STUDY OF EARLY CAREER ELEMENTARY TEACHERS' MATHEMATICS INSTRUCTION AND VIEWS ABOUT SUCCESS

By

Shannon P. Sweeny

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Curriculum, Instruction, and Teacher Education – Doctor of Philosophy

2013

ABSTRACT

STUDY OF EARLY CAREER ELEMENTARY TEACHERS' MATHEMATICS INSTRUCTION AND VIEWS ABOUT SUCCESS

By

Shannon P. Sweeny

Recent research has shown that emphasizing the importance of effort for learning mathematics can have positive effects on students' achievement, engagement and sense of competence (Dweck, 2010; Middleton & Jansen, 2011; National Mathematics Advisory Panel, 2008). In order for teachers to focus on the importance of effort, they need to believe that success in mathematics is attributable to effort (i.e., growth mind-set) and not a result of some inherent ability (i.e., fixed mind-set). Achievement goal theory provides a framework for examining teachers' instructional practices with regards to an emphasis on effort versus ability. Mastery-oriented instructional practices tend to emphasize effort, improvement and challenges while performance-oriented teaching practices focus on using competitive instructional methods and highlighting ability differences in students (Anderman et al., 2001). Although teacher education programs may focus on the importance of effort versus ability and promote the use of mastery-oriented instructional practices in mathematics, beginning elementary teachers may struggle to use mastery-oriented teaching due to factors such as their own experiences as K-12 students, experiences during student teaching, and aspects of their school and district contexts.

The purpose of this study was to explore the views and teaching practices of a small group (n=10) of elementary teachers who had recently graduated from the same university teacher preparation program and were teaching upper-elementary mathematics. Using data from teacher surveys, student surveys, teacher interviews, and classroom observations, I explored the following research questions: (1) When teaching mathematics, do early-career upper elementary

teachers who graduated from a specific teacher preparation program use instructional practices that are mostly mastery-oriented, mostly performance-oriented, or a more balanced combination of both? (2) What factors seem to be associated with whether early-career upper elementary teachers use mastery-oriented and/or performance-oriented instructional practices in mathematics? (3) How do early-career upper elementary teachers describe and communicate their views about success in mathematics? How do their students view success in mathematics?

The results showed that the 10 teachers who participated in the study reported and were perceived to be using more mastery-oriented than performance-oriented instructional strategies in mathematics. In order to examine the factors that seemed to be associated with teachers' uses of different practices and teachers' views about success in mathematics, I used an in-depth case study approach informed by a situated perspective on learning to teach mathematics (Borko et al., 2000; Peressini et al., 2004). In the first case study, I found that Diane and Luke's focus on mastery-oriented teaching practices in mathematics was in large part due to the strong degree of alignment they experienced among their second mathematics methods course, their cooperating teachers' practices, and their own personal visions of teaching. In the second case study, I found that Andrea and Kelsey's active participation in certain communities of practice seemed to have a strong influence on their learning and use of mastery-oriented teaching practices in mathematics. With regards to teachers' views about success in mathematics, I found that Diane, Luke, and Andrea all seemed to communicate views consistent with a growth mind-set while Kelsey seemed to have elements of both a growth and fixed mind-set. Based on limited survey evidence, there was evidence that students in all four classrooms might have had beliefs about success in mathematics that were consistent with both fixed and growth mind-sets. I conclude by discussing implications for teacher education and future research.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1: INTRODUCTION

Overview

Recent reports have called for the need to strengthen the preparation of elementary teachers in the specific area of mathematics (Conference Board of the Mathematical Sciences, 2001, 2012; Greenberg & Walsh, 2008; National Mathematics Advisory Panel, 2008). Although strengthening elementary teachers' understanding of mathematics content is an important part of this preparation, the National Mathematics Advisory Panel (2008) also emphasized the importance of having teachers focus on their students' goals and beliefs about learning mathematics. The Panel recommended that teachers should use instructional practices that help students understand that their success in mathematics is related to the effort they put forth. This recommendation was based on evidence that children's beliefs about the importance of effort versus ability in mathematics can be changed, and a greater focus on effort in the classroom can result in more positive learning experiences for students.

> Experimental studies have demonstrated that children's beliefs about the relative importance of effort and ability or inherent talent can be changed, and that increased emphasis on the importance of effort is related to greater engagement in mathematics learning and, through this engagement, improved grades and achievement.
>
> (National Mathematics Advisory Panel, 2008, p. 31)

In order for teachers to focus on the importance of effort in their instructional practices, they need to believe that success in mathematics is attributable to effort. According to Dweck (1996), people tend to subscribe to one of two different sets of beliefs about ability and intelligence, which she described as implicit theories of intelligence. People who hold an entity theory believe that ability or intelligence is a fixed entity that cannot be changed, while those

who hold an incremental theory believe that ability or intelligence is malleable and can be increased incrementally through effort. In more recent research, Dweck (2006, 2010) changed the terminology from theories of intelligence to "mind-sets" and labeled the two sets of beliefs about intelligence as a "fixed mind-set" (i.e., entity theory) and a "growth mind-set" (i.e., incremental theory). For the sake of being clear and consistent, I will use the more current terminology of fixed and growth mind-sets. If elementary teachers believe and promote the idea that mathematical ability is not fixed and all students can be successful, then they can help students improve their achievement and sense of competence in mathematics (Dweck, 2010; Middleton & Jansen, 2011).

A related issue is how teachers communicate ideas about success and failure in mathematics to their students. Elementary teachers' beliefs about success and failure can influence their instructional practices in mathematics. For example, teachers who believe that success in school mathematics is dependent on students being able to answer problems quickly and/or having the most correct answers may emphasize speed and competition in their own classrooms. Other teachers who embrace a view that success is achieved when students understand mathematical concepts and can explain their thinking may incorporate the regular use of group work and challenging mathematical tasks that require more time and effort. These differing instructional practices have the potential to influence elementary students' views of success and failure, both in general and in relation to their own perceived competence in mathematics. Previous research has shown that the "extent to which students are motivated to work hard to learn mathematics concepts and skills depends on how they define success in mathematics" (Middleton & Jansen, 2011, p. 87). If students believe that you can be successful in mathematics if you work hard, then they will be motivated to put in the effort required to learn

the mathematics content. On the other hand, if students believe that success is dependent on getting the highest grades in the class and they consistently earn low grades, then they might not be motivated to exert additional effort.

As a mathematics teacher educator, I became concerned about the number of prospective elementary teachers I worked with who talked about their own struggles with learning mathematics and made statements such as, "I'm just not a math person" or "I am planning to teach kindergarten so I don't have to worry about teaching difficult math." In order to gain insight about their experiences as learners and how they defined success in mathematics, I conducted a research project in which I analyzed 177 mathematics autobiographies written by prospective elementary teachers. In my analysis, I discovered five types of experiences that were written about most often as having an influence (either positive or negative) on how these prospective teachers viewed mathematics and themselves as learners of mathematics: (1) timed tests for mathematics facts, (2) university mathematics content courses, (3) advanced mathematics classes or other tracking of mathematics classes/groups, (4) geometry classes or concepts, and (5) helping others with mathematics content.

