need to shape identity as they build their teaching careers (Rebore, 2009). They enjoy work as a social adventure and have grown up collaborating and do not like to be isolated (Rebore & Walmsley, 2010). They have grown up consulting parents, teachers, coaches, and other authority figures and often desire rich and specific feedback about their performance (Half, 2008). They embrace change and often seek change as a way of stimulating or constructing new ideas and find change a positive forum for learning and altering existing ideas (Half, 2008).

Multiple modes of communication are important to Generation Y teachers concerning interactions with leadership and colleagues including the use of technology and meeting through in-person interactions because this helps them feel connected (Rebore & Walmsely, 2010). This interconnectedness is vital to their identities as developing teachers and capitalizes on their strengths and needs.

Online communities increase induction opportunities. These online communities have broadened the scope of induction opportunities offering new ways for beginning teachers to access support (Herrington & Oliver, 2000; Herrington, Oliver, Herrington, Sparrow, 2000). Herrington and Oliver (2000) developed an online support program for student teachers in which they solved problems collaboratively and communicated in professional dialogue. Small groups of student teachers were formed within the larger cohort to develop technology-enhanced products for classroom implementation. Pairs of teacher candidates worked on the authentic projects and accessed the professor only when needed. Rather than receiving a lecture, participants were required to make sense of an authentic teaching experience and develop a solution to present to the cohort. The opportunity to learn and respond to an authentic teaching problem emphasized the importance of teacher reflection and opportunities for collaboration.

A research study on an Australian professional mentoring program designed to address the 33% national teacher attrition rate, examined a distance learning Early Support Program for mathematics and science teachers (Ormond, 2011). This online program was developed as an additional support to school-based, face-to-face daily mentoring. Novice teachers and mentors were assigned to a two-year commitment to

allow for need-based conversations. Written and oral conversations between the mentor and mentee were analyzed to determine effective and ineffective mentoring characteristics. Throughout the study, the Australian beginning mathematics and science teachers raised many concerns about teaching content that would engage students and needed opportunities to reflect with mentor teachers in a more relaxed and non-judgmental manner. Novice teachers in the study reported positive aspects of the virtual mentoring program including a safe space to share concerns outside the school because there is "no threat or power" (Ormond, 2011, p. 66) in the relationship. While not a substitute for on-site mentoring and support, the distance mentors, in addition to the school site mentors, were effective in helping the novice teachers navigate their beginning years.

This notion of building support in an online environment can bridge multiple participants from schools and universities. A university-led pilot study including 12 first-year teachers, four experienced teachers, and eight university faculty investigated the use of collaborative online community to support the social, emotional, practical, and professional needs of beginning teachers (DeWert et al., 2003). The six-month study collected email messages, phone interviews, and a survey to determine and analyze the topics and issues the beginning teachers initiated and the types of support provided to them. All of the beginning teachers in the project reported feeling an increase in emotional support and a decrease in feelings of isolation. Additionally, the participants felt more confident about making teaching decisions with support from the online community that might be different from their own colleagues.

As previously indicated, isolation is a common theme among beginning teachers and the specialist teacher (e.g., special education, art, media specialist) may be more at risk because there are fewer of these teachers placed in a school. An online or virtual learning platform may provide opportunities for these teachers to connect with other isolated teachers across the school district, state, or nation. Hunt, Powell, Little, and Alyson (2013) examined the effects of a special education beginning teacher online mentoring program on the teachers' competencies and perceptions. The online mentoring community focused on engaging participants in discussions about classroom practices. Twenty-two mentees and mentors collaborated for up to 12 weeks on designated questions including topics such as planning and diversity. Another component of the community offered an open-ended discussion space for teachers to ask questions, explore current research, or learn a new instructional strategy. The teachers completed surveys before and after their participation in the online mentoring programs and reported an increase in teacher knowledge of standards-based instruction; however, the teachers indicated a need for more specific, need-based support directly related to their individual contexts.

As this discussion of beginning teacher induction indicates, the induction types, delivery, and number of induction supports all contribute to beginning teacher success. A variety of support sources are most helpful in making this important transition because beginning teachers may request the type of support that is most helpful for particular contexts (Ormond, 2011). Clearly the beginning teacher induction design must carefully match the specific learning needs of the beginning teacher. Next, a review of a

framework that may help the beginning teacher navigate negative experiences and feelings through a strength-based approach.

AI Framework

This section will introduce AI as a framework for supporting beginning teachers through an inquiry process to support their individual and collective growth. While novice teachers are not necessarily trying to change their schools, they are changing as they respond to their first-year teaching experiences. AI has not been used in induction programs but has been successfully implemented in educational settings.

A focus on strengths may offer an opportunity to support teachers during the beginning years. As the needs assessment revealed, novice teachers struggled to sustain their mathematics pedagogical beliefs amidst difficult contexts, and some even became resigned to follow others' beliefs even if they did not believe it was best for students. One commonality among the beginning teachers as captured through interviews, was the appreciation for the opportunity to tell stories about their students and experiences. These stories were often framed in problem contexts without immediate or even short-term solutions.

The AI framework was developed from the work of Cooperrider and Srivatsa (1998) as an alternative approach to the traditional problem-centered process in business and school settings. AI incorporates several factors and "involves the art and practice of asking, in collaboration with others, questions that seek answers likely to strengthen a system's capacity to apprehend, anticipate, and heighten positive potential" (Jansen, Conner, & Cammock, 2010). AI has been used as a capacity-building method and as a research tool (Jansen et al., 2010; Reed, 2006) and "focuses on supporting people getting

together to tell stories of positive development in their work they can build on" (Reed, 2006, p. 42). AI is considered,

> A method for changing social systems (groups, organizations, communities) that advocates collective inquiry into the best of what is in order to imagine what could be, followed by collective design of a desired future state that is compelling and thus, does not require the use of incentives, coercion or persuasion for planned change to occur. (Bushe, 2013, p. 1)

While the CoP and PLC models provide organizational structures for participants in learning communities, the actual work inside those groups is varied (Eaker, DuFour, & Burnette, 2002). With so much focus on novice teacher deficits, particular mindsets can form that bind stakeholders in negativity. Conversations, action plans, research, and data analysis immediately concentrate on the novice teacher, school, and student deficits and those strategies that will "fix" them. Focusing on the negative aspects may create a culture of negativity and even dramatize or emphasize negative concerns (Quick, Macik‐Frey, & Cooper, 2007). By building new ways of approaching difficult situations, novice teachers can become empowered to enact their own beliefs and construct problem-solving skills. As novice teachers engage in these communities, particular attention must be given to the environment, atmosphere, and organization of the intervention. An explanation of the AI principles, model, and research follow as a theoretical frame for organizing the proposed intervention.

There are five AI principles including (a) social constructionist, (b) simultaneity, (c) poetic, (d) anticipatory, and (e) positive (Cooperrider & Whitney, 2005). These principles combine to support the tenets of AI and are reflected in both design and

implementation. The constructionist principle focuses on understanding the organization from many different perspectives. Within this principle, each person holds a unique perspective, describes it uniquely, and may alter the perspective as beliefs change based on building relationships (Cooperrider & Whitney, 2005). Simultaneity is characterized by the process of questioning and change because asking questions implies change. One cannot be separated from the other because the moment the question is asked, change is simultaneously occurring because new ideas have been introduced to the conversation (Bushe & Kassam, 2005; Cooperrider & Whitney, 2005). The poetic principle refers to the ability to choose the topic to be studied and initiates change because the stakeholder has selected the topic, which implies both value and desire to grow and change (Bushe & Kassam, 2005). Finally, the positive principle capitalizes on optimistic and constructive feelings initiating growth because participants feel there are more options that, in turn, broaden thinking (Cooperrider & Whitney, 2005). Participants engaged in thinking positively about outcomes naturally move closer to realizing those outcomes (Barrett, Fry, & Wittockx, 2005). These strengths are identified and utilized to support individual and collective growth.

More recently five more principles have emerged to support the work of AI including (a) wholeness, (b) enactment, (c) free-choice, (d) awareness, and (e) narrative (Whitney & Trosten-Bloom, 2010). Often, in a hierarchal model, a few leaders get together to envision and implement changes for the larger organization to accept. The wholeness principle suggests that all stakeholders need to be present and part of the inquiry process to stimulate creative questions and ideas. The enactment principle empowers participants to both imagine and enact the vision for change because the

process they are engaging in supports changes (Bushe & Kassam, 2005; Whitney & Trosten-Bloom, 2010). People make greater commitments to change and are able to sustain modifications to original thoughts and ideas when they have free choice about how they will implement those changes, illustrating the free-choice principle (Whitney & Trosten-Bloom, 2010). While reflection is a hallmark of most intervention programs, the awareness principle utilizes continual, looping, reflective practices to create a heightened awareness about actions, behaviors, and underlying beliefs. Finally, the narrative principle may be demonstrated as individuals construct positive stories and use those stories as an identity and find desire to live in and up to them. These unique narratives create opportunities for participants to understand, share, define, create identities, co-create new beliefs, and enact change based on those beliefs (Gergen & Gergen, 2006; Ospina & Dodge, 2005). As the novice teachers participate in the intervention community, they can explore their own growth and adaptability and apply new understanding to difficult situations they encounter through these principles.

AI is comprised of a four-stage model developed by Cooperrider and Whitney (2005) to capitalize and build on the strengths of an organization to imagine, discover, and co-construct a new vision through collaboration. While many communities focus on a problem or weakness approach, this may lead to an overstatement of the issue as a problem and sidetrack members by needlessly spiraling them into negative mindsets (Cooperrider & Whitney, 2005; Grant & Humphries, 2006). AI encapsulates the "art and practice of asking questions that strengthen a system's capacity to apprehend, anticipate, and heighten positive potential" (Cooperrider & Whitney, 2001, p. 245).

The 4-D cycle (Cooperrider & Whitney 2005) is widely known as the core AI intervention model originally named (a) discovery, (b) dream, (c) design, and (d) destiny and now renamed as (a) appreciating, (b) envisioning, (c) co-constructing, and (d) sustaining. During the appreciating phase, participants question, discover, identify, and celebrate the strengths of the community by recalling and telling positive stories about things that worked well (Cooperrider & Whitney, 2005; Evans, Thornton, & Usinger, 2012). They then progress to the envisioning or dream stage of the model where they imagine possibilities if they could build and extend those strengths and then design or identify what they would like to happen (Cooperrider & Whitney, 2005; Evans, et. al., 2012). In the third stage, stakeholders "engage in dialogue to determine the structures the organization requires to reach shared vision" (Evans, et. al., 2012, p. 168). Finally, in the destiny stage, participants co-construct the ideal positive changes in more of an improvisational approach than a strategic approach by first utilizing prior contributions to the vision and, second, putting those ideas into action (Bushe & Kassam, 2005; Evans et al., 2012).

The AI model has been used in many settings including health care, business corporations, industry, and schools. The model has also been used as an action research methodology for qualitative research for the design and data collection (Calabrese, Hummel, & San Martin, 2007). There are several studies that analyze the effectiveness of organizations to influence improvement and change. In a meta-case analysis of using AI, Bushe and Kassam (2005) analyzed twenty research cases using AI as a theoretical framework to determine evidence of individual and transformational change. They examined the intervention models and measured the extent to which the individuals

followed through on the intervention model. Seven of the 20 cases appeared to have experienced transformational change. The biggest determining factor in concluding whether the change was transformational was whether new knowledge was created versus creating new processes and the identification of a generative metaphor or new perceptions or inventions to describe the change. However, all of the 20 organizations identified their change as transformational, which may illustrate a lack of understanding true powerful change. The researchers postulate that change comes from the ground up because the "ground is about the substructure that influences what people think and do" (p. 168). The objective is to uncover and strengthen individually and collectively from a positive perspective (Cooperrider & Whitney, 2005). While not one organization, a novice teacher community might become a new organization that can create and support individual and personal growth.

Additionally, AI used in evaluation design leadership may support improvements in communication, impact, and the sustainment of agreed upon core values (MacNeill & Vanzetta, 2014). While not specifically geared to beginning teachers, one case study of a school's use of AI to lead school improvement noted positive and sustaining changes for the school because of a concerted effort to improve communication (Willoughby & Tosey, 2007). In this study, a critical factor in the cultural shift was the opportunity to design new ways of approaching problems as a community. Two hundred forty students and 35 teachers were interviewed as part of the discovery phase, and 12 students and four staff members comprised the team. The team was trained to use the AI model to locate strengths among the students, staff, and school. Dreams for the school were identified and designed as part of the continuous improvement resulting in overwhelming support for

the school improvement initiative (Willoughby & Tosey, 2007). Furthermore, the AI model appears to rally support for innovation, positivity, and transformational change in numerous environments (Grant & Humphries, 2006).

Leadership, school-based professional communities, and nongovernment agencies are also utilizing AI to build capacity among members from different organizations as part of a PLC (Jansen et al., 2010). NGO leaders were brought together to enhance leadership capacity among the managers of the organization. The AI process was used to create the PLC using inquiry through positive collaboration. The PLC was created by bringing together 25 managers from non-government organizations to participate in a 14-month collaborative community that incorporated AI. The participants valued (a) a flexible and negotiated structure, (b) sharing positive stories, (c) cycles of exploration, (d) individual reflection, (e) collective reflection, and (f) an extended time frame to continue collaboration. While all participants were from different companies, they were able to participate in a collaborative effort by forming a new community with a collective vision much like the intended design of the novice teacher community in the present study.

While the AI model is an effective strengths-based change model, the related, Appreciative Advising (AA) model focuses on the positive potential of participants and incorporates two additional stages that precede and follow the four-step AI model including *Disarm* and *Don't Settle* (Bloom, Hutson, He, & Konkle, 2013). The Disarm stage focuses on identifying past positive experiences and determining personal strengths. Additionally, the subsequent stage, *Don't Settle,* targets behaviors and practices that will assist the individual in maintaining positive energy in pursuit of future goals and ideals

(Bloom et al., 2013). All six stages are flexible and promote opportunities to move between these junctures as reflection, decision making, and experimentation occur.

The AA mentoring model was first developed to support undergraduates and advisors through the advising process and shares the principles of AI (He, 2013). It has been used in middle and high schools to foster teacher and student relationships (Calabrese et al., 2007) and to advance teacher candidates' knowledge and support for English Language Learners (He, 2013). AI was applied in a teacher candidate graduate course to guide their interaction and communication with diverse populations. The parallel mixed methods study examined teacher candidates' cultural competence pre and post course enrollment. Through the AI process, teacher candidates were given multiple opportunities to reflect on their learning and discover their own students' strengths and contributions to the classroom learning environment through weekly discussions and reflection activities about their own cultural experiences, students' cultural experiences, cross cultural communication opportunities, and their field placement experiences (He, 2013). Survey results demonstrated that teacher candidates enhanced their understanding of cultural competencies. The use of the AI framework as tool to facilitate teacher candidates' reflection about cultural competency demonstrates promise for other inquiry-based teacher candidate field placement experiences to improve actual practice.

The framework has been modified to support teacher candidates as they negotiate the trials and tribulations of the internship experience by encouraging them to positively reflect and adapt to their experiences (Harkess, 2005). Harkess designed a qualitative study to follow 21 teacher candidates through their first field placement experience to examine their reflective process. AI was used to facilitate conversations about teaching as

a professional practice, particularly to help the teacher candidates connect their strengths to positive teaching practices. Teacher candidates demonstrated (a) reflection in action, (b) self-awareness, (c) the ability to conduct honest self-appraisal, and (d) the capability to design next professional teaching steps (Harkess, 2005).

As the previous studies indicate, the AI and AA framework provide insight into how a strengths-based approach creates awareness for change. Moreover, the AI approach was implemented in multiple contexts targeting schools, college students, and teacher candidates, demonstrating the promise for flexible use of this framework. The following section describes how the needs assessment findings point to the development of strengths-based learning community intervention.

Building a Professional Community Using AI

The needs assessment study illuminated the beginning teachers' need and desire for positive support to maintain and build mathematics pedagogical knowledge as practitioners seeking continuous improvement. They also described difficulties maintain their standards-based beliefs and practices in some school contexts. As the novice teachers engage in PLC's in their individual schools, additional and intentional support may increase their likelihood of maintaining and developing effective mathematics teaching practices (Ingersoll, 2012). The development of a hybrid learning community for the university graduates who are in their beginning years of teaching may address the social, emotional, and mathematics pedagogical needs through a strengths-based, AI approach. The intervention will be organized in a flexible format that includes opportunities for online and face-to-face engagement. Novice teachers will participate in varied activities that will support their mathematics pedagogical needs through

collaboration, discussion, and many opportunities that reflect a positive and safe learning environment.

Goals for the Beginning Teacher Mathematics Community (BTMC) will be developed using the AI Advising model (AA) to effectively utilize beginning teachers' strengths as Generation Y learners and classroom teaching strengths to further develop their teaching practices in a positive learning environment. Using components of AI and AA as a model for building the BTMC will provide the novice teachers with a context in which they may identify their personal and professional strengths in the initial face-to-face convening. These strengths can be discovered, dreamed, and designed throughout the year. One example of this would be to engage the beginning teachers in activities to build collaboration through principles of abundance to understand the positivity and new possibilities they might construct rather than getting mired in tired, old problems (Smith, Besharov, Wessels, & Chertok, 2012). Novice teachers are likely to focus on their weaknesses and perhaps dwell on the teaching elements that are not working. However, refocusing their energy, time, and effort on pedagogical practices that are working and using those strengths to bolster their overall teaching by designing explicit teaching practices that will enhance the teaching and learning experience for all classroom stakeholders. The following section describes the goals of the intervention, establishes the hypothesis, discusses the critical CoP and AI elements, and presents the research questions.

AI University Induction

The goal of this intervention was to support beginning teachers' mathematics pedagogical knowledge. This intervention design and implementation was informed by

research related to induction programs, situated learning theory, CoPs, PLCs, AI, and AA. The hypothesis was that beginning teachers who participated in the intervention will increase feelings of being supported, teacher self-efficacy, and sustain or build standards-based mathematics pedagogical beliefs.

Develop and Implement a Supplemental Induction Program

Effective induction programs promote life-long learning, increase retention, and increase student achievement (Britton et al., 2003; Ingersoll & Strong, 2011; Wong, Britton, & Ganser, 2005). Effective induction positively promotes good teaching practices including differentiating teaching strategies to meet students' needs and establishing a positive learning climate for students. The impact of induction is increased when beginning teachers are engaged in multiple forms of induction practices such as mentoring, cohort groups, and co-teaching (Ingersoll & Strong, 2011). Web-based support and collaborative online communities designed to enhance school-based induction programs increase novice teachers' reflective practices about teaching content (Ormond, 2011), feelings of being emotionally supported, and confidence in teaching decisions (Dewert et al., 2003). The intervention was a supplemental induction support for the beginning teachers incorporating good teaching practices within a positive community.