As I further analyzed the data from the mathematics autobiographies, I found evidence of three main theories of success in mathematics among the prospective teachers who participated in the study. First, some of the prospective teachers seemed to view success in mathematics as being dependent on speed and competition. This theory often came up in relation to experiences with timed tests for mathematics facts as they wrote about how they decided they were "good at math" and successful when they were faster and did better than other students or they felt they were "bad at math" and a failure when they were slow and did worse in relation to their peers. A second theory of success that arose from the data was based on a combination of recognition and

competition. In this case, the prospective teachers seemed to feel successful when they were part of a select group of students who were recognized by teachers and others as being successful in mathematics or they felt like a failure when they were not recognized and selected as a member of such a group. Both of these theories of success seemed to be focused on determining your success in mathematics by comparing yourself to others and trying to do better or appear to do better than your peers. Finally, I found evidence of a third theory of success in mathematics that seemed to be very different from the first two because it focused on understanding or mastering the content rather than on performance in relation to others. The prospective teachers who seemed to subscribe to this theory wrote about feeling successful in mathematics when they worked hard to understand challenging content or when they understood the content well enough to help others.

As I reflected on the different theories of success that seemed to be held by the prospective elementary teachers in the study, I wondered how these different theories might influence their instructional practices in mathematics. For example, would the teachers who defined their own success in mathematics based upon speed or competition focus on those same theories of success with their students? If teacher educators focus on the importance of effort and understanding the content in mathematics methods courses and other areas of teacher preparation, will the prospective elementary teachers emphasize those same ideas and theories of success with their own students? Considering that prospective elementary teachers may end up teaching in a wide variety of settings, I also wondered how teaching contexts might influence teachers' theories of success and related instructional practices. As I thought about how I wanted to explore these questions and issues in my dissertation research study, I searched for research

and theories that would help me study teachers' beliefs and instructional practices in relation to their theories of success in mathematics.

Achievement goal theory provided a useful framework for examining elementary teachers' instructional practices in relation to their views about success and failure in mathematics. According to achievement goal theory, teachers' practices can be described as being more mastery-oriented, more performance-oriented, or a combination of both. Mastery-oriented instructional practices tend to emphasize effort, improvement, and challenges while performance-oriented teaching practices focus on using competitive instructional methods and highlighting ability differences in students (Anderman et al., 2001). Achievement goal theory has also been used as a lens to examine students' views about success and failure in mathematics and look for possible connections to the goal orientations that teachers emphasize in their instructional practices.

Although teacher education programs may focus on the importance of effort versus ability and promote the use of mastery-oriented instructional practices in mathematics, beginning elementary teachers may struggle to implement mastery-oriented teaching in their classrooms for a variety of reasons. Beginning teachers may be new to teaching but they have a lifetime of experiences with school mathematics as both a student and observer of mathematics teachers, and these past experiences work together to form their institutional biographies. According to Britzman (1986), if these institutional biographies are left unexamined, then teachers may reproduce the teaching practices they experienced as K-12 students without considering the costs and benefits of such practices. Some teachers may have experienced a strong focus on performance-oriented teaching in their schooling, while others may have experienced more mastery-oriented practices or a combination of mastery- and performance-oriented teaching

practices. Beginning teachers' instructional practices can also be influenced by what they experienced in the classroom during their student teaching internship (Bickmore, Smagorinsky, & O'Donnell-Allen, 2005; Britzman, 2003; McDonnough & Matkins, 2010). If their cooperating teachers used mostly performance-oriented teaching practices, then beginning teachers may not have seen or experienced any models of how to implement mastery-oriented teaching in an elementary classroom. Research has shown that even when beginning elementary teachers enter the teaching profession with nontraditional (e.g., progressive) beliefs about how they should teach, they often struggle with the constraints of actual classroom teaching and eventually implement more traditional classroom practices (Brown & Borko, 1992; Raymond, 1997).

Research has shown that although achievement goals are somewhat stable for individual students over time, "there is less stability when students move from one learning environment (i.e., classroom, grade, or school) to another" (Middleton, Kaplan, & Midgley, 2004, p. 293). In addition, studies focused on the middle grades have provided evidence that middle school teachers and middle school environments tend to be more performance-oriented than elementary school teachers and schools, so the transition from elementary school to middle school can be especially challenging for students (Midgley, Anderman, & Hicks, 1995; Midgley, Kaplan, & Middleton, 2001). Middle schools vary in structure and grade configuration, so teachers in the upper elementary grades (4^{th} – 6^{th}) may be: (a) preparing students for the transition to middle school, (b) teaching in an elementary school that uses a middle school structure for the upper grades, or (c) teaching in an actual middle school setting. Beginning elementary teachers working in these grade levels may encounter additional challenges in trying to enact mastery-

oriented teaching practices in their classroom, so in this study I focused in particular on upper elementary beginning teachers.

The purpose of this study was to use achievement goal theory as a lens to examine the mathematics teaching practices of a small group of early career elementary teachers (n=10) who graduated from the same university teacher preparation program. In addition to describing and categorizing their instructional practices, I explored the different factors and/or experiences that seemed to influence their learning and development of instructional practices. Through the use of a situated learning perspective, I conceptualized each teacher's learning-to-teach experiences as "a single learning trajectory through the multiple contexts of teacher education" (Borko et al., 2000, p. 196). In my data collection, I focused primarily on three important contexts that provided potential learning opportunities for the teachers including: their experiences as K-12 students, their teacher preparation program (with a particular focus on elementary mathematics methods courses), and their school/district settings. I also collected data on their experiences with student teaching, mathematics curricula, professional development, school-based teacher colleagues, and administrators. Finally, I examined the teachers' views about success and failure in mathematics and how they might have communicated those views to their students through explicit messages and instructional practices.

Research Questions

In this study, I used data from teacher surveys, student surveys, teacher interviews, and classroom observations to explore the following research questions:

1. When teaching mathematics, do early-career upper elementary teachers who graduated from a specific teacher preparation program use instructional practices that are mostly mastery-oriented, mostly performance-oriented, or a more balanced combination of both?

2. What factors seem to be associated with whether early-career upper elementary teachers use mastery-oriented and/or performance-oriented instructional practices in mathematics?
3. How do early-career upper elementary teachers describe and communicate their views about success in mathematics? How do their students view success in mathematics?

CHAPTER 2: THEORETICAL BACKGROUND

Overview

In this chapter, I provide a brief overview of achievement goal theory, including a description of how the main categories of goal orientations have changed over time and how achievement goal theory has been used to categorize teachers' instructional practices, classroom goal structures, and school-wide goal structures. Next, I provide information on the goal orientations that have been recommended by researchers as most productive for students and how teachers' instructional practices have been linked to students' goal orientations. Then, I highlight findings from some research studies focused on the goal orientations of prospective elementary teachers and the influence of school-wide goal orientations. After explaining achievement goal theory, I discuss relevant research related to certain contexts and experiences that have been shown to influence beginning teachers' instructional practices in mathematics and more generally. Finally, I outline the conceptual framework for my study, which is based on a situated perspective on learning to teach mathematics.

Achievement Goal Theory

History and Development of Goal Orientations

Achievement goal theory was developed in the 1980s, as a way to make sense of the different responses students seemed to have in learning situations. The basic premise of the theory is that achievement goals "differentially influence school achievement via variations in the quality of cognitive self-regulation processes" (Covington, 2000, p. 174). Cognitive self-regulation processes include: how students analyze the requirements of tasks, how they use their resources to meet the demands of tasks, and how they keep track of their progress. The different achievement goals that students have "are thought to influence the quality, timing, and

appropriateness of cognitive strategies that, in turn, control the quality of one's accomplishments" (Covington, 2000, p. 174). In the last three decades, achievement goal theory has gone through some major transformations with the development of new categories of goals and debates over which goal orientations are most helpful for students and should therefore be emphasized by teachers.

When achievement goal theory was originally developed there were two goals that went by a variety of names: (a) mastery/task/learning goals and (b) performance/ego/self-enhancing goals. Although the names varied, theorists and researchers seemed to agree on some basic characteristics of each goal. In order to be clear, I will refer to the two goals as mastery goals and performance goals from now on. Mastery goals were usually described by researchers as being focused on developing competence or ability and gaining understanding or mastery of the content; while performance goals were usually described as being focused on demonstrating ability or competence, often in relation to others (Church, Elliott, & Gable, 2001; Covington; 2000; Kaplan & Maehr, 2007; Middleton, Kaplan, & Midgley, 2004; Midgley, Kaplan, & Middleton, 2001; Patrick, Anderman, Ryan, Edelin, & Midgley, 2001; Phelps, 2010). Some researchers also described mastery goal orientations as including a focus on attributions of success to effort and the belief that ability could be developed through effort (i.e., growth mind-set). Descriptions of performance goal orientations often included an attribution of success and failure to ability, or lack of ability, along with the belief that ability is a fixed attribute (i.e., fixed mind-set) (Ames, 1992; Ames & Archer, 1988; Dweck & Leggett, 1988; Leondari & Gialamas, 2002; Middleton & Spanias, 1999; Nicholls, Cobb, Wood, Yackel, & Patashnick, 1990; Perry, 2011; Siefert, 2004; Senko, Hulleman, & Harackiewicz, 2011).

Based on some inconsistencies in findings, researchers found the need to further differentiate mastery and performance goals into approach and avoidance orientations. Students with a mastery-approach orientation strive "to learn or improve skills" while mastery-avoidance orientation is characterized by "striving to avoid learning failures or skill decline" (Senko, Hulleman, & Harackiewicz, 2011, p. 27). Students with performance-approach goals have an "orientation to demonstrating ability" (Midgley et al., 2001, p. 77) or to demonstrating "ability relative to others" (Wolters, 2004, p. 236); while performance-avoidance goals are characterized by a "focus on avoiding unfavorable judgments of competence" (Church, Elliot, & Gable, 2001, p. 43) or on "trying to avoid looking incompetent in comparison to others" (Linnenbrink & Pintrich, 2002, p. 321). Although researchers have defined mastery-approach and mastery-avoidance goals, there has been minimal research focused on these particular distinctions so it is difficult to make any claims or generalizations about the possible patterns of student or teacher behavior associated with each one (Brophy, 2010; Kaplan & Maehr, 2007). Since the majority of the research using achievement goal theory has focused on mastery goals (without breaking the category into approach and avoidance orientations), performance-approach goals, and performance-avoidance goals, in this study I did not focus specifically on the distinctions between mastery-approach and mastery-avoidance goals.

In addition to using achievement goal theory to categorize students' academic goals, this theory has been applied to teachers' instructional practices and goals for their students, classroom goal structures, and school-wide goal structures. Researchers have measured the goals that teachers report establishing for their students, in addition to what students perceive as the teachers' goals. These goals are described similarly to the students' goals in terms of mastery and performance orientations. In order to categorize instructional practices as mastery-oriented

or performance-oriented, researchers often focus on the following categories: task structure, authority in the classroom, recognition of students, grouping of students, evaluation of student learning and behavior, use of time in the classroom, social interactions, students' help seeking-behavior, and messages from teachers about their beliefs and assumptions (Patrick et al., 1997). A mastery-oriented goal structure, whether classroom-level or school-level, has been described as an "environment in which the instructional practices, policies, and norms convey to students that learning is important, that all students are valued, that trying hard is important, and that all students can be successful if they work hard to learn" (Wolters, 2004, p. 236). A performance-oriented goal structure, on the other hand, is "an environment that communicates to students that being successful means getting extrinsic rewards, demonstrating high ability, and doing better than others" (Wolters, 2004, p. 236).

Recommended Goal Orientations for Students

In the early development of achievement goal theory, there was common agreement among researchers that mastery goals promoted greater educational benefits than performance goals. Research suggested that adopting a mastery goal orientation "promotes a motivational pattern likely to promote long-term and high-quality involvement in learning" (Ames, 1992). Teachers were encouraged to promote mastery goals and use mastery-oriented instructional practices in their classroom. Over the last 30 years, mastery goals have continued to be recognized as having positive benefits for students in learning situations. Personal mastery goals have been associated with higher achievement and the belief that ability can be modified through effort (Leonardi & Gialamas, 2002); higher perceived competence (Leonardi & Gialamas, 2002; Middleton et al., 2004; Perry, 2011); and greater effort, persistence, and willingness to take more mathematics classes (Wolters, 2004).

In the last decade, with the added distinction of performance-approach and performance-avoidance goals, there has been some debate about whether there may be positive benefits to a multiple-goals approach in which students are encouraged to adopt performance-approach goals in conjunction with mastery goals. Some researchers have argued that students who adopt both types of goals will be optimally motivated because the two goals promote different achievement outcomes. In a review of 14 studies focused on college students, researchers found that mastery goals tended to have a positive effect on interest outcomes such as: positive attitude, enjoyment, interest in class, and task value; while performance-approach goals tend to have a positive effect on academic performance (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). In a study focused on middle school mathematics students, Pintrich (2000) found that high mastery goals combined with high performance-approach goals was just as adaptive for students as having high mastery goals and low performance-approach goals. Other researchers have cautioned against recommending performance-approach goals because research indicates that the positive results of having both mastery goals and performance-approach goals may only occur with certain students in limited circumstances (Linnenbrink & Pintrich, 2002; Midgley et al., 2001).

Some research studies have demonstrated that students who adopt a performance-approach goal may have a tendency to switch to a performance-avoidance goal orientation when they struggle with content or receive low grades (Brophy, 2005; Senko & Harackiewicz, 2004; Shim & Ryan, 2005) and also when they make the transition to a new learning environment, such as the move from elementary to middle school (Middleton et al., 2004). Personal performance-approach goals have been associated with higher achievement and the belief that ability is modifiable with effort (Leonardi & Gialamas, 2002), but also with more procrastination, less persistence, and a desire to avoid future mathematics classes (Wolters, 2004). Personal

performance-avoidance goals have been associated with the belief that ability is a fixed entity (i.e., fixed mind-set), the avoidance of new and difficult mathematics tasks (Vogler & Bakken, 2007), and low self-efficacy (Middleton et al., 2004).

In summary, since achievement goal theory was first developed, mastery goals have continually been recognized as promoting positive learning benefits for students. When it comes to performance goals, there has been more debate about possible benefits and/or ill effects. Although there seems to be clear agreement that performance-avoidance goals are not beneficial, some researchers have provided evidence that performance-approach goals can be beneficial for students when combined with mastery goals (i.e., multiple-goals approach). Other researchers have warned against promoting this multiple-goals approach because there is evidence that performance-approach goals can easily transform into the potentially more harmful performance-avoidance goals when students struggle or encounter new learning contexts. Therefore, it seems most beneficial for students to focus primarily on adopting mastery goals.

Connections Between Students' Goals and Teachers' Instructional Practices

Multiple research studies have provided evidence that students' personal goal orientations can be influenced by the goal orientations that teachers emphasize in the classroom. Students who perceive a mastery goal orientation in the classroom are likely to adopt mastery goals, while students who perceive a performance goal orientation are likely to adopt performance goals (Lau & Nie, 2008; Maehr & Midgley, 1991; Meece, Anderman, & Anderman, 2006; Midgley, 2002; Patrick & Ryan, 2008; Wolters, 2004).