In Support of a Blended CoP and PLC

As teacher candidates transition to beginning teachers, their learning about teaching is primarily through context and is situated in their particular school learning environments. While on the surface the CoP and PLC appear to be similar, and indeed, they share many similarities including commitment to a shared practice, inquiry, and a

collective vision (Hord, 2004), they typically originate, develop, and progress differently (Blankenship & Ruona, 2007). The CoP develops organically, from shared interests, and progresses unevenly. The PLC model is implemented in a structured school-based setting and emphasizes implementing curricular changes to impact student achievement results (Dufour & Eaker, 2010). As previously discussed, the literature review indicates that beginning teachers thrive in effective PLCs (Lovett & Cameron, 2011) that are designed to target their unique needs (Brown & Wynn, 2009). In contrast, participants in CoPs join as a result of a shared interest and goals and are not always typically part of the formal organization and may be "found within or span organizational boundaries" (Blankenship & Ruona, 2007, p. 4) but are not necessarily part of the organized structure. Most importantly, membership in a CoP is voluntary and content typically develops organically by responding to the members' needs (Wenger, et al., 2002). Keeping in mind that the intervention would be delivered from the university setting, focus on shared interests, and invite beginning volunteers to participate, the decision to implement a blended CoP and PLC was made. The subsequent section describes the selection of the AI design framework for the intervention.

AI Design Supports Beginning Teachers

The blended CoP and PLC and the AI model both highlight shared inquiry as a process for learning, changing, and growing. Situating the blended CoP and PLC within the AI strengths-based framework invited participants to reflect about their mathematics teaching beliefs and practices. As previously discussed, the AI model and incorporates the 4D cycle, including (a) appreciating, (b) envisioning, (c) co-constructing, and (d) sustaining as a framework for the community. The intervention was designed for

beginning teachers to identify their personal and professional strengths throughout intervention with a focus on how those strengths could be leveraged to discover, dream, and design teaching practices. As many novice teachers are likely to focus on their weaknesses and perhaps dwell on the teaching elements that are not working, the AI framework in the learning community was designed to counteract those tendencies. Consequently, the intervention targeted refocusing the beginning teachers' energy, time, and effort on the discovering and celebrating the mathematics pedagogical practices that were working and using those strengths to bolster their overall teaching practices.

The design of the intervention included novice teachers from seven school districts teaching mathematics in kindergarten through eighth grade and encompassed a hybrid face-to-face and online format. The intervention was conducted from September to March and included opportunities for teachers to attend monthly face-to-face meetings, participate in online discussions, and access multiple classroom resources. Mathematics pedagogical beliefs, support, and teacher self-efficacy were measured.

Research Questions

The evaluation of the intervention addressed the following research questions:

RQ1: What are the beginning teachers' experiences within an Appreciative Inquiry based induction program?

A. What components of the intervention do participants report as having the greatest benefit?

B. What were the key factors that enabled or inhibited the beginning teachers from participating in the intervention components?

RQ2: How do beginning teachers' sense of self-efficacy change through participation within the Appreciative Inquiry Induction Program?

RQ3: How do beginning teachers' mathematics pedagogical beliefs change through participation within the Appreciative Inquiry Induction Program?

Conclusion

The development of a university-led induction community might support and sustain novice teachers by providing collegial, collaborative, emotional, and pedagogical support through a blended CoP and PLC that is driven by authentic needs. Focusing on strengths to build and sustain mathematics pedagogy may highlight positive teaching practices for novice teachers and their students. Understanding the unique characteristics of novice teachers in concert with the AI leadership model provides a positive, strengths-based framework for designing and facilitating the work in the intervention. While there are many common reasons why the national attrition rate hovers just below 50%, novice teachers report that the kinds and types of support are crucial (Ingersoll & Strong, 2011). Additionally, research reveals that comprehensive induction practices that incorporate multiple opportunities for support are most effective (Ingersoll & Strong, 2012). In the current political and educational climate, novice teachers need and deserve a safe space to learn and cultivate their mathematics teaching.

Chapter 4

Beginning Teacher Mathematics Community

As the needs assessment and intervention literature indicated, beginning teachers desire and benefit from additional support for enhancing their teaching (Ingersoll, 2003). In response to this need, the BTMC intervention was designed as a blended face-to-face and online learning community for Mid Atlantic university beginning teachers to reinforce the beginning teacher's standards-based mathematics pedagogical beliefs and practices. As undergraduates, the participants experienced a supportive environment to build their teaching repertoire through content delivered in university courses and strategic field placement experiences. The present intervention sought to continue the university support, as the beginning teachers transitioned to their new schools, by developing a new community for sharing positive experiences and bolstering student-centered teaching practices. This intervention design and implementation was informed by research on effective induction components culled from the literature related to situated learning theory (Lave & Wenger, 1991), effective CoPs (Fuller, et al., 2005; Lave & Wenger, 1991; Wenger, 2007), successful PLC (Dufour & Eaker, 2010), and a strengths-based approach through AI (Cooperrider & Whitney, 1999, 2005).

Through this face-to-face and online community, the BTMC focused on identifying and sharing the strengths of the beginning teachers to develop and sustain effective mathematics pedagogical teaching practices through an AI framework. As a learning community, participants dialogued in face-to-face and online formats during the intervention. Within this learning community, participants were encouraged to communicate about successes and challenges and were provided opportunities in both the

face-to-face and online components, support for the development of teachers' standards-based mathematics pedagogical knowledge. While I was the facilitator, all participants engaged in knowledge sharing and mutual problem solving by co-creating new mathematics pedagogical knowledge to sustain and support standards-based mathematics teaching practices through professional learning opportunities. The BTMC cohort included 19 novice teachers from a variety of school districts across Maryland. The mix of beginning teachers included first-, second-, and third-year teachers. The purpose of this chapter is to describe an overview of the intervention, purpose of the study, research design, participant selection, data collection, and data analysis.

Intervention Framework

The BTMC was designed using the AI strengths-based framework (Cooperrider & Whitney, 2005) by orchestrating professional learning opportunity sessions, discussions, and reflections from the teachers' positive stories of classroom strategies that were working well (Figure 4.1). The AI approach used appreciation or a focus on the positive aspects of a problem or the parts that were going well while the inquiry concentrated on using exploration to discover new possibilities to both reframe and solve practical problems (Reed, 2006). The participants were invited to bring classroom challenges and struggles to the professional learning sessions and were given opportunities to develop strategies to address those struggles.

Figure 4.1. 5-D AI framework. Adapted from Cooperrider and Whitney (2005).

AI is an approach that "concentrates on exploring ideas that people have about what is valuable in what they do and then tries to work out ways this can be built on" (Reed, 2006, p. 2). While a focus on success is important, the approach does not diminish the very real struggles of individuals. AI challenges participants to rethink their ideas about how growth can be fostered and implemented. The components or activities of the intervention combined different aspects of this design by integrating professional learning topics. For example, the face-to-face sessions incorporated all of the AI steps (Figure 4.1) because usually there was enough time to go through the entire cycle. This framework also afforded the participants opportunities to identify ideas about how they wanted to develop their classrooms as mathematics communities. AI goals are affirmative, stated with positivity, and identify clear objectives (Reed, 2006).

Purpose of Study

The purpose of this study was to understand how the participants' experiences in the BTMC reinforced standards-based mathematics pedagogical beliefs, knowledge, and practices, feelings of support, and teacher self-efficacy. The study also sought to

understand the nature of the informal learning that occurred and motivations for participation in the intervention.

Specifically, this project included (a) designing, developing, and implementing a supplemental induction program that incorporated a blended CoP and PLC, (b) designing explicit AI mentoring and coaching support, and (c) providing participants opportunities to initiate discussion and support. The hypothesis was that beginning teachers who participated in the BTMC would report positive feelings of support and teacher self-efficacy. Additionally, the beginning teachers would be able to sustain or build their standards-based mathematics pedagogical beliefs and knowledge. The research questions were:

RQ1: What are the beginning teachers' experiences within an Appreciative Inquiry induction program?

A. What components of the intervention do participants report as having the greatest benefit?

B. What were the key factors that enabled or inhibited the beginning teachers from participating in the intervention components?

RQ2: How do beginning teachers' sense of self-efficacy change through participation within the Appreciative Inquiry Induction Program?

RQ3: How do beginning teachers' mathematics pedagogical beliefs change through participation within the Appreciative Inquiry Induction program?

Method

Research Design

The BTMC addressed a critical need for continued university accreditation status; therefore, process and outcome evaluation measures were implemented to assess the success of the BTMC intervention. The BTMC intervention was facilitated during the 2015-2016 academic year to determine the viability for implementation the following year and therefore partially aligns to the small-sample study and evaluability assessment process approach (Wholey, Hatry, & Newcomer, 2010). The 19 novice teacher volunteer participants in the BTMC represented a sample of the larger university population of School of Education (SOE) graduates. Sampling reduced data collection but also produced reliable estimates of program success for the BTMC implementation for the entire population the following year (Wholey et al., 2010). Process monitoring was needed because "when a program design is innovative, unplanned results may occur during the course of implementation" (Rossi, Lipsey, & Freemam, 2004, p. 182). As a part of the process monitoring, professional learning satisfaction surveys were conducted periodically to assess the value and impact of face-to-face sessions, discussion topics, and resources (Appendix C). This information was formative and helped determine whether the professional learning opportunity activities were appropriate and if changes were needed to achieve the proposed outcomes (Haslam, 2010).

Participant Recruitment

The Mid Atlantic university graduated 57 teacher candidates in May 2015. Four of the participants were not initially eligible because they received certification in middle school social studies and language arts. Other participants were not eligible because they

were hired to teach in private schools, pre-kindergarten, or to teach subjects other than mathematics. Several students were hired to teach humanities, which is a popular position in the Mid-Atlantic states describing one who teaches only language arts and social studies. Additionally, one student enrolled in graduate school. Of the final eligible pool of 21 participants, 14 volunteered to be in the study. Five second- and third-year teachers, also graduates of the same university, volunteered to participate, increasing the teaching span from one to three years. The participation goal was approximately 20 participants, and 19 total participants enrolled.

The 19 BTMC intervention study participants included three early childhood certified teachers, eleven elementary certified teachers, and six middle school certified mathematics teachers who taught in seven school districts in the same Mid-Atlantic state. Study participants' student special education enrollment, English Language Learner (ELL) enrollment, and school Free and Reduced Meal rates (FARMs) were collected (Table 4.1). Participants' student population reflected a wide range of student characteristics spanning a large spectrum from very few special education and ELL students to a large majority. The hiring school characteristics varied greatly from less than 20% to 100% FARMs rates.

Instruments

Three instruments were used to collect data. Two Likert-scale surveys were used in this study: Teacher's Sense of Self-Efficacy Scale (TSES; Tshannen-Moran & Woolfolk-Hoy, 2001; see Appendix D) and the Teaching Mathematics Beliefs Survey (Appendix A). The Teaching Mathematics Beliefs Survey included the Prime Online Teacher Beliefs Scale (Pape, et al., 2012) and author-constructed questions to assess

standards-based beliefs and support for teaching mathematics. A Professional Learning Opportunity Satisfaction survey was used to assess the satisfaction and impact of the face-to-face sessions in November and March (Appendix C).

Teacher's Sense of Self-Efficacy Scale. The Teacher Sense of Self-Efficacy Scale (Appendix C) is a 24-item survey that measures teacher's self-efficacy beliefs (Tshannen-Moran & Woolfolk-Hoy, 2001). Tschannen-Moran and Woolfolk-Hoy asked preservice professors to identify skills that teacher candidates should know and perform at the conclusion of a teacher preparation program and items were constructed based on these skills. While testing the scale to determine reliability, Tschannen-Moran and Woolfolk Hoy located three moderately correlated factors including (a) Efficacy in Student Engagement, (b) Efficacy in Instructional Strategies, and (c) Efficacy in Classroom Management. Tschannen-Moran and Woolfolk Hoy determined the subscale scores for each of the subcategories by computing the unweighted mean of the items that load on each factor. Table 4.1 indicates the items on each of the subconstructs within the survey. An example of a question regarding student engagement is "How much can you do to get students to believe they can do well in student work?" An instructional strategy question example is "How much can you gauge student comprehension of what you have taught?" Efficacy in classroom management is evaluated by asking questions such as "How well do you respond to defiant students?" Survey directions prompt the participants to answer questions "by considering the combination of their current ability, resources, and opportunity to do each of the following in your present position." Participants responded to the statements on a nine-category rating scale including five

anchors: (1) nothing, (2) very little, (3) some influence, (4) quite a bit, and (5) a great deal.

Table 4.1

Subscale Efficacy Items

Subscale Efficacy	Items
Efficacy in Student Engagement	1, 2, 4, 6, 9, 12, 14, 22
Efficacy in Instructional Strategies	7, 10, 11, 17, 18, 20, 23, 24
Efficacy in Classroom Management	3, 5, 8, 13, 15, 16, 19, 21

Mathematics Pedagogical Beliefs Survey. This instrument is described in Chapter 3 (Appendix A).

Mathematics Teacher Beliefs Interview. This instrument is described in Chapter 3 (Appendix B).

Professional Learning Opportunity Satisfaction Survey. The 12-item Professional Learning Opportunity Satisfaction Survey was adapted from the National Staff Development Council Professional Development Guide (Haslam, 2010) and assessed participants' perceptions of overall satisfaction with the professional development, impact of the face-to-face professional learning experience, and levels of support (Appendix C). A question about satisfaction with the professional learning asks, "Which of the following statements best describes the usefulness of the professional learning." Participants are then asked to choose from six ordinal statements ranging from "It was a good start" to "Not clear." A question about impact asks participants, "Which of the following statements best describes the likelihood that you will apply what you learned in this professional learning to your classroom?" Participants were then asked to choose from a six-point ordinal continuum ranging from "I have already tried this in my classroom" to "I don't think this will work with my students." To determine feelings of

support, teachers were asked, “I feel supported by teachers in the BTMC” and “I offer support to other teachers in the BTMC.” Questions about perceptions of support ask participants to indicate the degree of agreement on a seven-point ordinal continuum including the following anchors: (1) strongly disagree, (2) disagree, (3) somewhat disagree, (4) neither agree or disagree, (5) somewhat agree, (6) agree, and (7) strongly agree.

Procedure

This section discusses an overview of the intervention components, data collection, and data analysis for the evaluation of the BTMC intervention. Ongoing participation evaluation information was also collected to determine the participation rates of the beginning teachers in the various professional learning opportunity components. While many of the professional learning themes were preplanned, beginning teachers were continually engaged in proposing, designing, and facilitating session content according to their classroom needs.

BTMC Intervention Components

Previously in this chapter, the BTMC AI technique was described as the overarching framework for the intervention. Two intervention components were facilitated within this framework including two-hour monthly face-to-face sessions and an online virtual community incorporating discussion posts and resource sharing. All component activities were designed and conducted to support voluntary beginning teacher participation. This section will describe the (a) face-to-face session launch, (b) face-to-face sessions, (c) virtual community discussion prompts, and (d) virtual community resources (Table 4.2).

Table 4.2

BTMC Activities Timeline, Duration, Description, and Example

Activity	Timeline	Duration	Description	Example
Launch	September 2015	Two hours		
Face-to-Face Activity Example One	September to April 2016. Monthly Face-to-Face Meetings	Two hours	An activity using the AI Approach that encourages participants to "discover what is working particularly well and then to envision what it might be like if the best of what is occurred more frequently" (Preskill & Catsambas, 2006, p. 3).	What was the best lesson you ever taught? What about it made it the best lesson? What about that best lesson can you design again?
Face-to-Face Activity Example Two	September, 2015 to April, 2106 Monthly Face-to-Face Meetings	Two hours	An activity facilitated to support mathematics pedagogical knowledge conducted during face-to-face meetings and discussion posts.	What are the elements of a rich mathematics task? What do students look like when engaged in rich mathematics tasks? What do teachers look like when engaged in a rich mathematics task? Novice teachers explore tasks and collaboratively design tasks for their own classrooms.
Discussion Prompts	September, 2015 to April, 2016. Biweekly	Varied depending on the length of time it takes the participant to post a discussion idea or respond to a post.	Brief post that communicates a positive message, struggle, strength, or mathematics pedagogical idea. Post encourages novice teachers to respond with ideas, reflections, and examples.	What is productive struggle? How might we engage our students to struggle productively?
Resources	September, 2015 to April, 2016. Continuous	Varied depending on the length of time it takes the participant to access or post a resource.	Websites with links to lesson plans, resources, and materials to support the teaching of mathematics.	Links to Illustrative Mathematics, NCTM Illuminations, Mathalicious YummyMath Dan Myer Blog Robert Kaplinsky

BTMC launch. The BTMC launch for the beginning teachers occurred in September 2015 with a face-to-face professional learning session at the university. The focus for this launch was to identify the strengths of the novice teachers and create a space for each novice teacher to develop a mathematics pedagogical vision and goals for the first month of teaching. The launch was facilitated using the AI framework including (a) define, (b) discover, (c) dream, (d) design, and (e) deliver (Cooperrider & Whitney, 2001). The AI framework included opportunities to share and collect positive stories, conduct paired interviews, and design a problem solution using the strengths-based model. The teachers were invited to discover the qualities of the best mathematics learning community they experienced. From these interviews, small groups determined themes for what they wanted their own classrooms to look like. The small groups then designed how they would create this mathematical community and planned the details for how they could translate their dreams into reality. Next, individuals and groups shared their ideas with the whole group. Then I conducted a short activity about the essential elements of a mathematics community including student engagement ideas to promote student discourse. The session closed with an opportunity for groups to reflect on the professional learning opportunity.

The launch session also provided an opportunity for participants to construct protocols for interacting as a community face-to-face and virtually. Additionally, participants offered professional learning topics they wanted discussed in future meetings. Before each meeting, novice teachers were informally surveyed to determine mathematics pedagogical topics for subsequent meetings. For example, participants requested a session about how to design and implement a rich task. At a follow-up

session, the novice teachers engaged in a rigorous and meaningful task and explored online and print resources where other such tasks could be located.

Face-to-face sessions. The two-hour face-to-face sessions were delivered monthly with a beginning launch in September 2015 and continued through April 2016. These sessions provided opportunities for novice teachers to share and reflect on the implementation of mathematics pedagogical ideas through the AI framework. An example of how the framework was used included a discussion about participant concerns about formal observations. Participants were asked to share a story about their strengths from their best observed lesson as a teacher candidate. Each pair joined another pair to identify recurring themes in the stories. Then, novice teachers dreamed what they wanted to happen in their formal observation and co-constructed elements of the design of this lesson. Finally, I conducted a mathematics pedagogical activity to examine how to design lessons that promote student engagement.

Each face-to-face session concluded with specific professional learning activities to address the targeted mathematics pedagogical topic. The goal of each session was to set the stage for continued discourse in collaboration as a blended learning community. As previously indicated, the AI framework was the method for engaging in purposeful interaction to impact teachers' classroom practices (Table 4.3).

Table 4.3

Sample Face-to-Face Session for the Standards for Mathematical Practice (SFMP)

Topic	Standards For Mathematical Practice (SFMP)
Discovery	Think about a lesson you taught where SFMP were integrated well. What happened in the lesson? Which SFMP did students exhibit? What did you do to facilitate those student behaviors? What were the most important conditions that supported the implementation of this lesson?
Dream	What are the themes that you notice about these lessons? What would you like to happen in your next lesson?
Design	What elements or strategies will you use as you design your next lesson?
Deliver	Share your next steps for implementing the SFMP. What explicitly will you do? What will this look like in your lesson
Learning Community	Activities Include: (1) Which of these things is not like each other? (2) Michael's work (Student diagnostic); (3) Questioning Strategies

Virtual components. The virtual components were delivered through an online Google+ community platform including discussion topics and resource sharing. Privacy and selective membership were maintained through fixed settings exclusive to the community and subscribers so that they would receive alerts when new posts were made. Beginning teacher virtual engagement occurred through opportunities including discussions and resource sharing.

Virtual discussions. The discussion prompts integrated within the virtual community focused on one or two aspects of the AI framework (Table 4.4). For example, a face-to-face session focused on dreaming and designing a particular mathematics pedagogical goal so the discussion board could focus on how the participants delivered or tried out their ideas. All BTMC communication reflected the AI aspects of this framework by focusing on the strengths-based approach to solve problems in the

classroom. The discussion board question prompts were used to help the participants identify what was working well to address their struggles (Reed, 2006).

Table 4.4

Sample of AI framework Integrated with the Discussion Components

Topic	Representation	Formative Assessment	Parents and Common Core
Define	What are the kinds of representations do students understand well? Struggle with?		
Discovery	What do you hope to have students represent? What does these representations look like in your classroom?		What types of parent communication have you tried? What positive responses have parents had to the mathematics learning in your classroom?
Dream	How are you ensuring that students have an opportunity to use representations in your lessons?		
Design	What specific classroom techniques do you use to ensure students make this connection?		
Deliver	Share your lesson plan and task.	Here are two great strategies for assessing students formatively: (1) Show Me (2) Hinge Question (3) Try these and share how they worked! (Fennell, Kobett, & Wray, 2015)	
Professional Learning	How might we promote student use of representations?	Short excerpt from an article explaining the *Show Me* and *Hinge Question* strategy.	Examples of positive parent communication techniques for parents including weekly CCSS-M student celebrations, Mathematics night ideas, and classroom website suggestions

One or two discussion prompts were posted monthly on a variety of topics on the Google+ private community. The discussion prompt topics were initially researcher generated but as the intervention progressed community members initiated discussion

topics as a follow up to face-to-face meetings or as issues or concerns developed in their classrooms. Some discussion prompt topics included developing productive struggle in students, using rich tasks, and exploring "Expired Rules" (Karp, Bush, & Dougherty, 2014; Table 4.5).

Table 4.5

Example Discussion Topics

Discussion Topics	Example
Productive Struggle	Elly Schofield discusses the idea of Beautiful Failure https://www.youtube.com/watch?v=sBPKoTr-XnQ How might we support our students in developing productive struggle during tasks?
Rich Tasks	Share a rich task that you have used in your classroom. Why do you feel it is rich? What did students do? What did you do to facilitate the task?
Expired Rules	How do we use mathematical vocabulary that enhances our students' conceptual understanding? (Karp, Bush, & Dougherty, 2014).

Virtual resource sharing. Several sections of the Google+ private community were devoted to mathematics resources for different topics and grade level interests. For example, there was a section linked to a shared drop box folder including resources such as (a) student productive struggle survey, (b) rich mathematics tasks for every grade level, and (c) sample lesson plans. Another resource section included website links to (a) popular mathematics blogs, (b) lesson plans and tasks, (c) assessment resources, and (d) mathematics articles and videos. I initially developed the shared resource section and invited members to contribute resources and links they found helpful.

Data Collection

Data collected for this mixed methods convergent design incorporated "collecting quantitative and qualitative data concurrently, analyzing the information separately, and then merging the two databases" (Creswell & Clark, 2011, p. 180). Data were collected in

several formats: surveys, individually recorded interviews, participation records, transcripts of virtual conversations, and transcripts of face-to-face sessions (Table 4.6). All participants were assigned a confidential participant number and pseudonym prior to data collection. The identification number and pseudonym were stored in a separate file from the data.

Table 4.6

Mixed Methods Data Collection and Timeline

Measure	Quantitative	Qualitative	Data Collection Type	Timeline
Mathematics Teacher Beliefs Survey	x	x	Web-Based Survey	September 2015 and April 2016
Teacher's Sense of Self-Efficacy Scale (Survey)	x		Web-Based Survey	September 2015 and April 2016
Teacher Beliefs Interview		x	Audio Interview	March and April 2016
Participation	x		Participation Records	September 2015 to April 2016
Virtual Conversations		x	Transcripts	September 2015 to April 2016
Face-to-face sessions		x	Transcripts	September 2015 to April 2016
Professional Learning Opportunity Satisfaction Survey	x		Web-Based Survey	November 2015 and March, 2016

Surveys. The Mathematics Teacher Beliefs and Teachers Sense of Self-Efficacy survey responses were collected pre- and post-intervention (September 2015 and April 2016) using an online survey program, Surveygizmo. A link to the Professional Learning

Opportunity Satisfaction survey was sent via email following the November and March face-to-face sessions.

Interviews. The interviews were conducted in March and April 2016 at the university or at the novice teacher's school site. Interviews lasted approximately 30-45 minutes. QuickTime audio was used to record the interviews, which were then transcribed and uploaded to DeDoose software for analysis.

Participation records. Participants' attendance at face-to-face sessions and the online community were recorded to determine participation rates. To determine the participation levels, individual attendance for the face-to-face sessions and online community were calculated by summing the participant levels for each category of interaction.

Virtual conversations. Participant's responses in the virtual community were captured through the Google+ community.

Face-to-Face sessions. All sessions were recorded and transcribed. Each session was conducted within the AI framework including (a) define, (b) discover, (c) dream, (d) design, and (e) deliver (Cooperrider & Whitney, 2001), therefore field notes from the session were recorded using this framework. For example, Table 10 demonstrates how the initial *Define* inquiry questions, *What is a rich task and how do you know when a task is rich?* prompted a deep discussion about how to engage special education students in rich tasks within a mixed ability classroom. The field notes incorporate the session inquiry questions, comments from individual beginning teachers, and notes about future actions for the online community (Appendix E).

Data analysis. This section describes the coding and statistical tests for quantitative and qualitative data (Table 4.7).

Table 4.7

Research Questions, Data, Timeline, and Analysis

Research Questions	Data	Collection Timeline	Analysis
What are the beginning teachers' experiences within an AI induction program?			
What components of the intervention do participants report as having the greatest benefit?	F-2-F Transcripts Online Discussion Interviews	September 2015 through April 2016	Inductive thematic coding
What were the key factors that enabled or inhibited the beginning teachers from participating in the intervention components?	Professional Learning Surveys Transcripts Interviews	September 2015 and April 2016	Inductive thematic coding
How do beginning teachers' self-efficacy change through participation within the AI Induction Program?	Transcripts Interviews TSES Scale	September 2015 and April 2016	Inductive thematic coding T-test
How do beginning teachers' mathematics pedagogical beliefs change through participation within the AI induction program?	Interviews Participation Logs Discussion posts Mathematics Teaching Beliefs Survey	September 2015 and April 2016	Inductive thematic coding T-test

Statistical tests. Survey data were entered into SPSS and cleaned. Traditional belief statements from the Mathematics Teacher Beliefs Survey were reverse coded to determine an overall score reflecting standards-based mathematics pedagogical beliefs. Descriptive statistics were calculated for the Mathematics Teacher Beliefs Survey and the Teacher's Sense of Self-Efficacy Scale (Tshannen-Moran & Woolfolk-Hoy 2001) for the sample as a whole and stratified by teaching certification. Pearson Product Correlations were calculated to examine the association of participant's teacher self-efficacy, beliefs,

and participation rates. Paired sample t-tests were performed to examine differences between participants' mean teacher self-efficacy ratings from pre- to post-intervention. To investigate the significance of the relationship between teacher self-efficacy and beliefs, Chi-Square tests were conducted.

Participant's level of participation was classified as high or low by examining the range of participation across the BTMC. Beginning teachers who attended five or more of the eight monthly face-to face sessions and participated in the online community by posting or responding to a post at least five times were categorized as high participation. Attendance at four or fewer of the monthly face-to-face sessions and four or fewer posts received a low participation rating.

Qualitative data coding. There were five kinds of qualitative data to analyze including transcripts from the face-to-face sessions, open-ended survey questions, interview responses, and direct communication from the participants. For each collection of qualitative data, all transcripts were thoroughly examined to record initial thoughts and ideas about the text on the transcript pages. These transcripts were uploaded to DeDoose Software to prepare for coding and analysis. The data were analyzed using an inductive coding process (Thomas, 2006). Data were coded and labeled based upon topics from the literature, which were used to generate new categories beyond the a priori themes: beliefs, strengths, and support. These categories were then organized within themes and larger categories of behaviors were established. This process reflected an emergent design as the analysis revealed codes or themes as "the researcher must come to the transcripts with an open attitude, seeking what emerges as important and of interest from the text"

(Seidman, 2012, p. 117). A qualitative codebook was constructed from these themes to organize the large amount of data.

Conclusion

Informed by the literature and needs assessment, the BTMC intervention was designed to support beginning teachers' standards-based mathematics pedagogical beliefs and knowledge. This chapter presented a mixed method approach to collecting and analyzing intervention data. The proposed research questions guided decisions about data collection and analysis. The chapter provided an overview of the BTMC intervention framework, purpose of the study, procedures, data collection, and data analysis. Through the mixed-method study, I collected data and analyzed participant responses to surveys, interviews, and interactions in face-to-face and virtual settings to assess their mathematics pedagogical beliefs and teacher self-efficacy using an AI framework. Chapter 5 describes key findings from the quantitative and qualitative data collection and analysis.

Chapter 5

Results and Discussion

The purpose of this dissertation was to examine beginning teachers' feelings of support, teaching self-efficacy, and standards-based mathematics pedagogical beliefs associated with their participation in a university-led beginning teacher induction program. In Chapter 4, I presented the research study design and BTMC induction components. The goal of this chapter is to present the findings for each research question. As stated above the following research questions focused the analyses within this study.

RQ1: What are the beginning teachers' experiences within an Induction program based on AI?

A. What were the key factors that enabled or inhibited the beginning teachers from participating in the intervention components?

B. What components of the intervention do participants report as having the greatest benefit?

RQ2: How do beginning teachers' sense of self-efficacy change through participation within the AI Induction Program?

RQ3: How do beginning teachers' mathematics pedagogical beliefs change through participation within the AI Induction program?

Beginning Teachers' Support

The first research questions focused on the participants' experiences within the AI induction program. To best understand these experiences within the BTMC, it is helpful to first understand their experiences outside of the BTMC. As previously described, the beginning teachers were situated in varying grade levels and taught diverse student

populations. Just as their school contexts varied, so did their support. The following discussion about support includes the beginning teachers' beliefs about the support they were receiving, the extent to which the support the beginning teachers were receiving matched their beliefs, and the beginning teachers' feelings about the BMTC support.

Support from Schools

In this Mid-Atlantic region, all novice teachers are required by the state to be enrolled in some type of induction support in their school districts. The types of support vary depending on the participants' contexts but might include mentoring, targeted professional development for new teachers, team planning, reduced course load, and smaller class size. Participants were surveyed in September and March to determine the types of support they were receiving (Table 5.1) and interviewed to determine the value of that support. The total number of supports for the nineteen beginning teachers in September ($n = 43$) and March ($n = 46$) remained relatively stable, but the types of support varied.

Table 5.1

Beginning Teacher Types of Support

Induction Support	September	March
Mentor	17	13
Regular Professional Learning Opportunities	5	13
Team Planning	16	16
Reduced Course Load	1	0

Note. Number of supports for each category. Participants could select all that applied.

Appointed mentors were primary sources of support for the beginning teacher but were regarded very differently by the beginning teachers. Typically, mentors were assigned to the beginning teachers. These mentors might be other teachers in the building

or designated school district mentors whose primary role was to support beginning teachers. At the BMTC launch, more than half of the participants discussed assigned mentors with some trepidation. Mary indicated, "I was given a mentor but I haven't met her yet. I am not sure what she does" (I, September, 2016[2]). Of the seven school districts represented by the participants in the BTMC, all but two assigned a mentor to the beginning teachers for the first school year. Two of the school districts employed an official novice teacher mentor whose primary responsibility was to provide support to beginning teachers in the school district.

Mentor support was highly individual as was reported throughout the BTMC in face-to-face sessions and interviews by the participants as either helpful or unhelpful. A re-occurring theme reflected by five beginning teachers who described their mentors as supportive focused on the mentor's ability to anticipate needs. In a face-to-face session, Sara described a special characteristic of her supportive mentor, "She seriously reads my mind or at least my face. She seems to know when I need a hug or a push. I am pretty sure she knows what I need more than I do" (I, March, 2016). Another, smaller group of beginning teachers characterized their mentors as unsupportive. Unsupportive mentors might just be described as unavailable or in more serious cases as people who were perceived by the beginning teachers to obstruct their progress. Lee is one of many non-tenured teachers in her building and competes for support from her mentor. She shared,

> I have an assigned mentor, and she is split between two schools and is helping ten teachers in our school. She pretty much has to deal with emergencies so I don't

[2] Participant quotes are designated by the following: I refers in Interview, F: Face-to-face, V: Virtual Community, S: Survey

> get much attention from her. On the other hand, if she is in your room a lot, people know you are struggling. (I, February, 2016)

Tension between mentors and beginning teachers mounted when the assigned mentor gave them advice that conflicted with their beliefs. The beginning teachers raised the issue of conflicting advice at every face-to-face session. Amy explained,

> She walked in during math class and gave me this look. My students were playing a dice game for fluency and were all over the classroom. They were having fun and excited and I could tell she didn't like it…. I also give them lots of choices. My mentor teacher got involved. She doesn't like them moving around or getting choices. Keep in mind they are first graders! She made lots of snide comments and made me uncomfortable to even ask questions. I tried to do what she asked, but it wasn't working and I was spending all my time telling them to be quiet because they couldn't move around. We were all miserable. (F, October, 2016)

Team planning was also a popular source of support for these beginning teachers (n = 16) but was reported by the beginning teachers to vary in benefit. Some beginning teachers found the team planning extremely helpful while others described it as frustrating and constraining. Casey wrote, "My great team is so supportive. We meet weekly to plan and discuss ideas and this makes me feel prepared" (S, March, 2016). Other beginning teachers found the team planning challenging because the teaching activities did not align with their beliefs. Amy explained, "I want more support to continue to implement problem-based learning and rich tasks regardless of what I am being told!" (S, March, 2016).

Matching Beliefs and Support

Mentoring and team planning benefits were connected to the beginning teacher's beliefs about teaching mathematics. If the mentoring and team planning activities matched the beginning teachers' beliefs about teaching mathematics, the beginning teachers found the support helpful. In September, three of the nineteen participants reported that the support they were receiving minimally matched their beliefs (Table 5.2). By March, this group grew to seven students. Furthermore, the group that believed that the support matched their beliefs to some extent decreased by half moving to a less extent or greater extent. Thus, overall the number of participants who expressed concerns relative to the degree to which their beliefs were supported by their mentors decreased across the school year. Participants indicated that as they received more support from the BTMC and from the school districts, they increased their understanding of how the support they were receiving actually matched their beliefs. Amy reported, "The more I am getting to know the school, the more I understand what the school wants us to do about teaching math. Things are different than [sic] what the county said at the new teacher orientation" (F, January, 2016). Additionally, all seven beginning teachers with a school designated mathematics support teacher described the value of this person in supporting their beliefs. Lori explained,

> We received training on number talks and the *notice* and *wonder* [technique] last week, and I was fascinated with how excited the teachers got. I was shocked they didn't know about it and glad my [mathematics support teacher] was sharing this. I am glad that we are doing this community because I feel more comfortable

doing what I want to do in my class. I don't want to have to wait until everyone else figures it out to become acceptable. (I, April, 2016)

Table 5.2

Beginning Teachers' Report the Extent to Which School Support Matches Beliefs

Criteria	September	March
Not at all	1	0
Little extent	2	7
Some extent	12	6
Moderate extent	0	3
Large extent	4	3

Note. Support survey question, *"The support I receive for teaching mathematics matches my own beliefs about the best way to teach mathematics."*

BTMC Beginning Teacher Participation

Analyzing the beginning teachers' experiences within the BTMC also required an investigation of the BTMC implementation fidelity and the beginning teachers' participation. Implementation fidelity refers to the degree to which a program is delivered as it was intended (Dusenbury, Brannigan, Flaco, & Hansen, 2003). Understanding the beginning teachers' participation within the BTMC is enhanced by knowledge of program adherence because conclusions about its effectiveness must be framed within this context (Kam, Greenberg, & Walls, 2003). Program adherence refers to whether the sessions were delivered as designed (Dusenbury et al., 2003). Within the context of program adherence, beginning teacher participation may be examined and is also a key component of determining implementation fidelity and refers to the program reach or participant involvement rate (Durlak & DuPre, 2008).

While the BTMC was originally designed to be delivered through face-to-face monthly sessions and an online community, participants immediately requested that two face-to-face sessions be offered each month to increase opportunities to attend one of the

sessions. Therefore, two options to attend face-to-face sessions were provided every month except December. This adjustment reflects a process evaluation decision that enhanced the fidelity and likelihood of beginning teacher participation. Additionally, the online community was delivered and maintained throughout the BTMC intervention.

The beginning teachers could participate in the BTMC by attending the monthly face-to-face sessions, joining a virtual session on Google Hangout, and posting on the Google+ online community. Overall, their attendance in individual sessions ranged from one to eighteen participants with a mean monthly attendance of 13 participants. Fifteen of the 19 beginning teachers were considered to participate at a high level, which was evidenced by attending five or more of the eight monthly sessions and participating in the online community by posting or responding to a post at least five times. In contrast, low participation ratings were assigned to three beginning teachers who attended fewer than five face-to-face sessions and participated in the online space less than five times. Although one participant did attend five face-to-face sessions, he never participated in the online community, which resulted in a low participation rating (Table 5.3). Overall participation rates may signal beginning teachers' interest in receiving support from the BTMC, and additional data analysis revealed that the BTMC provided a different kind of support than the participants were experiencing in their school district induction programs.