Teachers who promote mastery goal orientations have been shown to emphasize the importance of: attempting challenging work, understanding the work, learning from mistakes, enjoyment related to learning new ideas, providing time for exploration, recognizing students for

their effort, and providing feedback privately. Teachers who promote performance goal orientations tend to emphasize: public recognition and feedback, test scores, and special privileges for the high performing students (Dresel, Martschinke, & Kopp, 2009; Meece, Herman, & McCombs, 2003; Patrick & Ryan, 2008). Teachers may promote both types of goals through their instructional approaches and messages to students, but in many classrooms one goal tends to be emphasized more than the other (Kumar, Gheen, & Kaplan, 2002).

In a study that focused on how upper elementary teachers communicated achievement goal orientations to their students, Patrick, Anderman, Ryan, Edelin, and Midgley (2001) looked for associations between "students' perceptions of the classroom goal structure and observational records of teacher and student behavior" (p. 38). Some teachers were perceived by their students and observed by the researchers as emphasizing both performance and mastery goals, while other teachers emphasized mainly mastery or performance goals. The researchers did not collect data on the personal goal orientations of the students so there is no information about how the combined focus on both mastery and performance-oriented instructional practices may have influenced whether the students adopted mastery goals, performance goals, or both. It is possible that beginning teachers may exhibit a mixture of mastery and performance teaching practices as they move from being a university student to becoming an experienced teacher. The teachers in the Patrick et al. study were all experienced teachers who had been teaching for four or more years, so there was no specific information about early career teachers' instructional practices.

Classroom teachers may use a combination of mastery- and performance-oriented teaching practices in their classrooms, but most research studies using achievement goal theory have characterized teachers' practices as being either more mastery-oriented or more performance-oriented, rather than focusing on different combinations of both types of practices.

Although the study by Patrick et al. (2001) did report on teachers using different combinations of mastery- and performance-oriented practices in their teaching, the categorizations of their general instructional practices were based on observation and survey data about both mathematics and language arts instruction. The descriptions of their teaching practices were not broken down by subject area, so it is possible that the elementary teachers used different types of instructional practices in mathematics versus language arts (e.g., more mastery-oriented in language arts and more performance-oriented in mathematics).

In summary, research has shown that teachers can influence students' goal orientations through their instructional practices in the classroom. Since mastery goals have been recognized as being beneficial for students, teachers should be encouraged to use mastery-oriented instructional strategies in their classrooms. Therefore, teacher educators who work with prospective elementary teachers should model and promote the use of mastery-oriented teaching practices.

Prospective Elementary Teachers' Achievement Goals

Some recent studies have focused on the personal achievement goal orientations of prospective elementary teachers. Perry (2011) used survey data to explore the relationship between achievement goals and attitudes about mathematics among a group of 340 prospective elementary teachers. Perry found that mastery goals dominated, followed by performance-avoidance and performance-approach goals. Performance-avoidance goals were positively correlated with performance-approach goals, while mastery goals were positively correlated with confidence in learning mathematics.

Phelps (2010) used survey and interview data to explore the factors that prospective elementary teachers identified as influencing their achievement goals and their perceived

confidence in mathematics. Participants talked about negative performances in mathematics causing them to lose confidence in their ability and worry more about their grades (i.e., performance orientation) and less about understanding the material (i.e., mastery orientation). Many of them also mentioned a tendency to lose confidence in their ability and become less productive when they had to exert more effort in mathematics. For these prospective teachers, putting in more effort was a sign that they were not good at mathematics. This view related to effort seems to be consistent with a fixed mind-set rather than a growth mind-set. Verbal persuasions, in the form of statements from parents and teachers, sometimes increased perceived confidence and other times caused participants to focus more on grades (i.e., performance orientation). Most of the prospective teachers in the study also described social comparison situations (i.e., performance orientation) where their perceived confidence increased when they did better than others in mathematics, but decreased when they did worse in relation to their peers.

These two research studies (Perry, 2011; Phelps, 2010) provide evidence that while prospective elementary teachers may have personal mastery goal orientations, they may become more performance-oriented when they encounter challenges, social comparison situations, or statements from people of authority (e.g., parents or teachers). It seems possible that beginning elementary teachers may therefore have a desire to use mastery-oriented teaching practices, but they may find themselves using more performance-oriented strategies for some of the same reasons mentioned above: encountering challenges, social comparison situations, or statements from people of authority. For example, beginning teachers may encounter challenges in teaching mathematics due to a lack of content knowledge or being unfamiliar with the district-adopted curriculum. They may also encounter social comparison situations if they work at a school in

which teachers are compared to each other with regards to students' test scores. In addition, administrators or experienced teachers could make statements to beginning teachers about performance-oriented expectations around mathematics instruction. All of these are examples of reasons that may cause a beginning elementary teacher to use more performance-oriented strategies in mathematics.

In summary, research has shown that prospective elementary teachers may have mastery-oriented goals that transform into more performance-oriented goals when they encounter different situations. Since it seems most beneficial to have teachers focus on mastery-oriented instructional practices and promote mastery goals for their students, teacher educators need to consider the potential factors that may inhibit beginning teachers' use of mastery-oriented practices.

School-Level Goals

Achievement goal theory has also been used to describe school-level practices. School settings may promote a more mastery- or more performance-oriented learning culture for students through decisions about: using curriculum, empowering students, recognizing students for various behaviors, grouping students, evaluating students, and using time (Roeser, Marachi, & Gehlbach, 2002). Schools may also promote a more mastery- or performance-oriented work culture for teachers through an environment that may be described as "emphasizing competition, social comparison, and differential treatment of teachers (i.e., a performance goal structure); cooperation, equity, and a spirit of innovation (i.e., a mastery goal structure); or to some degree, both" (Roeser et al., 2002, p. 222). Researchers have found that teachers' instructional practices tend to be correlated with what they perceive as the learning culture for students and the work culture for teachers (Roeser et al., 2002). Therefore, teachers who perceive a more mastery-

oriented school culture are more likely to use mastery-oriented practices in their classrooms, whereas teachers who perceive a more performance-oriented school culture are more likely to use performance-oriented practices. These findings are important to consider in relation to beginning teachers who may have personal goal orientations or approaches to instruction that are in conflict with what they perceive to be the school-wide focus. If mastery goals are optimal for students but beginning teachers encounter a school-wide focus on performance goals, then they may have difficulty enacting mastery-oriented instructional practices in their classroom.

Factors Influencing Beginning Teachers' Instructional Practices

Experiences as K-12 Mathematics Students

Beginning teachers may not have much experience with teaching mathematics, but they have many years of experience with school mathematics as students, which is what Lortie (1975) referred to as their "apprenticeship of observation." All of these experiences and images of teaching combine to form part of their institutional biographies. Some researchers have described the importance of having beginning teachers critically examine their institutional biographies and explore how their past experiences might influence their teaching (Britzman, 1986; Feiman-Nemser, 2001). Some of these past experiences that are of particular interest in this study include: (a) whether beginning teachers experienced mastery- and/or performance-oriented mathematics teaching as students and (b) the nature of their experiences with success and failure in mathematics. In a research study using the achievement goal framework, researchers found that teachers' approaches to instruction were related to their own learning behaviors, so teachers who exhibited "mastery goals to facilitate their own learning were more likely to facilitate a mastery goal orientation in the classroom" (Gordon, Dembo, & Hocevar, 2007, p. 43). Therefore, it was important to explore how the teachers in my study approached

learning mathematics content and how their past experiences as K-12 students might have influenced their mathematics teaching.