Table 5.3

Beginning Teachers' Participation Rates

Participants	Face-to-Face Rate	Online Rate	Overall Participation Rate
Jane	8 (High)	16 (High)	High
Alane	8 (High)	24 (High)	High
Matt	8 (High)	17 (High)	High

Kim	8 (High)	9 (High)	High
Lori	8 (High)	10 (High)	High
Lee	8 (High)	10 (High)	High
Maureen	7 (High)	11 (High)	High
Sara	7 (High)	16 (High)	High
Kitty	7 (High)	17 (High)	High
Casey	7 (High)	8 (High)	High
Marcy	7 (High)	16 (High)	High
Karole	6 (High)	15 (High)	High
Tim	6 (High)	0 (Low)	Low
Amy	5 (High)	18 (High)	High
Nora	5 (High)	9 (High)	High
Nancy	5 (High)	12 (High)	High
Mary	3 (Low)	4 (Low)	Low
Bree	2 (Low)	2 (Low)	Low
Jake	1 (Low)	1 (Low)	Low

Note: n=19

BMTC Provides Multiple Kinds of Support

Both quantitative and qualitative data revealed that beginning teachers found support within the BTMC. This support bolstered them in challenging school environments and provided emotional and pedagogical support. Beginning teachers found that they were also able to extend the support to others. All sixteen of BTMC participants who completed the satisfaction survey (Appendix D; Table 5.4) agreed or strongly agreed that other teachers in the BTMC supported them. The support was characterized as both emotional and pedagogical support. The emotional support sustained positive feelings about teaching in challenging school environments. Maureen shared,

> The community impacted my teaching because it forced me to reflect on how lucky I am to be in the school, in the grade, and with the children I have. Sometimes I would get so stuck and feel so lonely… and it would make me pessimistic at times. I have a couple other, more experienced, teachers who can sometimes become very judgmental and not always so supportive… The group

allowed me to look past that and look for the good things that happen every day in the classroom and with other colleagues in the school. (I, March, 2016)

Table 5.4

BTMC Satisfaction Survey Support Questions

Questions	Strongly Disagree Disagree Somewhat Disagree	Neither Agree Or Disagree	Strongly Agree Agree Somewhat Agree
I feel supported by teachers in the BTMC,	0	0	16
I offer support to other teachers in the BTMC.	0	0	16
If I have a problem, I can bring it to the BTMC.	0	0	16
Teachers in the BTMC can trust each other.	0	2	14

Note. 16 of the 19 beginning teachers responded.

The emotional support might be considered the most important component or the first step in an induction program because beginning teachers are unlikely to take risks when they do not feel emotionally supported (Feiman-Neiser, 2001). The concept of "fitting in" was discussed in the first five months of the BTMC program. Beginning teachers struggled with finding balance between becoming accepted by the other teachers and finding their own teaching path. If the participants felt emotional support, they were more open to receiving pedagogical support. Kitty shared,

> Overall, the community helps me see that those farfetched ideas I have sometimes can actually be possible. I feel like the community allows you to be open to new ideas and calculated risks while teaching…. Leaving college I had all of these great student-centered, problem-based ideas that I was ready to use on a daily and weekly basis. However, when I started teaching, the reality of my other hundred jobs as a teacher sunk in too. Then I started to work with my team and molded

myself to fit what they had been doing for years. This made it hard for me to focus on those awesome ideas I wanted to try. Without the community, I don't know if I would have been able to get out of that "rut." (S, March, 2016)

The participants also looked to the community to find pedagogical support. Marcy explained,

> The group also gave me great ideas, manipulatives, and resources to go to when I get stuck on teaching a concept. It also made me look awesome to my principal who loved the fact that I went out to another source [BTMC] outside of my school district for further professional development. (I, March, 2016)

In addition to receiving support, BTMC participants also extended support to other new teachers. Fourteen of the 16 participants who completed the survey indicated that they offered support to each other (Table 5.4). This support was evident during a particularly emotional moment in a face-to-face session when Sara and Matt engaged in a supportive exchange about a difficult observation Sara had experienced that very same day.

> Sara: I would like to talk about this and maybe you can help me figure it out because it was horrible. [She begins crying]. So, I got observed by the math supervisor today and it was awful. He had to yell at some students for being rude and disrespectful to me [sobbing].
>
> Matt: I had something similar happen and I think the idea is that Mr.[___] wanted the boys to see how much he respects you and they should also respect you. He values you, and this is his way of showing you. You could have broken down in

the middle of the lesson, but you didn't. You kept going. That will impress him and should impress yourself.

Sara: I never thought of it that way. Thank you for saying that. (F, November, 2015)

While my role as the BTMC leader was to provide support to the participants, beginning teachers reported that it was more meaningful to receive this support from another beginning teacher who had experienced a similar event and could offer reassurance from a comparable perspective.

The support was also evident in the online community. Beginning teachers posted successes within the online community showcasing particular lesson ideas and strategies that went well and responded to requests from the participants. They viewed the opportunity to post these successes as a way of supporting other BTMC participants. Lee shared,

I was really happy to share the success stories with the group. They work really well with my students, and it makes me feel good to share something that can be really beneficial to students that struggle with particular situations. (I, April, 2016)

Support for the beginning teacher was provided by the schools and school districts in multiple forms; however, the quality of this support varied for each participant. The BTMC provided additional emotional and pedagogical support that may have more closely matched the beginning teacher's beliefs.

Benefits of BTMC Components

To understand the BTMC program better, a subquestion of the first research question focused on the perceived benefits of individual BTMC components including individual value and perceptions of the optimal combination of components. During the March face-to-face session and interviews, I asked the participants to rank the face-to-face sessions, virtual meetings, and online community in relation to their relative level of benefit, and to describe the benefits of each component. Eighteen of the 19 participants ranked the face-to-face sessions as the most beneficial component and found the virtual meetings least beneficial. Every participant found the online community moderately beneficial. While the participants overwhelmingly identified the face-to-face sessions as the most beneficial BTMC component, they also reported the online community component as helpful.

Participants also suggested that the combination of components was important to their engagement in the BTMC and that the components were mutually beneficial. One component, virtual meetings, developed spontaneously from the participants' requests to engage in discussions about additional topics between sessions. Given the lack of variation in participant responses on the survey, the qualitative comments provided additional insight about the benefits of each component.

Face-to-face session benefits. Beginning teachers reported three main benefits of the face-to-face sessions including opportunities to build connections between participants, hold deep conversations about lessons and students, and leverage strengths to discover what works. Participants appreciated the opportunity to see each other in person and share their own individual journeys. These connections were personal and often built upon the relationships developed as undergraduates. For others, these connections represented new relationships that developed over the course of the year. They looked forward to seeing each other and reclaiming a desire to be teachers. One participant shared,

> The interactions between all of us [are] invaluable. Every time I come, I am reminded why I chose this profession. I feel like [the sessions] give me back my sense of optimism that can be lost in the days in between sessions. (Marcy, F, February, 2016)

These connections developed over time as participants learned that others were going through similar experiences. Another shared,

> It is kind of funny, but I wasn't necessarily friends with all of these people last year. But now, I trust them and can't wait to see them. I think if you are a new teacher you have to find other people who get what you are going through. (Kitty, F, February, 2016)

The beginning teachers discussed the difficulty of having deep conversations about teaching in their school contexts. Often, when they sought colleagues to discuss worries about a particular lesson or student misconception, their concerns were quickly brushed aside. During each session at least three of the participants used the sessions to

bring up a concern to see if they could get some advice. One participant shared, "I knew that the other teachers would listen to me and give me suggestions. Like they would really listen instead of interrupt me and tell me what to do" (Sara, F, January, 2016).

Each session also highlighted mathematics pedagogical strategies that participants could integrate into their own classrooms. Beginning teachers liked knowing they would engage in mathematics activities during the face-to-face session. During the October face-to-face session, one beginning teacher shared, "This is awesome that we get to hear about the math activities and how to use them in our class – it feels like we are in methods class again" (Nora, F, 2016). The wide range of beginning teacher placements made session planning somewhat challenging, but the teachers often spontaneously started brainstorming about how the strategy could be implemented in various grade levels. An example of this occurred during an activity highlighting Mathematics Talk Moves (Chapin, O'Connor, & Anderson, 2013; Herbel-Eisenmann, Steele, & Cirillo, 2013). I placed the symbols for each talk move on a card and explained the meaning of each symbol (Figure 5.1). As we engaged in the mathematics task, I asked the beginning teachers to use the talk moves during our discussion. A seventh grade teacher and a first grade teacher discussed how they could strategically introduce the talk moves to their students:

> Alane: I think my seventh graders could do all of these pretty quickly. Although, I don't think I will introduce them all at one time.
>
> Lori: That is funny because I was thinking the same thing!
>
> Beth: This is a really interesting point. Which ones would you think you would introduce first and why? Do you think student age makes a big difference?

Alane: I know it makes a difference, but I think my seventh graders will still need to get used to it. I think they would really appreciate the opportunity to start with the *Wait Time* one…..I worry about the kids that don't feel like they have a voice.

Lori: I have kids that need to share their ideas but our other friends are talkin' [sic] all over and on top of them. I think I will start with the *I Agree* and *Wait time*.

Alane: I think I will start with those two and also include *Add On*…. I want my main focus to be on how to help them listen to each other. Seventh graders just want to talk and mostly about themselves, not listen.

Lori: Same with first graders, but they want to yell it!

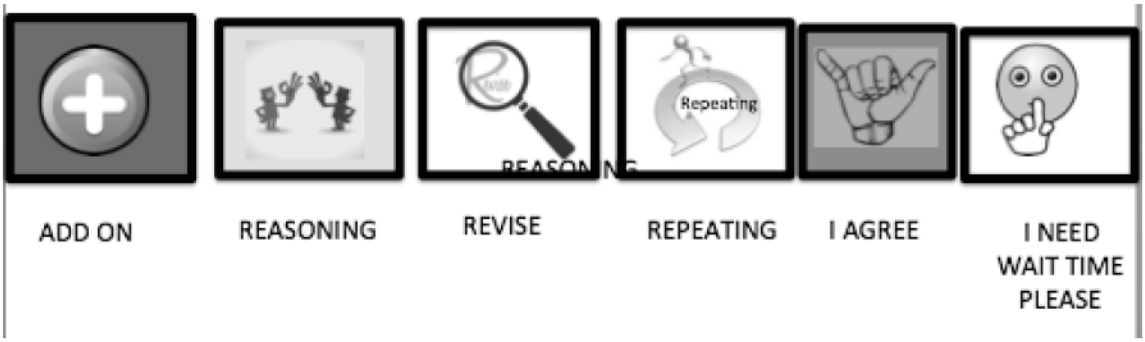


Figure 5.1. Example of Mathematics Talk Move cards.

As part of the AI framework, each face-to face session began with asking participants to share a positive moment that they recently experienced. Additionally each face-to-face session highlighted a particular kind of positive teaching moment including mathematical teaching successes, student successes, and collaborative planning successes. After identifying the positive teaching moment, beginning teachers were asked to explain how they contributed to the positive teaching moment success. All beginning teachers reported that the AI was a unique benefit to the face-to-face sessions because they didn't always see that kind of atmosphere in their schools. Tim explained, "Even though it is

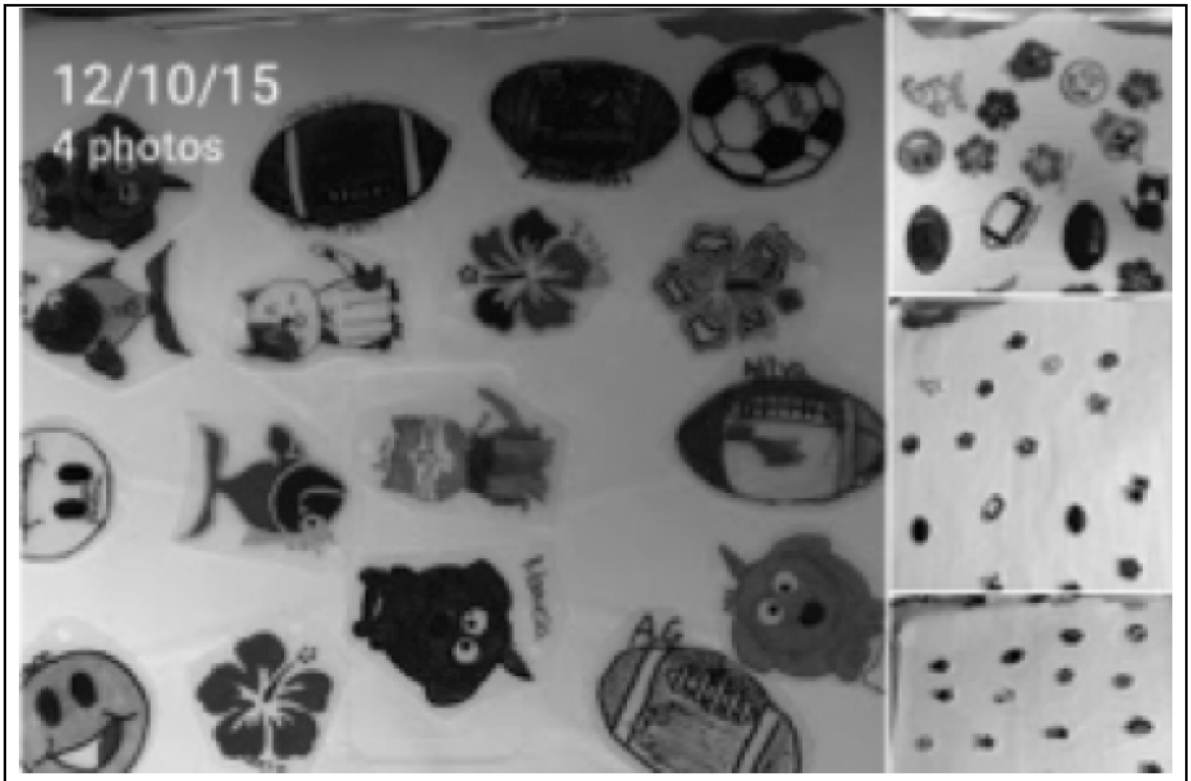
hard to talk about good things that happen, it helps me get how what I am doing does matter to the kids" (F, October, 2015). Another beginning teacher shared, "I honestly couldn't wait until you made us do that [share positives]. I started thinking about what I would share before we met and have been planning it out. Today, I was literally dying to tell all of you my story" (Casey, F, February, 2016). Connecting positive stories to specific teacher actions was initially difficult for the beginning teachers. Most of the teachers needed help connecting positive moments to something they created. This process became easier for them as the BTMC progressed. In September, Nora conveyed, "One of my students had a bunch of absences and now she is coming to school and actually doing work" (F, September, 2016). After some prodding to explain how her actions contributed to this success, Nora continued, "I pulled her aside and told her that I missed her when she was gone and she started coming to school more." In February, the same beginning teacher shared, "I was observed by the mathematics supervisor and she said the lesson was excellent! I think it was excellent because I thought a lot about how my students would respond to the task and made adjustments" (Nora, F, 2016). This example suggests that Nora knew that she would be asked to identify her role in making this good thing happen and immediately made the connection between her successful observation and her anticipation of students' response to the lesson.

During the final April session, the participants were asked to describe the best moment of the BTMC. Of the 15 attending participants, thirteen indicated that determining a success and listening to each other's successes was the highlight. As Jane described, "You just feel better after you tell something good about your teaching. And it isn't just about feeling good because it helps you figure out what you should be doing all

the time" (F, April, 2016). Lori excitedly shared, "It gives you courage, like courage to keep going and know you are making a difference for these kids" (F, April, 2016). The rest of the group spontaneously clapped.

As the previous discussion described, the face-to-face BTMC component benefits included multiple opportunities for beginning teachers to build connections between participants, hold deep conversations about mathematics teaching, and leverage their own teaching strengths to discover what works.

Online community benefits. Participants also described several important benefits of the online community. The beginning teachers explained how the online community afforded opportunities for them to share what worked and connect with participants between sessions. As previously indicated beginning teachers regularly communicated their successes as a regular part of the face-to-face sessions. They also appreciated the opportunity to describe some of these successes in the time between the face-to-face sessions. One of the spaces in the online community was a This Worked! section where beginning teachers posted pictures, lessons, teaching strategies, or other successes. For example, Kitty shared a successful ratio and proportion lesson from her sixth grade classroom (Figure 5.2).



Today we made Shrinky Dinks! (Hopefully everyone knows what they are – I was shocked to hear how many had never heard of them – teachers included!) I took them home to bake them and tomorrow we are comparing the measurements before and after. It part of our ratio and proportions unit! (V, December, 2015)

Figure 5.2. An example of a This Worked! post.

When sharing his thoughts about the online community, one beginning teacher explained, "I thought this was great to have because it gave us a space to reflect, share ideas, and see what some people are thinking" (Matt, I, March, 2016). The teachers' willingness to try new teaching ideas were bolstered by others' success. They shared that they were willing to try something new when they saw another beginning teachers' success. An example of this occurred in a face-to-face session about an online post. A participant stated, "I feel like I will actually try something if someone from our group

tries it, you know? Like it seems doable or less scary somehow" (Amy, F, January, 2016). Knowing or understanding each other's situation made it more likely that they would also understand the depth of one another's successes. During a face-to-face meeting, Jane explained, "I was so happy to see that cool post, Maureen, because I know your students struggle" (F, January, 2016). These comments suggest that describing what works showcased individual successes and at the same time supported other teachers in trying new strategies.

Beginning teachers connected with colleagues by directly replying to each other's posts between sessions and engaging in conversations about prior posts during face-to-face sessions. One way they connected in the online community was to use the *I Am Worried About* space to gather support on problematic situations. Mary posted a common new teacher concern about teaching to a wide range of mathematics abilities and received three responses from other beginning teachers. One detailed response highlighting specific details about what she was doing in her classroom to engage multiple student needs:

> We use a lot of around the room task cards in my school when students are finished early. You could possibly challenge/engage your above grade level students by putting up task cards that are for the next topic that you will be teaching. Instead of having the students solve them, have them do a notice and wonder activity with it. They may even be able to come up with some strategies on solving the problem that can be used to teach the class. (V, October, 2015)

Many beginning teachers worried about their students, parents, and lesson observations. They used the community to solicit ideas, connect, and gain support from

the community. A beginning teacher shared, "I was happy that I had a place to share about my students on the community to see if anyone had ideas" (Mary, November, 2015). Another commented, "This felt like a safe place to reach out" (Lori, 2016). The beginning teachers often spontaneously began the session reflecting on posts they had seen on the online community. During the February face-to-face session, the following conversation occurred about a prior post:

> Jane: How is your one little munchkin? Is he better? Did the mom come in to meet with you?"
>
> Marcy: He is doing so much better. He is finally opening up to me, which is helping him settle down. His mom came in and brought the baby and it was a good meeting. I think she realizes I really like _____. I can't believe you remembered!
>
> Jane: You seemed so worried. I have been wondering about it.
>
> Marcy: Awww, Jane. That was so nice of you to ask!