Effects of Elementary Mathematics Methods Courses on Beginning Teachers

Some researchers have used longitudinal studies to track the degree to which beginning teachers seem to adopt and incorporate the beliefs and instructional practices they were exposed to during their elementary mathematics methods courses and teacher preparation programs (Cady, Meier, & Lubinski, 2006; Marbach-Ad & McGinnis, 2009; Steele, 2001).

Marbach-Ad and McGinnis (2009) collected survey (n = 31) and interview (n = 6) data on the beliefs and reported practices of beginning teachers at the completion of their teacher preparation program and after they had taught for two years. At both points in time, the majority of teachers reported beliefs and practices consistent with the instructional strategies emphasized in their mathematics methods courses. These instructional practices included the use of: real-world applications, connections to science, multiple representations, discussion, group work, and inquiry-based teaching. Many teachers mentioned that it was challenging to use inquiry-based teaching and other innovative practices due to district expectations about content coverage, but they felt much more comfortable implementing these practices in their second year of teaching (Marbach-Ad & McGinnis, 2009). The results of this study were based on self-report by teachers, so it seems possible the results could have been different if there was data about teachers' actual use of instructional practices from classroom observations or student surveys.

In another longitudinal study, Steele (2001) tracked the beliefs and observed mathematics teaching of a small group of elementary teachers (n = 4) over a period of four years. Teachers who participated in the study completed a beliefs survey at three points in time: (a) at the beginning of their mathematics methods course, (b) at the end of their mathematics methods

course, and (c) after completing two years of full-time teaching. Steele also gathered data about teachers' beliefs and practices through interviews and classroom observations during their second year of teaching. At the end of the elementary mathematics methods course, the survey results provided evidence that all four teachers had developed similar ideas about teaching and learning mathematics consistent with the instructional practices promoted in the methods course (e.g., teaching through problem solving and using knowledge of children's thinking to drive instruction).

After two years of teaching, Steele (2001) observed major differences between some of the teachers' instructional practices and whether or not they had enacted ideas from the mathematics methods course in their classrooms. Although all four of the teachers had originally developed a similar conception of mathematics teaching and learning, only two of the teachers were observed to be implementing instructional practices that focused on problem solving and the deliberate use of children's thinking. The factors that seemed to influence teachers' conceptions and instructional practices in varying ways were: personal commitment, content knowledge, mathematics curriculum, beliefs and knowledge about teaching and learning math, and support from school administration (Steele, 2001).

Cady, Meier, and Lubinski (2006) conducted a longitudinal study in which they gathered survey and interview data from a group of K-8 teachers (n = 12) at three different points in time: (a) during their teacher preparation program, (b) after their first year of teaching, and (c) at the end of their sixth year of teaching. During their teacher preparation program, the teachers were exposed to a cognitively-based vision of teaching mathematics focused on utilizing children's thinking, incorporating problem solving tasks, and viewing students as active constructors of their own mathematics knowledge. In their first year of teaching, most of the teachers in the

study were unable to implement the cognitively-based instructional practices and they blamed their inabilities on three main factors: lack of time, high stakes achievement tests, and environments that were not supportive of these practices. At the end of their sixth year of teaching, the teachers reported beliefs about teaching and learning that were more consistent with what they had been exposed to in their teacher preparation program.

Teachers in the study (Cady et al., 2006) also reported making changes in their instructional practice as they transitioned from being novices to more experienced teachers. They identified the following factors as having a positive influence on their changed practice: gaining confidence through experience, being involved in the research project, increasing their pedagogical content knowledge, the passing of time, working in supportive environments, and professional development opportunities. Although professional development was important for their growth, the teachers mentioned that it was most beneficial after they had acquired some experience as a full-time teacher. They felt that the second or third year of teaching was an optimal time because, at that point in their career, they did not feel as overwhelmed and were ready to focus on improving their practice. As with the first longitudinal study (Marbach-Ad & McGinnis, 2009), the findings about teachers' use of instructional practices in this study (Cady et al., 2006) were based solely on self-report, so it seems possible there may have been more variation in teachers' actual uses of the different practices.

Since these research studies (Cady et al., 2006; Marbach-Ad & McGinnis, 2009; Steele, 2001) showed the influence of mathematics methods courses may be more evident in the second year of teaching and beyond, I decided to include beginning teachers who were in their first, second, or third year of teaching. I also recognized that elementary mathematics methods courses were not the only contexts during teacher preparation with the potential to influence

teachers' views and practices. It seemed likely that teachers' learning and development could have also been influenced by other contexts in teacher preparation including: mathematics content courses, other university courses, field experiences, student teaching, mentor teachers, university field instructors, etc. Therefore, I planned my data collection methods with the intent of finding out as much as possible about the full range of teachers' experiences during their teacher preparation program.

Effects of School and District Contexts on Beginning Teachers

Other research studies have provided evidence that aspects of school and district contexts can influence beginning teachers' views and instructional practices. At the school level, administrators may provide an influence through their direct interactions with beginning teachers and/or their facilitation of opportunities for teachers to work with mentors and other school colleagues (Youngs, 2007b). School administrators have also been shown to shape beginning teachers' learning and development as a result of: the way they provide access to certain policy messages about instruction, their participation in the social construction of meaning around those policy messages, and how they structure opportunities for teachers to collaborate (Coburn, 2005). In addition, beginning teachers' perceptions of the quality of the relationships between administrators and teachers have been shown to influence their intent to remain at the same school in the future (Pogodzinski, Youngs, Frank, & Belman, 2012).

School colleagues were found to be another strong influence on how teachers made sense of policies around instruction and changed their instructional practices. Coburn (2001) found that teachers in her study used their formal and informal professional communities to help them understand new policies and make decisions about instructional practices. As a result, the ways

in which teachers' views and instructional practices changed were dependent upon the views and experiences of the school colleagues they worked with in those professional communities.

At the district level, there are a variety of factors that have been identified as having the potential to influence beginning teachers' views and practices. In a study that focused on first-year teachers, Grossman and Thompson (2004) found that district contexts provided a lens that focused the beginning teachers on certain issues and practices, which varied widely from district to district. Beginning teachers in different school districts had varied learning experiences based on: curriculum materials, available resources, assigned tasks (e.g., becoming familiar with district and state curriculum frameworks), district assessments, professional development opportunities, and district structures (e.g., mentoring programs and curriculum specialists). District policies on induction programs have also been found to influence beginning teachers' learning through mentor selection, mentor assignment, and professional development opportunities (Youngs, 2007a).

Finally, teachers in some of the previously mentioned longitudinal studies identified school and district factors that influenced their mathematics teaching including: high stakes achievement testing, professional development, and school environments (Cady et al., 2006); curriculum and support from administration (Steele, 2001); and content coverage expectations (Marbach-Ad & McGinnis, 2009).

It is possible that some of these factors related to school and district context may influence whether beginning teachers use mastery-oriented and/or performance-oriented strategies. For example, if a district has a strong focus on test preparation and increasing scores on high stakes standardized tests, beginning teachers may feel pressure to use more performance-oriented strategies. Therefore, I developed my interview protocols with the intent of exploring

the influence of these different aspects of school and district contexts on the teachers in the study.