Marcy appeared genuinely pleased by Jane's interest and concern. Knowing about worries and successes beyond the face-to-face sessions was an important benefit because the beginning teachers used knowledge about posts to initiate connections between and during face-to-face sessions. Even when participants did not reply to the posts, there was evidence that they saw and reflected on the posts. Carole noted in a November face-to-face session, "Alane always posts such great pictures of her stuff. It is like I can imagine her classroom is down the hall" (F, November, 2015). Another beginning teacher shared, "I know I don't post much, but I read everything on there!" (Lori, F, January, 2015).

The prior discussion highlighted the individual benefits of the face-to-face and online spaces in the BTMC community. The beginning teachers' comments suggest that participation in each component may also support engagement in the other component. The participants' comments demonstrate that face-to-face sessions provided beginning teachers opportunities to share successes and personally connect. These special connections may then extend to the online space when questions were posed, successes were described, and pictures were posted. Conversely, online communication between posts aided the overall community momentum and spilled over into face-to-face sessions. Many beginning teachers noted that so many things happened between face-to-face sessions that it seemed difficult to recall. Jane shared,

> I love being able to share pictures and commentary about what is going on in our classrooms. This is a great place to post things you are excited about in the moment in case you forget about it by the next face-to-face session. (F, February, 2016)

Having an online community and face-to-face sessions delivered multiple ways for participants to get to know each other. Maureen explained, "We are kinda [sic] learning about each other in a different way, which is kinda cool. Like the online stuff helps us know what each other is doing before we see each other again" (F, November, 2015). The online community also regularly sparked questions and conversation starters that enriched the face-to-face mathematics pedagogical discussions. During the February face-to-face session, Maureen probed Matt about his online community post.

> Matt, your student's horse competition task blew my mind. How did you get her to write that task? I have so many questions about this and have been wondering if I could get my students to do something like this! (F, February, 2016)

This discussion suggests that although Maureen did not respond directly to Matt's post, she was anxious to continue the conversation in the face-to-face format.

Virtual Session. As previously indicated, the virtual meetings were not part of the original intervention study plan; however, participants requested additional meetings that could be held virtually. The request for the first virtual session occurred during an early November face-to-face session when the beginning teachers shared concerns about upcoming family conferences. Beginning teachers reported that the main benefit of the virtual meetings was topical timeliness and easy access to sessions.

All of the virtual meetings were initiated by the beginning teachers based on timely requests. At the conclusion of the first virtual session, one beginning teacher stated,

> This was so much fun and relaxed. I liked being in comfortable clothes and sharing experiences. It was cool how everyone could join in on the conversation from their homes and share tips. I feel a lot better about the conferences now. (Maureen, F, November, 2016)

Another participant shared, "I like the face-to-face better, but I do think the virtual sessions are a good way to reconnect, especially to talk out an issue or problem that comes up. I liked getting on, getting advice, and then getting off" (Jane, F, March, 2016). Beginning teachers also traveled to the face-to-face sessions from as far as 80 miles away. The virtual sessions not only saved the participants travel time, but generally only lasted about an hour. Marcy noted, "I thought I would not like the hangouts [virtual session],

but I got used to them and liked how easy it was to check in" (F, January, 2016). Clearly, the participants favored the face-to-face sessions, but they also found that the virtual sessions could substitute for the face-to-face session when there was an immediate need.

While participants preferred the face-to-face sessions, they were able to stay connected through the online community when they missed a face-to-face session. Each participant's ability to participate in particular activities may inform their perception of the benefits of each component. Marcy explained, "I hated missing everybody (face-to-face session), but I felt better because I could post something on the community and check in" (F, January, 2016). Another beginning teacher explained, "Even though I can't seem to get myself to post very often, I like reading what other people post. It is easy to keep updated because I have it set to get the posts on my phone" (Kim, F, February, 2016). On the surface, it appears that Kim did not perceive the online portion of the community to be beneficial because she posted infrequently, yet she described the ease of reading the posts and being knowledgeable about the BTMC community as favorable. As the beginning teachers navigated their teaching experience, they found particular components more beneficial depending on individual needs, challenges, and successes in their particular contexts.

Understanding Beginning Teachers' Participation in the BTMC Components

The second subquestion related to the participants' overall experience focused on the key factors that may have enabled or prohibited the beginning teachers from participating in the face-to-face, online community, and virtual BTMC components. Participants reported varying reasons for participation or nonparticipation in each of the components including session flexibility, school schedules and obligations, and

relationships with other beginning teacher participants. This section will describe the beginning teachers' reasons for participation in each of the components.

Face-to-Face Session Participation Factors

Three themes emerged from data analysis regarding beginning teacher participation. Beginning teachers highlighted the need for flexibility, described schedule and obligation barriers, and discussed how prior relationships influenced decisions to participate.

The beginning teachers indicated that with increased face-to-face session flexibility, they were more likely to participate. They asked for two face-to-face sessions with one scheduled on Sunday afternoon to provide more options and increase the likelihood for attendance. As one participant reasoned, "If you could hold the session on Sunday afternoon, we could all be relaxed and not have to worry about getting home to get ready for the next day" (Casey, F, September, 2015). Individual attendance patterns varied from month to month with about half of the participants attending the weekend and half of the participants attending the weekday session. The beginning teachers traveled from multiple school districts and distances, with one participant traveling more than 170 total miles to attend a session. When discussing the driving distance, this beginning teacher stated,

> Even though the community is so far away and it is a struggle to drive up when I know I should be home planning, it is so worth it in the end that I don't let the distance stop me. (Marcy, F, February, 2016)

Participants struggled to manage their schedules amidst the growing demands on their time and an increase of responsibility demands from leadership. Initially, the

beginning teachers were able to determine their availability to attend the sessions, but as the year progressed, many were asked to undertake additional responsibilities. One beginning teacher shared, "I am not going to make the session tonight! Somehow I am now in charge of our Family Literacy Night and I can't leave school until I have everything ready" (Karole, V, December, 2015). Others agreed to conduct after-school tutoring or after-school clubs to make additional money or because they felt obligated to support students. One teacher explained, "I am running the after-school STEM club because no one else wanted it. If I didn't pick it up, the kids wouldn't have the club" (Kitty, F, October, 2015). Participants reported that they were uncomfortable declining administrators and team leaders because they felt it would impact their overall evaluation. Carole explained, "There was no way to say no. I mean, you gotta [sic] step up and show you are a team player. I mean inside I am dying, but I gotta [sic] do it. Plus the kids need me." All of these beginning teachers struggled with balancing the additional responsibilities with their regular school responsibilities. As the qualitative evidence suggests, they felt obligated to agree to leadership requests because disagreement might influence perception of their abilities. As previously noted, the BTMC participation was voluntary; therefore, the beginning teachers often had to prioritize school tasks over the BTMC sessions.

Within the community, there were several prior friendship groups that were formed when the beginning teachers were undergraduates. A few beginning teachers preferred to attend the face-to-face sessions when particular friends were also attending. For some beginning teachers, these deep friendships formed as undergraduates and the community provided an opportunity to reconnect. One beginning teacher explained, "We

don't even have time to text each other now. We set it as a goal to meet here" (Kim, I, March, 2016). While the friendships were a positive contributing factor, others reported concerns about sharing vulnerabilities. Lee stated, "In the beginning of the year, I was kind of nervous to share things going on in my classroom because I was worried that they [another beginning teacher] would be critical" (Lee, I, March, 2016). As these comments indicate, beginning teacher's prior relationships that were formed as undergraduates served as both positive and negative reasons to initially join the community and attend face-to-face sessions.

Online Community Participation Factors

Participant access to the community and comfort with posting influenced the beginning teachers' participation in the BTMC online community. Participant access to the community included the ability to receive updates and ease of using the community. The online community also served as another opportunity for beginning teachers to share successes with the community in between face-to-face sessions.

Ability to access the online community was both a barrier and strength for the beginning teachers. Initially, gaining access was troublesome for some participants. As previously indicated, the BTMC was organized in a private Google+ community forum, which required participants to accept email invitations to join. In two of the seven school districts, the web invitation was blocked preventing beginning teachers from receiving the email invitation. These participants were required to register with the BTMC using an alternate email address. Once the beginning teachers joined, they could register to receive notifications when a post was added to the community. The initial decision to set the notification setting from the community impacted the beginning teacher's likelihood of

posting to the community because the notifications served as reminders. One beginning teacher wrote, "The app [sic] was always accessible and I liked being able to go to the community at any time to review previous posts. This was very easy to navigate" (Sara, F, February, 2016). In contrast, another beginning teacher commented,

> Sometimes the community is hard for me to access. Once I figured out how to get notifications sent to my phone, I started using the community more. I like knowing when someone has posted because it reminds me to look. (Lori, F, October, 2015)

The beginning teachers' responses reflected varying levels of comfort with posting ideas about their teaching on the virtual community. While the beginning teachers reported reading the ideas on the virtual community, some beginning teachers also expressed reluctance to post an idea or resource on the BTMC online community. This initial reluctance focused on worries about being perceived too confident or successful. After being encouraged to post a great idea, one beginning teacher stated, "I don't want to look like I am bragging or showing off. Everybody has good ideas" (Amy, F, November, 2015). The participants often encouraged each other to post ideas on the community and sometimes needed encouragement. The following excerpt was originally sent as an email and after some encouragement, the beginning teacher posted the same story on the community.

> In my experiences, I have noticed that I learned the most when I was sharing or creating. I want to share this experience more with my students, which has led me to wanting and itching to get students more involved in the task creation process. Recently I asked a student if she would like to do a task on horses (She really

likes them – I mean really likes them). Her eyes lit up and she accepted excitedly…Immediately the next day she had a plethora of ideas! (V, February, 2016)

Beginning teachers discussed how they felt more comfortable after they posted and appreciated the opportunity to be heard by others in the community. Maureen shared her thoughts about this during a face-to-face session in January, "Hey everyone thanks for responding to my post and saying nice things" (F, January, 2016).

During the March face-to-face session, participants discussed pictures posted about a strategy that one of the beginning teachers used to highlight particular Standards for Mathematical Practices (NGACBP & CCSSO, 2010; Figure 5.3). Each day, this beginning teacher poses the school mascot engaging in various activities that indicate the Standard for Mathematical Practice that will be highlighted in that lesson. This beginning teacher shared, "I was so excited to post these pictures and other things on the community because it feels like (pause) bam (pause) instant success and good feelings" (Alane, F, March, 2016).

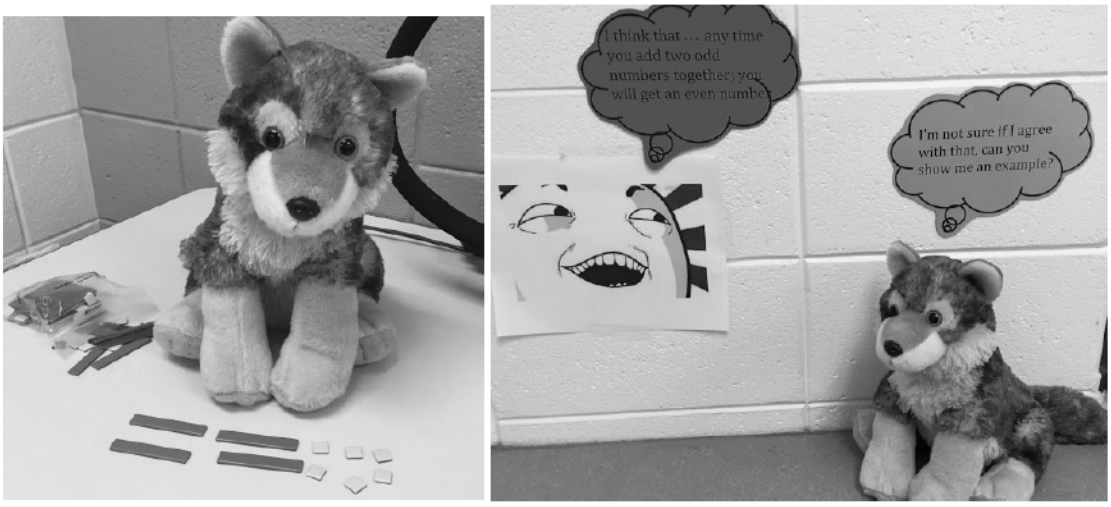


Figure 5.3. BTMC Success post.

Other participants described how posting a picture easily communicated a successful strategy. Maureen explained,

> When you post a pic, it is fun, feels good, and you don't have to write a bunch of explanation to go with it. Everyone can see what you are talking about. Like the clock activity I posted (Figure 5.4). That would have taken forever to explain when a picture is so much better anyway. (F, February, 2016)

Figure 5.4. Maureen's successful manipulative clock post.

Virtual Sessions Community Participation Factors

Virtual sessions were offered in response to participant interest in discussing family conferences and establishing a positive classroom environment. Topics, timing, and technology access were key factors for beginning teacher participation.

The virtual sessions were offered on topical and timely events related to the beginning teachers' school calendar and events. This timeliness was reported by the beginning teachers as a crucial reason for attending a virtual session. The first two sessions discussed family conferences and highlighted tips for preparing for the conferences, communicating with families, and family resources. Participants indicated that a deep interest and concern about this topic was a crucial reason for attending. One participant shared,

> I was pretty scared about the conferences, this was not something I got to do last year and now we are expected to run these on our own. Thank you for offering that session last week. I tried the one technique you shared about sitting on the same side of the table and it worked like a charm. (Marcy, F, November, 2015).

Another beginning teacher said during the virtual session, "My whole school seems freaked out by the conferences and this is calming me down" (Maureen, V, November, 2015). As the year progressed, the beginning teachers moved from one new experience to the next and preparation for these new experiences was challenging. Casey remarked, "The Google hangout is an easy way to have face-to-face conversations when time and travel are not convenient and can be a good visual to show ideas that would be difficult to explain in an email or post" (I, March, 2015). While the face-to-face and virtual sessions both provide professional learning opportunities, the opportunity to facilitate targeted and topical virtual sessions was a key factor for beginning teacher participation.

A key factor for virtual session participation for the beginning teachers was the ability to access the virtual session from home. Technology access and ease was particular to the individual and seemed connected to prior experience with Google

Hangout. Only one beginning teacher had experience with the Google hangout format prior to the first virtual session. Ease with technology also contributed to the beginning teacher's decision to participate in a virtual session. Lori shared, "I think I need a lesson on video chatting to feel comfortable with this format" (F, November, 2015). Other participants also expressed concern over the mechanics of logging on and participating in the virtual session. Casey offered, "Maybe we could do a sample one (Google Hangout) at our next face-to-face session?" (F, January, 2015).

Participation is More than a Number

Measuring beginning teacher participation in the online community by number of posts provides limited information. Google+ analytics does not provide the number of participant views in the community, which would have provided additional information regarding the community's participation. While participants may not have posted often on the community, they remarked that they were reading other's posts and developing ideas or implementing activities they read about. That is, they may have read a post and been moved toward an action without a physical record, thus exhibiting what Lave and Wenger (1991) refer to as legitimate peripheral participation. Every face-to-face meeting provided an example of this type of participation. Lori shared, "I read everyone's posts even though I might not post on the community. I am the only one who teaches kindergarten and I feel like this might not relate to the others" (F, March, 2016). Another beginning teacher conveyed this positive effect from reading posts, "I do find inspiration through some of the stories the others share even though I might not comment on [them]" (Maureen, F, March, 2016).

The beginning teachers often discussed things they had seen on the virtual community in the face-to-face sessions. They did not know if others had seen their posts because there were few follow up posts. Typically, a post might receive only one follow-up post from this researcher or another beginning teacher. A beginning teacher explained, "I look forward to seeing who responds to my posts. I think I would post more if more people would respond to my posts" (Kim, F, February, 2016). Using the visible indicator of actual posts to determine participation level may be misleading. Beginning teachers' decisions to post on the online community were highly individual and personal and may not represent an accurate picture of their participation. Thus, defining participation through physical attendance or virtual community posts may not be best described quantitatively.

Clearly participation in the face-to-face sessions was preferred by the beginning teachers, but the online component also supported them. Participation in face-to-face sessions and the online community varied and was constrained by their contexts. Less apparent initially, but still highly influential, beginning teacher participation decisions included factors such as participants' relationships and comfort with the particular BTMC component. The qualitative evidence suggests that a variety of component offerings supported the beginning teachers' participation at different points of time during the course of the study. As one beginning teacher shared, "If we had only face-to-face sessions, you might have lost me. The other stuff kept me connected and going" (Sara, F, March, 2015).

Beginning Teacher Self-Efficacy

In this section, I investigate how beginning teachers' sense of self-efficacy changed through participation within the AI Induction Program. First, I examine the quantitative teacher self-efficacy data in isolation and then consider these data in terms of participation rates. Next, I provide a qualitative look at two high participators, one with the greatest decrease in teacher efficacy and one with the greatest efficacy increase. Cronbach's alpha was used to assess the reliability or internal consistency of the TSES. These values demonstrated a moderate internal consistency with an overall alpha = 0.74, subscale engagement alpha = .87, subscale instruction alpha = .67. The subscale management was slightly lower with the alpha = .41.

To determine whether the beginning teacher self-efficacy beliefs changed across participation in the intervention, pre and post intervention overall teacher self-efficacy scores and subscale scores from the TSES survey (Tschannen-Moran & Woolfolk Hoy, 2001) were compared (Table 5.5). A paired samples t-test revealed no significant difference between pre intervention teacher self-efficacy score ($M = 6.85$, $SD = 0.71$) and post intervention teacher self-efficacy score ($M = 6.92$, $SD = 0.71$; $t = -.49$, $p = 0.63$). September beginning teacher self-efficacy scores ranged from 5.5 to 8.38, while March beginning teacher self-efficacy scores ranged from 5.91 to 8.16. The overall mean teacher self-efficacy change was 0.47.