Conceptual Framework

Situated Learning

The conceptual framework that informed the research design for this study applied a situated perspective on learning to the study of learning to teach mathematics (Borko et al., 2000; Peressini et al., 2004). A situated perspective on learning posits that learning occurs within various physical and social contexts, and those contexts are an essential part of the learning (Greeno, Collins, & Resnick, 1996). Therefore, "how a person learns a particular set of knowledge and skills and the situation in which a person learns, becomes a fundamental part of what is learned" (Putnam & Borko, 2000, p. 4). For early-career teachers, such as the ones who participated in this study, learning to teach mathematics occurs over time and across a wide variety of contexts and situations including: experiences with mathematics as K-12 students, university mathematics content and methods courses, student teaching and other field experiences, and experiences in school and district contexts.

Participation is a key concept in theories of situated learning as learning occurs through participation in various communities of practice. Lave and Wenger (1991) describe legitimate peripheral participation as the process "by which newcomers become part of a community of practice" (p. 29). When people first enter a community of practice, such as prospective teachers who are in their first elementary classroom field experience, they may spend more time observing and listening rather than actively participating. As the prospective teachers learn more about the classroom community and the practice of teaching, they may begin to participate more in the classroom activities. This learning process is a form of legitimate peripheral participation.

The prospective teachers engage in a continuous cycle of learning and participating in their field experiences and university classes in which, the more they learn, the more they may participate in a given community of practice. As prospective teachers continue through their teacher preparation program and into their first few years of teaching, they may have the opportunity to participate in and learn from a variety of communities of practice as they move away from legitimate peripheral participation and toward full participation in the practice of teaching.

Communities of practice can exist in a variety of forms and sizes from small groups of teachers who work together at the same school to large groups of people who are located all over the world and meet in an online environment. Although various groups of people can be labeled as communities, Wenger (1998, 2000, 2011) defined communities of practice according to three important characteristics: (a) joint enterprise (i.e., the domain), (b) mutual engagement (i.e., the community, and (c) shared repertoire (i.e., the practice). First of all, a community of practice is a joint enterprise where members are committed to a shared domain of interest, such as teaching elementary mathematics. Second, members of a community of practice develop their sense of community through mutual engagement as they work together and learn from each other. Finally, communities of practice develop a shared repertoire of resources, which amounts to a shared practice. In the case of a shared domain of interest around teaching elementary mathematics, those resources might include things such as lesson plans, manipulatives, mathematical tasks, activity sheets, rubrics, student work examples, etc.

Teachers may participate in a variety of communities of practice as they learn and develop their practice. For example, student teachers may participate in a community of practice where they meet on a regular basis with their mentor teacher and other teachers at the same grade level to develop lesson plans, examine student work, share reflections from their teaching, and

work together to improve their practice. Another example of a community of practice could be a group of teachers at a school who decide to work together to develop and improve on a specific aspect of their teaching practice, such as improving discussions in mathematics or implementing a mathematics workshop approach. Throughout their participation in various communities of practice, teachers are constantly negotiating and renegotiating meaning from their experiences and developing their professional identities and visions of themselves as effective teachers of mathematics. Identities can be described as "long-term, living relations between persons and their place and participation in communities of practice" (Lave & Wenger, 1991, p. 53).

Since learning is situated and dependent on the social and physical contexts in which it occurs, and individual teachers are constantly renegotiating meaning from experiences and developing their identities, what and how teachers learn will vary from person to person. In previous studies, researchers have used a situated view of learning to explore the process of learning to teach mathematics at the secondary level. In the Learning to Teach Secondary Mathematics (LTSM) in Two Reform-Based Teacher Education Programs Study, researchers followed six secondary mathematics teachers over four years to learn more about the situated nature of their knowledge, beliefs, and practices related to mathematics subject matter (i.e., proof, functions and transformations, and rate), mathematics-specific pedagogy (i.e., tasks and discourse), and professional identity (Borko et al., 2000; Peressini et al., 2004). Borko et al. found that the compatibility or coherence between the practices promoted in the university methods courses and the student teaching placements was essential for the prospective teachers' development as mathematics teachers. Peressini et al. examined the instructional practices and professional identities of teachers in the study during their first two years of full-time teaching. One teacher in particular (Mr. Hanson) was observed to be teaching mathematics during his first

year in ways that were very different from his instruction during student teaching and disconnected from his vision of effective teaching and the teacher he wanted to become. Through the situated learning lens, the researchers were able to see that Mr. Hanson's instruction seemed to be influenced by characteristics of his school context including time constraints, covering content in preparation for high-stakes tests, students' expectations about mathematics class, and colleagues' instructional practices around mathematics tasks and discourse. In his second year of teaching, Mr. Hanson developed strategies that allowed him to enact the vision of effective mathematics teaching he had developed during his teacher preparation program.

In another longitudinal study, researchers followed eight secondary teachers (i.e., four mathematics teachers and four social studies teachers) and used a situated learning lens to explore the teachers' learning, motivation and identity development from teacher preparation into their early years of teaching (Horn et al., 2008; Nolen et al., 2011). Horn et al. found that the prospective teachers began their teacher preparation program with visions of effective teaching that reflected their professional identities as beginning teachers. As the prospective teachers participated in university courses and student teaching placements, they further developed or modified their visions of effective teaching and their professional identities through the processes of identification and/or negotiation. In some cases, prospective teachers identified with trusted persons such as mentor teachers or course instructors and incorporated new practices that were not originally part of their visions of effective teaching. In other cases, prospective teachers' experiences caused them to re-examine and negotiate what was included in their visions of effective teaching. Nolen et al. reported on the teachers' development of assessment practices over time and across various contexts and communities of practice. The researchers found that teachers had to negotiate the meaning and value of different assessment tools and practices as

they crossed the boundaries between university courses, field placement settings, and school contexts for full-time teaching. The teachers' negotiation of those tools and practices and the learning that resulted from those negotiations was dependent on how they were positioned relative to others and the degree of alignment between the different contexts.

In two related studies, researchers used a situated learning framework to explore the factors that influenced the instructional practices of secondary mathematics teachers during student teaching (Cavanagh & Prescott, 2007) and during their first year of full-time teaching (Prescott & Cavanagh, 2008). Cavanagh and Prescott examined prospective teachers' experiences with participation in two communities of practice focused on teaching mathematics (i.e., one based in their university methods courses and the other based in their student teaching context) during their student teaching internship. The prospective teachers in the study struggled with a lack of coherence or alignment between the two communities of practice in regards to the more reform-oriented instructional practices modeled and promoted in their university methods courses and the more traditional practices modeled and encouraged in their student teaching placement. Most of the prospective teachers ended up teaching in ways that were consistent with their mentor teachers' practices, which they also viewed as being consistent with their own experiences as K-12 students. Prescott and Cavanagh later followed up with four teachers from the previously mentioned study to see if they were implementing any of the instructional practices emphasized during teacher preparation. Although the teachers seemed to recognize the potential benefits of the instructional practices promoted in their teacher preparation program, they all ended up using a more traditional textbook-dependent approach due to the pressures they felt in their school contexts to keep students under control, maintain the pace of their colleagues' classes, and be seen as effective teachers.

In this study, I applied a situated view of learning to the study of learning to teach mathematics at the elementary level. Even though the 10 teachers in this study all went through the same teacher preparation program and primarily took the same required mathematics content and methods courses, I did not expect them to have learned and appropriated the same ideas about mathematics instruction and what it means to be successful in mathematics. In order to examine how the teachers in this study had learned and developed their instructional practices in mathematics, I developed a data collection plan that allowed me to gather information about the various contexts and situations that seemed to be an integral part of their learning.

Summary of Chapter

Previous research using achievement goal theory has shown that mastery goals are optimal for students' learning and teachers can promote mastery goals through mastery-oriented instructional practices in the classroom. Although prospective and beginning elementary teachers may have personal mastery goals and the desire to use mastery-oriented instruction, they may become more performance-oriented due to various challenges, social comparison situations, or statements from people of authority (e.g., administrators). Beginning teachers' practices may also be influenced by a school- or district-wide emphasis on mastery or performance goals in their teaching contexts.

According to situated learning theory, all learning is situated within the contexts in which it occurs and those contexts have an impact on what is learned. Research on beginning teachers has shown that teachers' beliefs and instructional practices in mathematics may be influenced by their experiences as K-12 students and the school/district contexts in which they work. Mathematics methods courses have also been shown to influence beginning teachers' beliefs and practices in varying degrees, but sometimes that influence did not show up in teachers' practices

until after the first year or two of teaching. Previous research studies that have used a situated learning approach to explore the process of learning to teach mathematics at the secondary level have emphasized the importance of a sense of coherence and alignment between the different contexts and communities of practice that teachers participate in as they learn to teach, in addition to how the teachers are positioned in those communities.

If mathematics teacher educators are going to promote mastery-oriented teaching, then they need to understand the range of factors that seem to influence beginning teachers' use of mastery- and performance-oriented instructional strategies in mathematics. Considering that many beginning teachers end up getting jobs in contexts that are very different from where they did their student teaching, it is important to consider factors that stretch beyond the teacher preparation program. It is also important to consider that in the current educational climate where there is an emphasis on high-stakes testing and teacher evaluation, there may be more of a push towards performance-oriented practices than in the past. This could make it more difficult for beginning teachers to implement mastery-oriented practices in mathematics. I was unable to find any research that focused specifically on beginning teachers' use of mastery- or performance-oriented instruction in mathematics or any subject area. If mathematics teacher educators had a better sense of the factors that promote and inhibit mastery-oriented teaching for beginning teachers, then they could work on finding ways to address those factors during teacher preparation and also in professional development with beginning teachers.

CHAPTER 3: METHODOLOGY

Research Design

The design for this study involved a mixed-methods approach using both quantitative (teacher and student surveys) and qualitative (teacher interviews and classroom observations) data to address the three main research questions. Information provided by the teacher surveys, student surveys, and classroom observations was used to categorize the beginning teachers' instructional practices as mostly mastery-oriented, mostly performance-oriented, or a combination of both. In the surveys, teachers reported on the practices they used and students reported on their perspectives about the teachers' instructional practices. The observation data provided additional information about what the teachers and students were actually doing in the classroom. Multiple teacher interviews were the main source of data about the factors that seemed to be associated with teachers' use of mastery-oriented and/or performance-oriented instructional practices, but the teacher surveys also provided some important data about how the teachers perceived the school-wide focus on achievement goals in their schools.

In regards to the last research question about how the teachers describe and communicate their views about success in mathematics (and how their views compare to their students' views of success), all of the data sources were used to help address this question. The teacher interviews and teacher surveys were used to investigate the teachers' personal views about success and failure in mathematics. The classroom observations were used to gather evidence about the ways that teachers communicated views about success and failure to their students. Finally, the student surveys provided information about how the students viewed success in mathematics and what they perceived the teachers to be emphasizing in the classroom.

Participants

The participants in this study were 10 early-career upper elementary teachers who had graduated from the same university teacher preparation program and were teaching mathematics on a regular basis during the 2011-2012 school year. The teachers were described as early-career teachers because they were in their first, second, or third year of teaching; and "upper elementary" was defined as teaching 4th, 5th, or 6th grade.

I served as both a course instructor and a field instructor in the teacher preparation program. In order to select participants for this study, I compiled a list of all the prospective elementary teachers I had worked with who were employed as full-time teachers during the 2011-2012 school year. Since I had worked with these teachers in my role as an elementary mathematics methods course instructor or as a field instructor of elementary interns, I knew they had been exposed to a focus on mastery-oriented teaching practices in mathematics during their teacher preparation program. I provide more details on this later in the chapter. After eliminating any teachers who were not teaching in the upper elementary grades, I contacted teachers to see if they would be willing to participate in the study.

Table 1 provides background information about the 10 teachers who agreed to participate in the study. There were two male teachers and eight female teachers among the participants. In regards to years of teaching experience, four teachers were in their first year of teaching, four were in their second year, and two were in their third year. Half of the participants (5 teachers) were teaching 5th grade, while the remaining participants taught 4th grade (3 teachers) or 6th grade (2 teachers). All of the participants were at different schools except for Andrea and Kelsey, who were both at Draper Upper Elementary in the Greenwood School District. The nine different schools varied as far as what grade levels they served with four K-5 schools, three K-6 schools,

one 5-6 school, and one K-8 school. The 10 teachers worked in seven different public school districts and one private school setting. In addition to Andrea and Kelsey working in the same school district, Jennifer and Theresa also worked in the same school district (Carnation) but at different elementary schools. Finally, the teachers were located in a variety of states with four in Michigan, three in Utah, two in Colorado, and one in Tennessee.

Table 1

Participant Information

Name*	Gender	Years of Teaching Experience (including 2011-2012)	Teaching Assignment (2011-2012)				
			Grade Level	School*	Grade Levels at School	School District*	Location (State)
Andrea	F	1	5th	Draper Upper Elementary	5-6	Greenwood	MI
Diane	F	2	5th	Cooper Elementary	K-5	Mountain	TN
Erin	F	2	5th	West Lutheran School	K-8	-	MI
Jennifer	F	3	5th	Arbor Glen Elementary	K-5	Carnation	CO
Kelsey	F	1	5th	Draper Upper Elementary	5-6	Greenwood	MI
Luke	M	2	4th	Northwest Elementary	K-6	Fremont	UT
Paul	M	2	6th	Jackson Elementary	K-6	Baker	UT
Rachel	F	1	6th	Pinewood Elementary	K-6	Rosewood	UT
Samantha	F	3	4th	Ridgecrest Elementary	K-5	Trumpet	MI
Theresa	F	1	4th	Douglas Fir Elementary	K-5	Carnation	CO

*****All teacher names, school names, and school district names are pseudonyms.*

Teacher Preparation Program

All of the participants completed the same five-year teacher preparation program at a large university located in the Midwestern United States. In this program, prospective elementary teachers earned a bachelor's degree in their chosen teaching major and then completed a full-year of student teaching and graduate-level methods courses. Students were required to take two semester-long elementary mathematics content courses and two semester-long elementary mathematics methods courses.

The same two elementary mathematics content courses were required for all of the prospective elementary teachers in the program, regardless of their major. Instructors taught both of those courses from the Mathematics Department. All of the prospective elementary teachers in the program also had the same requirement for their first mathematics methods course, which was taught by instructors from the Teacher Education Department. As a component of this course, prospective teachers were required to spend four hours per week in a field placement classroom. For the second mathematics methods course, there was a difference in requirements based on students' majors. The prospective elementary teachers who majored in Special Education were required to take a methods course taught by the Special Education Department, while all the other prospective elementary teachers took a methods course taught by the Teacher Education Department. For a period of three years (2007-2010), I served as a course instructor for both of the elementary mathematics methods courses taught by the Teacher Education Department.