Table 5.5

Participant Mean (SD) Teacher Sense of Self-Efficacy Scores

Teacher Sense Self-Efficacy (TSES) (Tschannen-Moran & Woolfolk Hoy, 2001)	Pre-Intervention	*SD*	Post Intervention	*SD*	P-values
Overall	6.85	0.71	6.92	1.55	0.63
Student Engagement	6.95	0.93	6.82	0.92	0.66
Instructional Strategies	6.86	0.77	6.90	0.90	0.91
Classroom Management	6.73	0.76	7.01	0.79	0.27

A paired samples t-test demonstrated that there was no significant difference between pre intervention teacher self-efficacy instructional strategies subscore ($M = 6.86$, $SD = 0.77$) and post intervention teacher self-efficacy instructional strategy subscore ($M = 6.90$, $SD = 0.90$; $t = -0.12$, $p = 0.91$). The beginning teachers' TSES efficacy student engagement subscore (Tschannen-Moran & Woolfolk Hoy, 2001) ranged in September from 5.875 to 8.875 to a March self-efficacy score range from 5.5 to 8.63. Two beginning teachers had no change in student instructional strategy teacher self-efficacy scores from September to March while nine beginning teachers increased their scores with a mean increase of 0.69 ($SD = 0.50$). Eight participants decreased their score with a mean decrease of 0.7 ($SD = 0.56$).

A paired samples t-test revealed no significant difference between pre intervention teacher self-efficacy student engagement subscore ($M = 6.95$, $SD = 0.93$) and post intervention teacher self-efficacy student engagement subscore ($M = 6.82$, $SD = 0.92$; $t = 0.44$, $p = 0.66$). The beginning teachers' TSES engaging students subscale scores (Tschannen-Moran & Woolfolk Hoy, 2001) ranged in September from 5.75 to 8.62 to March self-efficacy score ranged from 5.25 to 8.38. Eight participants increased their self-efficacy score with a mean increase of 0.52 ($SD = 0.43$), two participants

maintained the same score, and nine participants decreased their self-efficacy scores with a mean decrease of 0.68 (SD = 0.51).

A paired samples t-test revealed no significant difference between pre-intervention (M = 6.73, SD = 0.76) and post- intervention teacher self-efficacy classroom management subscale score (M = 7.01, = *0.79*; t = -.1.13, p = 0.27). The beginning teachers' TSES classroom management efficacy subscale scores (Tschannen-Moran & Woolfolk Hoy, 2001) ranged in September from 5.25 to 8.88 (Δ = 3.63), representing the largest self-efficacy score range for the overall and subscale self-efficacy scores. The classroom management March subscale score range was 5.88 to 9 (Δ = 3.13). This subscale also revealed the largest number of beginning teacher self-efficacy score increases among the overall self-efficacy score, student engagement subscale score, and instructional strategy subscale scores. Eleven beginning teachers increased their classroom management self-efficacy subscore with a mean increase of 0.91 (SD = 0.65). This category also revealed the largest single difference in the self-efficacy scores was 2.25. One beginning teacher's efficacy score did not change. The mean decrease of the seven remaining participants was 0.66 (SD = 0.45).

As previously reported, participant beginning teachers taught in kindergarten through eighth grade in low and high poverty schools and to students with differing levels of English Language Learners proficiency as well as students with special needs. A one-way Analysis of Variance was conducted to assess the effect of grade level, poverty, and special education on the change in intervention self-efficacy scores. A significant difference was not found in these variables (Table 5.6).

Table 5.6

Results of One-Way ANOVA of Change in Self-Efficacy and Participant Demographic Variables

Variable	df	F	Significance
Level	2	2.238	.139
FARM	5	0.513	.726
ELL	5	1.120	.305
SPED	2	0.405	.674

Although no statistical differences were found in the TSES overall or subscale scores, BTMC participant means are slightly higher than other early career teachers (Fives & Buehl, 2010) and significantly higher than preservice teachers (Oh, 2011). An examination of qualitative data suggests some ways the participants' teacher self-efficacy was sustained or changed through participation in the BTMC.

Teaching Self-efficacy and Participation

Teacher self-efficacy changes varied across participation levels, with both increases and decreases found among those with high participation levels and no changes or decreases found among those with low participation levels (Table 5.7). Eight of the nineteen beginning teachers' increased their overall teaching self-efficacy. All eight of these participants also had a high overall participation level in the BTMC. Three of the four beginning teachers exhibiting low participation also showed a decrease in teacher self-efficacy with the third beginning teacher exhibiting no change. The high participators' mean teacher self-efficacy change was 0.16 while the low participators experienced a mean decrease of 0.36 in teacher self-efficacy. Interestingly, the largest overall teacher self-efficacy increase ($\Delta = 1.49$) and decrease ($\Delta = 0.80$) were both associated with high participators.

Table 5.7

Participants Overall Participation and Change in Teacher Self-Efficacy

Participants	Overall Participation	Δ Teacher Self-Efficacy
Jane	High	0.18
Alane	High	0.83
Matt	High	-0.89
Kim	High	0.26
Lori	High	-0.59
Lee	High	-0.46
Maureen	High	1.38
Sara	High	-0.30
Kitty	High	0.09
Casey	High	1.49
Marcy	High	0.50
Karole	High	0.76
Tim	Low	-0.29
Amy	High	0.21
Nora	High	0.00
Nancy	High	-0.09
Mary	Low	0.00
Bree	Low	-0.63
Jake	Low	-0.54

None of the beginning teacher participants dropped out, but three exhibited low participation in the face-to-face sessions and the online community. Each of these three beginning teachers communicated varying reasons for their low participation. All expressed personal or family challenges outside the school conflicted with their participation and one explained that a difficult teaching context prohibited participation. Instead, the participants sought one-on-one support from me to elicit additional support or advice.

The prior discussion focused on the beginning teacher's participation level and the associated changes in self-efficacy to examine associations between these constructs. This analysis revealed an interesting trend among the high participators. Among the 28 teacher self-efficacy subscore increases, all but two were high participators. Further examination of the data from a qualitative perspective may reveal insight into the

association between participation and self-efficacy. Next we explore the experiences more fully of two high-participator beginning teachers with the greatest increase and decrease in teacher self-efficacy scores.

An Investigation of Two Beginning Teachers

Analysis of the experiences of two beginning teachers, Matt and Casey, reveal the complexity of the relationship between participation level and teacher self-efficacy score.

Matt. Matt was a high participator in the face-to-face sessions and the online community, yet his teacher self-efficacy decreased ($\Delta = -0.79$) the greatest amount of anyone in the community; however, his pre-intervention teacher self-efficacy score was also the highest score of all of the scores for the pre and post intervention (8.38). Matt attended every session and posted lengthy descriptions of lessons, strategies, and ideas on the online community. Face-to-face session discussions revealed Matt's reflective nature and tendency to be self-critical and analytical about his teaching. Matt stated,

> Typically when I am having a struggling day or days, I try to think of what am I asking the kids to do and what questions am I asking. A lot of the time I have found that I am not wording my questions in a friendly manner. It is not fostering and facilitating the students' thinking. I am asking too deep of a question or being too direct with my questioning rather than helping lead the students…if this makes sense. Jumping the gun and not giving the students time to use what they know. Reframing the struggle helps me reflect on what I know is in the best interest of the kids and using practices I know I can do well and work. (March, F, 2016)

Matt's reflection divulges deeper insight into his teacher self-efficacy and indicates his ability to target specific teaching practices that can be improved. He also demonstrated that he believes he can do well and implement effective teaching practices. In an interview, Matt shared that his leadership are "pleased with his teaching and appreciate how he builds relationships with students and uses rich tasks in the classroom" (I, March, 2016). When discussing his teaching success, Matt explained,

> I liked how we talk about the successes in our classroom. I am not typically very good at that. Sometimes I get uncomfortable because I am not used to thinking that way. I think being an athlete all my life, I tend to be hard on myself and pick apart the things I need to improve. (I, March, 2016)

When asked if he felt that he was a successful beginning teacher Matt shared,

> Yes, I feel good about my teaching overall. Some days, of course, when it is not a good day or I didn't reach a kid, I feel bad. It is amazing how you can feel like a great teacher one day and the worst on another day. (I, March, 2016)

Matt's decrease in teacher self-efficacy may likely reflect his response to his own teaching on the particular day he answered the survey questions or could reflect how beginning teacher self-efficacy declines during the early years of teaching (Ross, 1994). He may have responded with a perspective on that day rather than the overall perspective on his teaching. Using his athlete's analogy, he self-assesses his performance daily to determine what he needs to improve for the next day. Matt also noted,

> I think I need to focus on what works more, too. If I was not involved with this community, I would not have your questions to engage me in reflection of areas I

did not think of. It would not have made me approach ideas with a new perspective. (I, March, 2016)

Perhaps, the BTMC components provided additional experiences to discuss teaching at a deeper level, which then pushed Matt to reflect on his own teaching with a more critical perspective in March resulting in his teacher self-efficacy score decrease. Opportunities to self-examine teaching practices, coupled with Matt's tendency to self-examine with an athlete's viewpoint may also have changed the way Matt perceived his teaching ability. Matt explained, "The community has helped me realize how I tend to focus on the negative things. The community is making me aware of positive things. I tell myself to stop thinking negatively, and turn it around" (I, March, 2016).

Casey. Casey had the greatest increase in teacher self-efficacy ($\Delta = 1.49$) and was also a high participator in the BTMC. While Casey was a highly active participant in the face-to-face sessions, she indicated some concern about sharing successes on the online community because she worried how others might perceive her when she couldn't see their faces and interpret their responses. Casey explained,

> Some people are very competitive and judgmental even if you consider them your friend. I love my job and what I do in my classroom is quite personal because I do not want to open up too much to people who I do not trust or that I feel will judge me or use personal information against me. (I, March, 2016)

Casey's apprehension about the online community may have prevented her from participating at a high level in the online component; however, she fully participated in the face-to-face sessions. Casey's preference for the face-to-face sessions suggests that

the AI format contributed to her positive self-efficacy. Notably, Casey shared an insight in the March face-to-face session that may reveal how her teacher self-efficacy increased.

> I talked with my principal about how we always have to share successes here and how that made me start thinking about how things are going well. She constantly compliments me about things I am doing and even called me down to tell me about a nice email from a parent. She said she noticed how I am now sharing good things with her. (F, March, 2016)

As a beginning teacher, Casey may be struggling with how her peers perceive her successes, particularly when she cannot see them in a face-to-face environment. Prior relationships with other beginning teachers may have impacted her participation in the online community, but not the face-to-face sessions where she could attend with a close friend and select one of the two monthly sessions. Casey was able to build her strong sense of teacher self-efficacy in part because she could select the BTMC components that were personally valuable and might be translated to her own school context.

As noted previously, the beginning teachers began each BTMC session by describing a particular teaching success they had experienced since the last face-to-face session. In the first few sessions, Casey, like her fellow beginning teachers, was reticent to share a success from the classroom. As the intervention progressed, she became more confident about sharing her successes and connecting her teaching decisions and practices to these successes. As the group discussed the plans for the final April session, Casey expressed a desire to invite the next group of beginning teachers to the BTMC meeting to share ideas about searching for a teaching position and demonstrate "the way we talk about what works in our classrooms" (F, March, 2016). Casey reported that a

BTMC conversation about connecting with students propelled her to make a big decision that transformed her classroom. She wrote an email to all the families to let them know that she would like to attend students' activities in the evening and weekends. The students and families were overjoyed with this offer and Casey was pleased with the results. She explained,

> The principal told me she was getting all kinds of emails from the parents. I was scared until I found out that they were emailing the principal about how I was visiting the kids at sports games. The kids are so excited when I show up. It is pretty exciting to see how much it means to them. (I, April, 2016).

While other factors may influence Casey's teacher sense of self-efficacy score including her commitment to her students and principal support, Casey's teacher sense of self-efficacy score increase is also supported by her comments and behaviors in the BTMC.

Tschannen-Moran and Woolfolk Hoy (2001) described teacher self-efficacy as "a judgment about his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (p.1). Teachers with a high sense of teacher self-efficacy believe they can persevere through classroom challenges with effort and make changes to their teaching practices, while teachers with a low sense of teacher self-efficacy believe they can do little to change the outcome. Casey demonstrated growth in her own ability to share positive teaching experiences connected to classroom practices in multiple ways.

Mathematics Pedagogical Beliefs over Time

The third research question focused on how the beginning teachers' mathematics pedagogical beliefs changed through participation within the AI induction program. The beginning teachers' mathematics pedagogical beliefs remained remarkably stable through the intervention. A paired samples *t*-test indicated no significant difference between pre intervention mathematics pedagogical belief scores ($M = 4.13$, $SD = 0.39$) and post intervention mathematics pedagogical belief scores ($M = 4.03$, $SD = 0.35$; $t = 0.79$, $p = 0.43$). Cronbach's alpha was used to assess the reliability or internal consistency of the ten mathematics pedagogical questions. These questions demonstrated a strong internal consistency with an alpha = 0.85. In addition, two key themes related to mathematics pedagogical beliefs emerged from the qualitative analysis that provided insight into the beginning teachers' ability to maintain stable beliefs.

Maintaining Beliefs within the School Culture

As beginning teachers integrated into their new environments, they realized how their own teaching beliefs aligned or did not align within the existing school culture. While these contexts varied for the BTMC beginning teachers, they most often reflected more traditional mathematics teaching practices. Seventeen of the 19 beginning teachers reported predominantly observing traditional teaching practices within their schools. They discussed the influence of school culture on their mathematics pedagogical beliefs during every face-to-face session. They willingly shared the struggle of balancing their beliefs about teaching mathematics while also satisfying the expectations of others. During an October face-to face session, beginning teachers shared trepidation about expectations from colleagues about how to teach mathematics to challenging groups of

students. Several of the participants felt pressure to use traditional teaching practices to control lively students. Matt responded, "A lot of times this isn't about you, but someone is trying to bring you into other school dynamics. If you make this work, then what will they do?" (F, October, 2015). Jane agreed, "Just shut it down. Be polite. Be respectful. Be kind. But protect yourself. You have to do what is best for the students not the adults" (F, October, 2015). While the pressure from school colleagues to teach traditionally was significant, the beginning teachers discovered that developing an understanding of their students supported standards-based mathematics teaching.

Understanding Students Supports Mathematics Pedagogical Beliefs

Learning and knowing about students also proved to be a powerful influence on the participants' pedagogical practices. As they progressed through the BTMC intervention, they continually expressed a desire to learn more about the students they were teaching to determine the best ways to teach them. These student experiences both informed and strengthened their mathematics pedagogical beliefs. Lee described how she worked on developing strategies to reach a student.

> I heard so many things about this student beforehand and so many people were predicting how I was going to be a mess trying to teach him. I wanted to show them that this student could be successful. [Now] I build lessons around his interests and it is working really well. (F, November, 2016)

Matt shared a similar story:

> I was advised to build more structure and use only procedures with [_____]. He is so interested in so many things and has obsessions about things so I designed a task around one of his obsessions. He wants to talk about the math, too. He really

> responded when I stopped pushing and tried to get into his world instead of making him come into mine. (F, November, 2015)

Maureen described a moment when her pedagogical beliefs were supported by her belief in a student.

> Yes, so I was told to basically give up on a student and move on because she didn't understand place value and base ten blocks weren't working. I just knew I that I had to provide lots of different ways [for her] to create those tens! She needed to talk about it and build it in [many] ways. We used all kinds of manips [sic] and other stuff not just base ten blocks. I realized she didn't have conservation. We back tracked and then went back to place value. She got it! But I realized all these extra activities helped the whole class. (F, October, 2015)

Magical Moments Strengthen Mathematics Pedagogical Beliefs

While the prior examples demonstrate how knowledge of individual students strengthened beliefs about teaching mathematics, most of the beginning teachers in this group shared how particular events, even moments, helped support their standards-based mathematics pedagogical beliefs. These stories were revealed during the opening of each face-to-face session when participants were asked to share a success. Interestingly, these successes were often shared by first addressing a challenge. Marcy explained,

> I was standing in front of them and I just looked at them and they were just sitting there, kinda [sic] out of it. I was talking too much and too long. I could tell they were bored out of their minds. The next day, I started with a number string and had them talk about it. Literally, they told me strategies and everything. They were excited. I was excited. It was magical. (F, November, 2015).

Marcy realized that the way she was teaching did not match her own pedagogical beliefs and changed her teaching practice. The students' positive response to this new strategy reinforced her standards-based mathematics pedagogical beliefs. Four months later, Marcy shared additional thoughts on this moment:

> When I shared that success about the number string, I realized how much I needed to listen to myself and my kids more. I may not know what I am doing all the time, but if I listen to myself about what I know about teaching math, it goes better. The kids can do it, we just need to believe in them more. I have to keep telling myself this – stop talking – stop telling – believe. (I, April, 2016)

As the intervention was ending participants shared how these early successes continued to sustain or strengthen mathematics pedagogical beliefs throughout the intervention. The post intervention interviews revealed many examples of this. Karole explained,

> I have become more resistant to being forced to implement lessons that do not engage my students. I have become more creative as to how I approach mathematics and become a strong believer in letting students explore concepts on their own and struggle productively and use guided questions to allow them to discover concepts. (F, March, 2016)

Kitty shared a similar experience:

> The turning point for me was when we brainstormed [during a face-to-face session] how to deal with my fifth period class. Everyone helped me figure out that I was trying to control the students with traditional teaching because I was afraid they [students] would get wilder. Instead, everyone encouraged me to do

the opposite – engage them, talk to them, and tell them I needed their leadership during the lessons. I changed the way I was teaching and the students loved it. (I, April, 2016)

These BTMC moments occurred at different points in time for each of the beginning teachers, but they all shared in common a new awareness for how the opportunities to reflect with other like-minded teachers supported their thinking and strengthened their mathematics pedagogical beliefs.

Implications for Practice

Although limited in sample size and scope, this study revealed meaningful results that can be applied to teacher education program providers, school districts, and other professional learning providers. While no statistical differences were found in the beginning teachers' sense of self-efficacy or standards-based mathematics pedagogical belief pre- and post- intervention scores, the BTMC beginning teachers maintained relatively high teacher self-efficacy scores and standards-based mathematics pedagogical beliefs throughout the intervention. Research indicates that preservice teachers have relatively high teaching self-efficacy (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998; Woolfolk Hoy, & Spero, 2005) that falls during the first years of teaching before settling into a stable sense of teaching self-efficacy that is difficult to shift (Ross, 1998). Woolfolk and Spero (2005) recommend that "because efficacy beliefs are shaped early, it would be useful to better understand what supports and undermines efficacy in the early years" (p. 2005). As many stakeholders who offer induction support know, beginning teachers experience classic beginning teacher phases (Moir, 1999) or stages (Friedman, 2000) that can plunge them into negative beliefs about their own teaching. Knowledge

about how teacher self-efficacy and mathematics pedagogical beliefs change within a positive, strengths-based program, could provide these stakeholders critical information that could transform induction practices. This section will discuss the implications for all those who serve and support beginning teachers.

AI Techniques Inform Mastery Experiences

Bandura (1977, 1997) described four sources for the development of self-efficacy: mastery experiences, physiological and emotional states, vicarious experiences, and social persuasion. While all of these sources may contribute to the development of teacher's sense of self-efficacy, mastery experiences are a key factor in developing beginning teacher self-efficacy beliefs (Mulholland & Wallace, 2001). The BTMC utilized the AI framework by encouraging the beginning teachers to share positive successes about teaching mathematics and helped them connect teacher strengths to teacher decision making about teaching practices. By identifying teaching success through mastery experiences (Bandura, 1997), beginning teachers developed beliefs about their teaching self-efficacy as they "built the capacity for understanding cause-and-effect relationships and the capacity for self-observation and self-reflection" (Maddux, 2002, p. 279). Lori explained, "My big take away from being in the community is gaining confidence. After our meetings, I feel that I can conquer anything" (F, April, 2016).

Initially, the participants struggled to identify and share their teaching strengths, but as the BTMC progressed, they became more comfortable at both identifying positive teaching strengths and describing their own role in promoting the teaching success. At the final face-to-face session, each beginning teacher was asked to share an experience from the BTMC with the teacher candidates who would be invited to the fall, 2017 BTMC. All

of the fifteen present participants noted the AI framework as a critical element of their support system. Kim said,

> You don't realize how important it is to focus on the things you are doing right instead of what you are doing wrong. I hate to say it, but there is a lot of negative stuff in the schools. Here, we had to share the things that we did well. This gave me courage to figure things out and try new ideas. (F, April, 2016)

Positivity heightened the new teachers' awareness of negativity into their school contexts. Jane explained,

> After a while you might notice that people in the school want to talk about all the things are going wrong. It is easy to get sucked in but you have to ask yourself, "How is this helping me or my students?" (F, April, 2016)

The findings suggest that program providers and those who support preservice and inservice teachers may integrate AI strategies to maintain or improve teacher's sense self-efficacy and standards-based mathematics pedagogical beliefs.

AI Techniques Support the Beginning Teacher Journey

Described as phases (Moir, 1999), stages (Friedman, 2000), and modes (Achinstein & Athanases, 2006), new teachers journey through their first years of teaching traversing these tumultuous emotional cycles. After eagerly awaiting their new teaching positions with anticipation, they enter the survival stage that is signaled by the exhausting effort to keep up with daily teaching tasks, responsibilities, and expectations. This is followed by the disillusionment phase (Moir, 1999) or what Friedman (2000) calls the slump or fatigue and exhaustion phase. Teachers in this part of the cycle feel isolated and struggle to make sense of their teaching practices and question decisions to become

teachers. It is at this moment that support is critical to new teachers because they may naturally focus on all that is going wrong. The BTMC emphasis on strength supported the beginning teacher to discover the successful moments and strategize how to leverage a teaching success into multiple successes.

In the beginning, teachers demonstrated evidence of this phenomenon in the BTMC. Sara shared, "I really didn't want to come today. I forced myself because I knew I needed to be around people who would push me to think that I can be a good teacher" (F, November, 2015). Later in the intervention, Kitty stated, "We need to be around other people who know what we feel and will push us to remember why we did this [become teachers] (F, April, 2016). The participants reported that the turbulent feelings "feel permanent" (Mary, F, October, 2015) and "never-ending" (Lee, November, 2015), but that "eventually goes away when you come to a session or sign on to the community" (Alane, F, April, 2015) and then you "feel like you are doing this well or at least passable" (Jane, F, April, 2015). While it may be impossible to avoid the new-teacher cycle, the evidence from this intervention suggests that induction program providers might use AI techniques to support and sustain beginning teachers as they navigate the beginning teacher cycle.

BTMC Extends the University Experience

Education programs are reacting to intense media scrutiny (Carr, 2013). Known as a profession that "eats their young" (Carlson, 2012), one mired in disputes over whether it may be considered a profession (Hayes & Hegarty, 2002) and scrambling to align to new CAEP (2013) requirements, program providers must be diligent in delivering high quality programs that satisfy the public, graduates, and their hiring school

districts (CAEP, 2013). Beginning teachers' call to support others, school district perceptions of the university, and beginning teachers' feelings about the university contributed to this theme of extending support.

As the BTMC program was nearing conclusion, participants requested that the program continue and extend to a larger group best represented by their comments: "this [BTMC] was so helpful. We need this for everyone at [university]. We need to invite the next group to participate, but can we stay?" (Casey, F, March, 2016). Another teacher piped in "And some people that didn't join before want to join now – can they?" (Kitty, F, March, 2016). "We need to help them [this year's graduates]. No one should ever do this alone" (Alane, F, April, 2016).

Beginning teachers also reported that school leadership were pleased with the university's decision to continue to support the participants. "My principal couldn't believe it. She said she will interview a [university] graduate over someone else because of this program!" (Maureen, F, April, 2016). At the culminating April session, several participants told university students to mention the BTMC program in interviews. For example, Lori explained "Your principal will want to know that you are going to keep getting support – that [university] didn't just dump you and say good luck. Plus it shows you are willing to get help and still learn." (F, April, 2016).

Finally, the beginning teachers consistently remarked how the face-to-face sessions "felt relaxed - like being in class again" (Matt, F, February, 2016) and "made me feel like I am still here [university] in my safe cocoon" (Lee, F, November, 2016). The opportunity to learn in a collegial, safe community suggests that the university experience was extended for these participants.

Limitations

There are several limitations to this study including sample size and composition, intervention length, and absence of a comparison group. The study sample included only 19 beginning teachers, all graduates from the same university. While the decision to include a small sample from the same university was purposeful, it may be limiting in scope regarding the generalizability of the findings. A larger sample of beginning teachers might reveal more information about the usefulness of a university-led induction program. Additionally, all of the participants knew each other prior to the intervention, which may have enhanced their ability to share successful stories and increased their interest in participating in the intervention components. Although the beginning teachers shared the same preservice training, their teaching contexts reflected rich diversity. The 19 participants taught in seven school districts, kindergarten through eighth grade, and varied percentages of poverty, special education, and English Language Learners. Although no statistical differences were apparent between groups, the small sample size made this difficult to detect potential differences in this study.

The study participants were all volunteers and may represent beginning teachers who are more inclined to participate in a learning community about mathematics. Beginning teachers who did not elect to participate may demonstrate lower teaching self-efficacy and may be less inclined to hold standards-based mathematics pedagogical beliefs.

The BTMC intervention was conducted for eight months from September to April and may not be enough time to measure change in teaching self-efficacy or mathematics pedagogical beliefs. Wong (2004) recommended that the most successful induction

programs offer a "continuum of professional development through systematic training over a period of two or three years" (p. 48) suggesting that additional time is needed to support the beginning teacher.

Finally, the absence of a comparison group indicates that the study results may not be generalizable to other beginning teachers in different contexts. Comparing the beginning teachers in the BTMC to a matched control group would increase the external validity of these results (Rossi, et al., 2004).

Conclusion

This research study examined the experiences of 19 beginning teachers participating in a university-led induction program. While the participants did not demonstrate statistical changes on teacher self-efficacy or standards-based mathematics pedagogical beliefs from the pre- and post-intervention scores, qualitative evidence suggests that participation in the BTMC supported teacher self-efficacy and standards-based mathematics pedagogical beliefs. Using AI as a framework for this university-led induction encouraged beginning teachers to find positive examples of their teaching successes and identify their own roles within that success to build new teaching practices in their classrooms.

As this research study and the literature indicate, beginning teachers desire support that will sustain them through the challenges of the first years of teaching. Traditionally, new teacher induction is provided by schools and school districts and reflects various components and delivery methods. The university-led BTMC provided an opportunity for the university to extend support from the preservice to the inservice teaching stages, thus increasing the opportunity for program impact. The BTMC provided

a space for new teachers to share stories and resources, collaborate about their teaching, and use their strengths to build meaningful teaching practices.

More research needs to be conducted to determine how alternative induction programs can best support beginning teachers. We need to know more about how blended learning communities might nurture our beginning teachers to understand and connect their teaching practices to student learning. Creating flexible, thoughtful, and targeted induction programs will help us respond to the newest members of our profession with careful consideration of their needs. Instead of a "sink or swim" (Briton et al., 2000) mindset, we can aspire to support our newly-minted professionals as if they were "training to be an Olympic athlete" (Bubb, Heilbronn, Jones, & Totterdell, 2002).

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Appendix A

Mathematics Teacher Beliefs Survey

Please select the most appropriate choice(s).

I teach _____ grade(s) (Check All that apply)	P-K	K	1	2	3	4	5	6	7	8

I am responsible for teaching	Mathematics only	Mathematics and one other subject	Mathematics and two other subjects

The FARMs rate at my school is	Less than 10%	10% - 20%	20% - 40%	40%-60%	60% - 80%	80%-100%

Indicate the number that best reflects your personal views.

Strongly Agree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	2	3	4	5

	1	2	3	4	5
1. It is important to conduct teacher research to inform my practices.					
2. Students can typically solve mathematics problems quickly in a few steps. *					
3. All my students learn mathematics in similar ways. *					
4. Using evidence-based instructional practices with my students learning disabilities is important.					
5. Mathematics is about looking for a pattern to explain our environment.					
6. I typically do not make adjustments to the district-approved mathematics curriculum.					
7. The primary source of students' academic failures in learning math result from their instructional experiences.					
8. Using explicit and systematic instructional practices with my students with learning disabilities is important.					
9. Being able to memorize facts is critical in mathematics learning.					
10. Mathematics knowledge is the result of the learner interpreting and organizing information gained from experiences.					
11. The primary source of students' learning problems in mathematics lies within the student. *					
12. Mathematics competence is primarily about getting the right answers quickly. *					
13. It is important for me to raise questions about my classroom practice on an ongoing basis.					
14. The best mathematics assessments yield correct and incorrect answers that can be graded quickly.					

15. Progress monitoring tools offer important data for assessing my students in math.					
16. Teachers should provide instructional activities that focus on problem situations for learners to solve.					
17. It is important to me to have ownership and control over my own professional development.					
18. I am able to make better decisions about my instructional practices when I collect data from my students regularly.					
19. It is important to me that I consider more than one source of data when making changes in my instructional practice.					
20. Mathematics learning is enhanced by activities that build upon students' prior experiences.					
21. The role of the mathematics teacher is to transmit mathematical knowledge and to verify that learners have received this knowledge. *					
22. Right answers are much more important in mathematics than the ways in which we get them. *					
23. To enhance mathematics learning, it is important to use teaching strategies that address the specific learning needs of students.					
24. Students learn mathematics best when they are grouped with those that are the same academic level.					
25. It is important to adjust instruction daily using formative assessment information.					
26. Students need to be able to represent their mathematics solutions using representations.					
27. Students should have opportunities while they are learning mathematics to talk with each other about the mathematics.					
28. Mathematics competence is primarily about getting the right answers quickly. *					
29. The role of the mathematics teacher is to design mathematics lessons that provide opportunities for students to engage in productive struggle.					
30. Teachers should model exactly how to do mathematics procedures. *					
31. The support I receive for teaching mathematics matches my own beliefs about the best way to teach mathematics.					

Indicate the number that best reflects your school situation.

1	2	3	4	5
Not At all	To little extent	To some extent	To a moderate extent	To a large extent

35. The support I receive for teaching mathematics matches my own beliefs about the best way to teach mathematics.	1	2	3	4	5

36. To what extent do you receive professional learning support for teaching mathematics?					
37. To what extent has your understanding of the teaching of mathematics changed since you graduated and began your teaching career?					
38. To what extent is it important for you to receive professional learning support for teaching mathematics?					

1	2	3	4	5
No interest	Little interest	Some interest	Moderate interest	Large interest

39. Please indicate your degree of interest in receiving support for teaching mathematics	1	2	3	4	5
40. Please indicate your degree of interest in receiving support for teaching mathematics from SU.					

1	2	3	4	5
Poor	Below Average	Average	Above Average	Excellent

41. Please rate the quality of the professional learning support you receive for teaching mathematics.	1	2	3	4	5

42. Please describe the kinds of support that will help you teach mathematics more effectively (not including adding more personnel).
43. How have your beliefs about teaching mathematics changed since you started teaching this school year?
44. Please add any other information about your teaching of mathematics or support(s) you are receiving for teaching mathematics.

* Indicates items that were reverse-coded.

Appendix B

Semi-Structured Interview Mathematics Beliefs Interview

Script

1. Say, "Thank you so much for agreeing to do this interview. I appreciate how busy you are in your first year of teaching and value the time and effort it takes to share your day with me. I am conducting a study on first year teachers' mathematics pedagogy. I hope that you will be comfortable being candid with me. I want to really understand your experiences this year teaching mathematics."
2. Share the consent form and ask the participant to read the document thoroughly. Ask if he/she has any questions about the information. Do not continue until the form is signed.
3. Say, "Please be candid in your responses and share as much as you would like. If you have any questions or concerns at any time and would like to stop the interview, please don't hesitate to let me know. With your permission, I will be recording the session using Livescribe Pen technology that will record audio of our conversation and make a visual record of my notes. This file is called a pencast and can be uploaded to my computer, which is password protected. I will not be sharing the data with anyone other than my advisors, dissertation committee, and peers. At no time will I be sharing your name or other identifying information. This work will be reported in my needs assessment analysis for my dissertation."
4. Say, "Do you have any questions before we start?"
5. Say, "I would like to start with gathering some data about you and your school."

Background Data

1. What grade level or levels do you teach?

2. What content area or areas are you responsible for teaching?

- Mathematics only
- Mathematics and _____

3. The Free and Reduced Meal Rate at my school is

    - I don't know
    - Less than 10%
    - 10 - 30%
    - 30 - 60%
    - 60 - 100%

Interview Questions

The questions are designed to be open and the prompts will be used only if the teacher doesn't mention the concept.

1. Please tell me about your experience teaching mathematics this year.

2. How do you feel about teaching mathematics this year?

    a. What is working well? (prompt)

    b. What is challenging? (prompt)

3. What works best for teaching mathematics to your students?

    a. Types of lessons that work best (prompt)

    b. Management (prompt)

    c. Organizational style (prompt)

4. Please describe a typical mathematics lesson that you prepare and teach.

5. What might be some concerns you have about teaching mathematics?

6. What kinds of support have you received for the teaching of mathematics?

    Human – administrator, mentors, other teachers (prompts)

a. Resources/materials/curriculum (prompts)

b. Emotional (prompts)

7. What is the value of the support you have received for teaching mathematics?
8. Do you feel your approach to teaching mathematics has changed this year? Why or why not?
9. Please tell me what might help you teach mathematics more effectively?
10. If you have a problem teaching mathematics, what would you do or have you done?

    a. Planning (prompts)

    b. Delivering the Lesson (prompts)

    c. Classroom Management (prompts)

    d. Content (prompts)

Closing

Say, "Thank you so much for agreeing to do this interview with me today. I appreciate your time and thoughtful responses to my questions. If a thought or idea occurs to you after I leave and you would like to talk again, please feel free to email or call me."

Appendix C

Professional Learning Satisfaction Survey

1. Which of the following statements best describes the primary purpose of this professional learning session? *Please choose all that apply.*

   The purpose of the professional learning was:

   A. To communicate new ideas for me to consider using in my classroom.
   B. To provide an opportunity for me to learn from other teachers in the BTMC.
   C. To help me understand _____ (Fill in with appropriate topic.)
   D. To help me apply/implement _____ in my classroom.
   E. Not Clear
   F. Other. Please explain.

2. Which of the following statements best describes the usefulness of _____. *Please choose one.*

   A. It was a good start.
   B. It was a good start, but I have many questions.
   C. It was a good start, and I look forward to trying these ideas in my classroom.
   D. It provided almost everything I need to implement the ideas in my classroom.
   E. It provided everything I need to implement the ideas in my classroom.
   F. Not clear

3. Which of the following statements best describes the likelihood that you will apply what you learned in this professional learning to your classroom? *Please choose one.*

   A. I have already tried this in my classroom.
   B. I have already tried this in my classroom with success.
   C. I have already tried this in my classroom, but it was not successful.
      If this is selected, the participant will receive a prompt to explain.
   D. I look forward to trying this in my classroom in the next few weeks.
   E. I would like to try this, but I don't have materials I need.
   F. I don't think this will work with my students.

4. Which of the following statements best describes how today's professional learning compares with other professional learning (not facilitated by the BTMC) in which you have participated in this year? *Please choose one.*

   A. This professional learning was more useful than other professional learning I have participated in.

B. This professional learning was about the same as other professional learning I have participated in.
C. This professional learning was less useful than the other professional learning I have participated in.
D. I don't have an opinion.

5. Which of the following statements best describes how today's professional learning focused on your strengths.

   This professional learning helped me use my strengths to imagine how I can implement these strategies in my classroom.

   1 – Strongly Agree
   2 – Disagree
   3 – Somewhat disagree
   4 – Neither Agree or Disagree
   5 - Somewhat Disagree
   6 – Agree
   7 – Strongly Agree

   Please indicate the extent that you agree or disagree with each of the following statements:

   1 – Strongly Agree
   2 – Disagree
   3 – Somewhat disagree
   4 – Neither Agree or Disagree
   5 - Somewhat Disagree
   6 – Agree
   7 – Strongly Agree

6. During this professional learning, teachers in the BTMC showed that they care about each other.
7. If I have a problem in my classroom I feel that I can bring it to the BTMC to discuss.
8. Teachers in the BTMC can trust each other.
9. Teachers in the BTMC believe their students can learn.
10. Teachers in the BTMC look out for each other.
11. I feel supported by teachers in the BTMC.
12. I offer support to other teachers in the BTMC.

Adapted from the National Staff Development Council (Haslam, 2010).

Appendix D

Teachers Sense of Self-Efficacy Scale

Directions: Please indicate your opinion about each of the questions below by marking any one of the nine responses in the columns on the right side, ranging from (1) "none at all" to (9) "A Great Deal" as each represents a degree on the continuum.

Please respond to each of the questions by considering the combination of your current ability, resources, and opportunity to do each of the following in your present position.

Questions	Not at all		Very Little				Quite a bit		A Great Deal
1. How much can you do to get through to the most difficult students?	1	2	3	4	5	6	7	8	9
2. How much can you do to help your students think critically?	1	2	3	4	5	6	7	8	9
3. How much can you do to control disruptive behavior in the classroom?	1	2	3	4	5	6	7	8	9
4. How much can you do to motivate students who show low interest in school work?	1	2	3	4	5	6	7	8	9
5. To what extent can you make your expectations clear about student behavior?	1	2	3	4	5	6	7	8	9
6. How much can you do to get students to believe they can do well in school work?	1	2	3	4	5	6	7	8	9
7. How well can you respond to difficult questions from your students?	1	2	3	4	5	6	7	8	9
8. How well can you establish routines to keep activities running smoothly?	1	2	3	4	5	6	7	8	9
9. How much can you do to help your students value learning?	1	2	3	4	5	6	7	8	9
10. How much can you do to gauge student comprehension of what you have taught?	1	2	3	4	5	6	7	8	9
11. To what extent can you craft good questions for your students?	1	2	3	4	5	6	7	8	9
12. How much can you do to foster student creativity?	1	2	3	4	5	6	7	8	9
13. How much can you to get children to follow classroom rules?	1	2	3	4	5	6	7	8	9
14. How much can you do to improve the understanding of a student who is failing?	1	2	3	4	5	6	7	8	9
15. How much can you do to calm a student who is	1	2	3	4	5	6	7	8	9

disruptive or noisy?									
16. How well can you establish a classroom management system with each group of students?	1	2	3	4	5	6	7	8	9
17. How much can you do to adjust your lessons to the proper level for individual students?	1	2	3	4	5	6	7	8	9
18. How much can you use a variety of assessment strategies?	1	2	3	4	5	6	7	8	9
19. How well can you keep a few problem students from ruining an entire lesson?	1	2	3	4	5	6	7	8	9
20. To what extent can you provide an alternative explanation or example when students are confused?	1	2	3	4	5	6	7	8	9
21. How well can you respond to defiant students?	1	2	3	4	5	6	7	8	9
22. How much can you assist families in helping their children do well in school?	1	2	3	4	5	6	7	8	9
23. How well can you implement alternative strategies in your classroom?	1	2	3	4	5	6	7	8	9
24. How well can you provide appropriate challenges for very capable students?									

Appendix E

Face-to-Face Session Field Notes

AI Framework	Inquiry Questions	Field Notes	Future Action for Online Community
Define	What is a rich task? How do you know when a task is rich?	Sara -Connected to multiple topics Nora – engages everyone Matt – multiple entry points for students	*Highlight the resources section.*
Discover	What is the best experience you have had teaching or participating in a rich task?	Matt – Students were so engaged and didn't want to stop. Marcy- When I lost track of time. I was so motivated to find an answer, I didn't realize an hour had gone by. Kim – Everyone was into it. So, that is my question. How do I design a task for my special education students – so they will also be engaged.	*Perhaps invite beginning teachers to write these stories down.*
Dream	What is your dream for including special education students in a rich task?	Marcy – My dream is to get them involved! I need to get them integrated with the other students. I need to ask the paraeducator to release them from the back table so they can engage. Kim – So how can I do this? What can I say to the special education teacher and para? Maureen – Yes, how can I introduce this idea to my team?	*Investigate the practices for special education instruction at these schools. Are students routinely separated?*
Design	How can you design a rich task for a variety of learners?	Matt – what if you set up the task for students to work together, but also explained to the special education teacher that you are prepared with scaffolds if the students struggle unproductively?	*Potential future topic-scaffolding tasks.*

		Amy – yes, also, why not let the leadership know that you are trying this because you believe all students can do this?	
Deliver	How and when will you deliver this dream?	Kim – I will try it and let you all know! Kitty – I will try too. (Make sure to post a discussion prompt as a follow-up.)	*Follow up! Make sure to specifically ask these beginning teachers how this went!*

Beth McCord Kobett

School of Education
Stevenson University
Stevenson, Maryland
W - (443) 334-2545
bkobett@stevenson.edu

6691 Slacks Road
Eldersburg, MD 21784
H - (410) 549-6378
C- (410) 340-2963
bethkobett@comcast.net

ACADEMIC BACKGROUND

EdD	Johns Hopkins University - Baltimore, Maryland
M.S.Ed	Johns Hopkins University - Baltimore, Maryland Administration and Supervision
B.S.	University of Missouri - Columbia Major: Elementary Education (1-8)

PROFESSIONAL EXPERIENCE

Stevenson University

2008-Present	**Assistant Professor**
1997-2008	**Adjunct Professor**
2000-2005	**Professional Development University Coordinator**

Elementary Mathematics and Teacher Leadership Project

2010-Present	**Lead Consultant**

McDaniel College

1997-2000, 2010 - Present	**Adjunct Lecturer**

Johns Hopkins University

1992-2002	**Faculty Associate, School of Continuing Studies**

Howard County Public Schools

1989-1992	**Mathematics Resource Teacher**
1987-1989	**Team Leader – Centennial Lane Elementary**
1985-1987	**Teacher – Centennial Lane Elementary**

Independent Consultant

1990-Present	**Mathematics Coach and PD Facilitator**

SELECTED PUBLICATIONS

Fennell, F., Kobett, B. M., Wray, J. (in press). *The Formative Five: Everyday Assessment Techniques for Every Math Classroom.* Thousand Oaks, CA: Corwin

Fennell, F., Kobett, B., and Wray, J (2015). Classroom-Based formative assessments: Guiding teaching and learning. In J. Rankin (Ed.) *Annual Perspectives in Mathematics Education - 2015.* (pp 51-62). Reston, VA: National Council of Teachers of Mathematics.

Caldwell, J., Kobett, B. & Karp, K. (2014) Essential understanding of addition and subtraction in practice, grades K-2. Reston, VA: NCTM.

Fennell, F., Kobett, B. M., & Wray, J. A. (2014). Fractions are Numbers, Too!.*Mathematics Teaching in the Middle School*, *19*(8), 486-493.

Fennell, F., Kobett, B. M., & Wray, J. A. (2013). Elementary Mathematics Leaders. *Teaching Children Mathematics*, *20*(3), 172-180.

Bay-Williams, J. M., McGatha, M., Kobett, B., & Wray, J. (2013). *Mathematics coaching toolkit.* New York, NY: Pearson.

Larsen, M., Fennell, F., Lott, T., Dixon, J., Kobett, B., & Wray, J. (2012). *Common core mathematics in a professional learning community at work: Grades 3–5*. Bloomington, IN: Solution Tree Press.

Larsen, M., Fennell, F., Lott, T., Dixon, J., Kobett, B., & Wray, J. (2012). *Common core mathematics in a professional learning community at work: Grades K-2*. Bloomington, IN: Solution Tree Press.

Elliott, P. C., & Garnett, C. M. E. (2008). *Getting into the mathematics conversation: Valuing communication in mathematics classrooms: readings from NCTM's school-based journals*. Reston, VA: National Council of Teachers of Mathematics.

Kobett, B.M. (1998). *Linking attribute elephants on a safari*. Baltimore, MD: World Class Learning Materials.

Kobett, B. M. (1998) *Making sense of money*. Baltimore, MD: World Class Learning Materials.

Kobett, B. M. & Stillman, M. (1998). *Teddy bear counters at the fair*. Baltimore, MD: World Class Learning Materials.

Kobett, B. M. & Sammons, K. B. (1996). *Exploring data and chance, grades 3-4.* Alsip, IL: I deal, 1996.

Sammons, Kay B. & Kobett, B. M. (1996). *Exploring data and probability, grades 5-6*. Alsip, IL: Ideal, 1996.

Sammons, K. B., Kobett, B. M., Heiss, J. & Fennell, F. (1992). Linking instruction and assessment in the mathematics classroom. A*rithmetic Teacher, (7)*3 11-16.

Sammons, K. B., Kobett, B. M. (1992). Ideas; Kites and number sense. *Arithmetic Teacher, (8)*4, 18-25.

SELECTED AWARDS, SPECIAL RECOGNITIONS

Chair, Professional Development Services Committee, National Council of Teachers of Mathematics, 2016-Present
President, Association for Maryland Mathematics Teacher Educators, 2016 – present
President's Leadership Seminar, Stevenson University, 2015-2016
Awarded, Stevenson University Research Grant
Rose Dawson Excellence in Teaching Award for Fulltime Faculty, 2013
Stevenson University Technology Award, 2011
Student Selected Faculty Speaker, Stevenson University Baccalaureate, 2010
Outstanding Club Advisor Award, 2009
Rose Dawson Excellence in Teaching Award for Part Time Faculty, Villa Julie College, 2003
Mathematics Educator of the Year, Maryland Council of Teachers of Mathematics, 2000
Excellence in Teaching Award, Johns Hopkins University, 1997

ACADEMIC DUTIES

Four Courses per Semester, Mathematics Methods for Early Childhood Teachers, Mathematics Methods for Elementary Teachers, Mathematics Methods for Middle School Teachers, Child and Adolescent Psychology, Equity in Education Freshmen Seminar. (Also have taught, Curriculum and Methods, Educational Psychology)
Academic Advisor - Averaging 40 Undergraduate Students, 2009-present
Academic Affairs Committee – Vet course redesign and proposals for the University, 2009-present
General Education Task Force Committee – 2013- present
Club Advisor, Teachers of Tomorrow, 2006 -present
Technology Committee – Member, 2011 - 2012

MATHEMATICS COACHING/SELECTED SCHOOLS/School System

Cecil County Public Schools (MD) – K-5 Mathematics Presentations to every teacher in the school system on Common Core Topics, 2012-2015

Odyssey School (MD) – Mathematics Presentations. Planning sessions, Diagnostic Interviews/Demonstration Lessons, 2003-Present

Spencer Elementary (WV) - Mathematics Presentations, Planning sessions, Demonstration Lessons, 2012- Present

Elmer Wolfe Elementary (MD) - Mathematics Presentations. Planning sessions, Diagnostic Interviews/Demonstration Lessons, 2012--Present

Longfellow Elementary (MD)– Mathematics Presentations, Work sessions, Long-Range Planning, 2009-Present.

Swansfield Elementary (MD) -Mathematics Presentations. Work sessions, Diagnostic Interviews/Demonstration Lessons, Professional Learning Community, 2001-2008.

Williamsport Elementary (MD) – Mathematics Presentations. Work Sessions, Diagnostic Interviews, Demonstration Lessons, Professional Learning Community, 2001-present.

Roye-Williams Elementary (MD) -Mathematics Presentations**.** Work sessions, Diagnostic Interviews/Demonstration Lessons, Professional Learning Community, 1995-1998.

REFEREED PRESENTATIONS/CONFERENCES (Selected)

Common Core Mathematics: Upside Down, Flipping PD and Engaging Teachers (with F. Fennell and J. Wray). 2104 NCTM Regional Meeting and Exposition, October, 2014 (Houston, Texas)

Thanks for Teaching Me Like I Am Smart (with Zac Stavish and Alix Weyforth). NCTM Regional Meeting and Exposition, October, 2014 (Richmond, Virginia).

Focusing on Fluency: Connecting to the Standards for Mathematical Practice. 2014 NCTM Annual Meeting and Exposition, April 2014 (New Orleans, LA)

Math Specialists: The Assessments Are Here - Now What? (with F. Fennell and J. Wray) 2014 NCTM Annual Meeting and Exposition, April 2014 (New Orleans, LA)

From PARCC and Smarter Balanced to your classroom: Creating, aligning and learning from formative assessments – EVERYDAY. (with F. Fennell, J. Wray and K. Sammons) 2014 NCSM Annual Conference, April 2014 (New Orleans, LA)

Assessment Literacy, Mathematics Teaching and PARCC and SBAC - How Are These Connected? (with F. Fennell and J. Wray), Association of Mathematics Teacher Educators Conference; February 7, 2014 (Irvine, CA)

Using Look For's to Consider the Common Core Content Standards and Standards for Mathematical Practices, AMTE National Conference, February, 2013, Orlando, Florida.

I am a Math Specialist, Who Says I am a Leader? (with F. Fennell, J. Wray), National Council of Teachers of Mathematics Regional Conferences, Dallas, TX, 2012, November, 2012, Chicago, December, 2012.

The Mathematical Emergency Room, Diagnosing Student Misconceptions, Annual NCTM Meeting, April, 2012, Philadelphia, PA.

An Analysis of State Certification Efforts and Coursework for Elementary Mathematics Specialists. (with F. Fennell , J. Wray), AMTE National Conference, February, 2012.

So You're An Elementary Mathematics Specialist? Got This Figured Out, (with F. Fennell, J. Wray), National Council of Teachers of Mathematics Regional Conferences, Atlantic City, NJ, October, 2010.

So You're An Elementary Mathematics Specialist? Got This Figured Out, (with J. Wray), National Council of Teachers of Mathematics Regional Conferences, Albuquerque, NM, November, 2010.

Moving the Common Core State Standards from Vision to Leadership, (with F Fennell, J. Wray) NCSM Summer Leadership Academy in Atlanta, GA - June 21-23, 2011.

Mathematics Specialist/Coaches and Relationships - Navigating the Slippery Slopes of Leadership, National Council of Supervisor of Mathematics, April, 2011, Indianapolis, IN.

An Analysis of State Certification Efforts for Elementary Mathematics Specialists: Mathematics, Pedagogy, and Leadership. (with F. Fennell and J. Wray), Association of Mathematics Teachers Educators Annual Conference, January, Irvine, CA.

Cases for Coaches: Professional Development for Elementary Mathematics Specialists (with F. Fennell and J. Wray, National Council of Teachers of Mathematics, April, 2010, Indianapolis, 2010.

Scaling Practice-Based Professional Development: Issues and Design Considerations (with F. Fennell and J. Wray), Association of Mathematics Teachers Educators Annual Conference , January, 2011 Irvine, CA.

Elementary Mathematics Specialists: An Update and Challenges, (with F. Fennell and B. Kobett), National Council of Supervisors of Mathematics Annual Conference, April, 2010, San Diego, CA.

Elementary Mathematics Specialists: An Update and Challenges, (with F. Fennell and B. Kobett), National Council of Supervisors of Mathematics Annual Conference, April, 2010, San Diego, CA.

Using Alternative Techniques to Engage College Students, (with Nicholson, D.), First Annual Faculty Development Conference for Colleges and Universities in Central Maryland at Stevenson University in October 2010.

Standards for Elementary Mathematics Specialists (EMS) Preparation and Certification: Elementary Mathematics Specialists & Teacher Leaders (EMS&TL) Project, (with F. Fennell and B. Kobett), Association of Mathematics Teacher Educators Annual Conference – Research Presession, January, 2010, Irvine, CA.

So You're a Math Specialist, Coach, Resource Teacher or Mentor: Now What? Come Find Out, (with F. Fennell and B. Kobett), National Council of Teachers of Mathematics Regional Conference, October, 2009 Baltimore, MD.

Mathematics Specialists – Emerging Issues – Coherence, Communication and Adult Learners, (with F. Fennell and B. Kobett), Maryland Council of Teachers of Mathematics Annual Conference October, 2009, Germantown, MD.

Mathematics Specialists/Instructional Leaders and Leadership Issues: It's All About Relationships, (with F. Fennell and J. Wray), National Council of Supervisors of Mathematics Leadership Seminar, October, 2010, New Orleans, LA.

Primary Problem Solving, National Council of Supervisors of Mathematics, April, 2009, Washinton, DC

Mathematics Mythbusters, Maryland Council of Teachers of Mathematics**,** October, 2008, Montgomery County, MD.

Number Sense for All, National Council of Teachers of Mathematics, April, 1990, Salt Lake City, Utah.

INVITED PRESENTATIONS (Selected)

Implementing Common Core, Visalia School District, 2014**,** Visalia, CA.

Common Ground for Common Core, Delaware State Department of Education, 2013-2014,
Multiple Sessions, Dover DE

Back to School and Common Core, Frederick County Public Schools Keynote, 2013, Frederick, MD.

The Mathematical Practices: Through the Eyes of Students, MCTM Keynote, 2013, Baltimore, MD

Common Core for Principal Leaders, Principal Academy, 2013, 2104, Cecil, MD

Common Core and UDL- What Preservice Teachers Should Know (with D. Nicholson), 2012, Stevenson University, Stevenson, MD.

Parenting a College Student, (2012), Stevenson University, Maryland.

Challenging Students with the Practices, (2012) Norwood School, Maryland.

Common Core and You, (2011) Stevenson University School of Education Faculty, Stevenson, Maryland.

Mathematical Practices, (2011) Frederick County Public Schools, Frederick, Maryland

Teaching Problem Solving to Gifted Students, (2011), Howard County Public Schools.

Improving Mathematical Perseverance, (2010), Odyssey Parents, Stevenson, Maryland.

Communicating in Mathematics, (2010), Howard County Public Schools, Maryland.

Differentiation in Mathematics, (2010), Howard County Public Schools, Maryland.

Teaching Number Sense and Developing School-Based Leaders Mathematics Series (with F. Fennell) 2003-2005. Washington County Public Schools, Maryland.

Teaching Algebra in the Intermediate Grades (4-8), Maryland Governor's Academy, 2003, Towson, Maryland.

Teaching Algebra in the Primary Grades, Maryland Governors Academy, 2003, Towson, Maryland.
Teaching Mathematics for the Learning Disabled, Odyssey School, 2004, Baltimore, Maryland

Teaching Preschoolers Mathematics, Mid-Atlantic Preschool Conference, 2003, Washington, DC.

Linking Algebra for the Elementary Grades, Pennsylvania School Consortium, 2002, Philadelphia, PA.

Developing Meaningful Mathematics, Baltimore County Public Schools Series, 1996-1999, Baltimore, Maryland.

Teaching Mathematics with Engagement, 2002-2003, Harford County Public Schools, Harford County, Maryland.

Helping Your Child with Mathematics Parent Night, 2001, 2002, 2003, Friendship Valley Elementary. Carroll County, Maryland.

Using Manipulatives to Teach Mathematics- A Hands-On Institute, Phi Delta Kappa Professional Development Institute, 1996, Tampa, Florida.

Using Manipulatives to Teach Mathematics- A Hands-On Institute, Phi Delta Kappa Professional Development Institute, 1996, El Paso, Texas.

Using Manipulatives to Teach Mathematics- A Hands-On Institute, Phi Delta Kappa Professional Development Institute, 1995, Jackson, Mississippi.

Developing Number Sense, National Council of Teachers of Mathematics, April, 1990, Salt Lake City, Utah.

PROFESSIONAL SERVICE, PROFESSIONAL MEMBERSHIPS, ORGANIZATIONS, CERTIFICATION, LICENSURE

National Council of Teachers of Mathematics Professional Development Services Committee, 2014-Present
National Council of Teachers of Mathematics Conference Committee, Atlantic City, October 2015
National Council of Teachers of Mathematics Conference Committee, St. Louis, October 2016
Association for Maryland Mathematics Teacher Educators, Board Member, 2012-2104
Association for Maryland Mathematics Teacher Educators, President Elect, 2015
Missouri Teacher Certification, (Grades 1-8) Lifetime Certificate, 1985-
Maryland Teacher Certification, Advanced Professional Certificate, 1985- present
National Council of Teachers of Mathematics, member 1986- present
Maryland Council of Teachers of Mathematics, member 1987-present
National Council of Supervisors of Mathematics, 1989-present
Association for Mathematics Teacher Educators, 2009-present
Association for Childhood Education International, 2005- present
Kappa Delta Pi, 1983-present