During their final year in the teacher preparation program, all of the prospective elementary teachers completed a yearlong student teaching internship (August-April) and attended methods courses at the university one day a week. They were also assigned a field

instructor (i.e., university supervisor) who observed their teaching and met with them on a regular basis. For a period of two years, (2010-2012), I served as a field instructor in the program and worked with prospective elementary teachers in their student teaching placements. The prospective teachers who majored in Special Education worked in two different contexts during their student teaching experience, with half the year in a general education classroom and the other half in a special education setting. The rest of the prospective elementary teachers in the program usually spent the entire year of student teaching in one classroom setting, although some of them rotated between classrooms if their cooperating teacher worked on a departmentalized team (e.g., a team where one teacher taught mathematics and science and another teacher taught language arts and social studies).

Among the 10 teachers who participated in my study, Andrea was the only one who was a Special Education major. As a result of her major, she had a different mathematics methods course and worked in two different settings (general education and special education) during her year of student teaching.

Due to the large size of the teacher preparation program, there were multiple (9-12) sections of the elementary mathematics methods courses taught by the Teacher Education Department each year. Although there was some variation in teaching practices and styles from section to section, the course instructors met and planned on a regular basis to try to maintain continuity in content and focus. Since I had taught both of the elementary mathematics methods courses for multiple years, I knew that the courses focused on teaching mathematics for understanding and finding ways to help all elementary students learn and achieve success in mathematics. There was also a strong focus on using group work, discussion, and challenging tasks. Although the other course instructors did not explicitly focus on the use of the term

"mastery-oriented practices," they were likely modeling and promoting aspects of mastery-oriented instruction in their courses with a focus on any of the practices mentioned above.

Even though I believed that recent graduates of the program had most likely been exposed to some mastery-oriented practices in their mathematics methods courses, I recognized that the amount of exposure might have varied widely based on different course instructors. Therefore, I decided to recruit participants for this study who I had worked with as a course instructor or as a field instructor, so I could be certain they had been exposed to similar mastery-oriented instructional practices for mathematics. In my teaching of the methods courses and my supervision of student teachers, I made a point to model and promote a variety of mastery-oriented practices. For example, in both of the methods courses, I structured every class session so that students sat in groups and worked together on various tasks. In the methods courses and my work with student teachers in the field, I tried to create a learning environment where everyone felt safe to ask questions, share their opinions, build on each other's ideas, and learn from each other. For every assignment that was graded, I provided detailed feedback and students had the opportunity to revise and resubmit their work as many times as they wished. I also encouraged students to work together and help each other as much as possible, as they all had expertise to share. We even had specific discussions about what it meant to be "smart" or successful in mathematics and we explored instructional practices that could promote different ideas about success in mathematics (e.g., timed tests).

Table 2 provides a summary of when I worked with each teacher participant during his or her time in the teacher preparation program, and in what role (course instructor or field instructor). As a course instructor, I worked with the teachers for one semester. In the field instructor role, I worked with teachers for the full year (two semesters). Note that I worked with

nine of the participants as a course instructor and with only one participant as a field instructor. Among the 10 teachers in the study, Erin was the only one I taught in both mathematics methods courses.

Table 2

Author's Past Relationship to Teacher Participants

Year	Author's Role		
	Course Instructor	Course Instructor	Field Instructor
	First Elementary Mathematics Methods Course (1 semester)	Second Elementary Mathematics Methods Course (1 semester)	(2 semesters)
2007-2008	Samantha		
2008-2009	Erin	Jennifer	
2009-2010	Andrea	Diane	
	Kelsey	Erin	
	Theresa	Luke	
		Paul	
2010-2011			Rachel

Methods

In this study, I used multiple sources of data (teacher surveys, student surveys, teacher interviews, and classroom observations) to address the three research questions. Table 3 provides a summary of which data sources were used to address each research question.

Table 3

Data Sources Used to Address Research Questions

Research Questions (RQ)	Data Sources
Categorizing Teachers' Instructional Practices (RQ #1)	Teacher Surveys Student Surveys Classroom Observations
Factors Associated with Use of Instructional Practices (RQ #2)	Teacher Surveys Teacher Interviews
Views about Success in mathematics (RQ #3)	Teacher Surveys Student Surveys Teacher Interviews Classroom Observations

Survey Data

Surveys were used as a tool to collect quantitative data from both the teachers and their students. All of the teachers completed an online survey at the beginning of data collection for the project (December 2011). The teacher survey (*see Appendix A*) consisted of 36 statements and the teachers were asked to use the following scale to demonstrate their agreement or disagreement with each statement:

1 **2** **3** **4** **5**

STRONGLY DISAGREE SOMEWHAT AGREE STRONGLY AGREE

The majority (29 out of 36) of statements listed on the teacher survey and the response scale shown above were adapted from the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000). The PALS survey items have been widely used over the last two decades by researchers interested in issues related to achievement goal theory and motivation. The scales have been revised over time based on research findings and changes in the achievement goal framework, such as the added distinction between performance-avoidance and performance-approach goal orientations. The manual available online for people interested in using PALS

includes descriptive statistics on the validity of each of the scales (Midgley et al., 2000). For my study, I chose to use teacher survey statements from three of the PALS sub-scales: Perceptions of School Goal Structure for Students, Approaches to Instruction, and Personal Teaching Efficacy.

Although the scales were written to measure general achievement goal orientations, many mathematics education researchers have adapted the statements to be mathematics-specific or administered the surveys within a mathematics class (Middleton et al., 2004; Perry, 2011; Phelps, 2010; Vogler & Bakken, 2007; Wolters, 2004). In the current study, I adapted the statements so they were specific to mathematics teaching and learning. For example, the statement "I give special privileges to students who do the best work" was adapted to "I give special privileges to students who do the best work in mathematics." This is consistent with what other researchers have done in the past to make the PALS statements mathematics-specific.

The 13 survey statements from the first subscale, *Perceptions of the School Goal Structure for Students,* provided information on whether the teachers believed that their school environment promoted mastery goals, performance goals, or a combination of both for their students. Teachers' responses were used to calculate an overall mean value for their perception of a school mastery goal structure and an overall mean value for their perception of a school performance goal structure. This data helped to address the second research question about factors that seemed to be associated with teachers' use of mastery-oriented and/or performance-oriented instructional practices.

The nine statements from the second subscale, *Approaches to Instruction,* asked teachers to report in general whether they used instructional practices in mathematics that could be categorized as mastery-oriented or performance-oriented. Teachers' responses were used to calculate an overall mean for mastery orientation to instruction and an overall mean for

performance orientation to instruction. This subscale provided information related to the first research question about the types of instructional practices used by teachers. It is important to note that the teacher scales used were only broken down into mastery and performance categories; i.e., there were no teachers scales available from the PALS materials that broke performance down further into the approach and avoidance distinctions. At the time I was developing my study, I did not find any teacher survey scales that were broken down into the performance-approach and performance-avoidance distinctions. After completing my data collection for this study, I discovered some researchers who recently reported on the use of a survey instrument where teachers' achievement goals for teaching were broken down into the categories of mastery, performance-approach and performance-avoidance (Shim, Cho & Cassady, 2013).

The seven statements from the third subscale, *Personal Teaching Efficacy,* referred to "teachers' beliefs that they are contributing significantly to the academic progress of their students, and can effectively teach all students" (Midgley et al., 2000, p. 38). Teachers' responses were used to calculate an overall mean for their personal teaching efficacy in mathematics. In my data analysis, I realized this subscale did not provide information directly related to my research questions so I did not report this data in the findings.

I planned to include survey items that addressed teachers' views about success and failure in mathematics to address the third research question, but I was unable to find any applicable survey items that had been tested and validated in previous research studies. Therefore, I wrote seven survey items that highlighted different views of success in mathematics, including the importance of: natural ability, lack of natural ability, effort, understanding concepts, learning from mistakes, speed/accuracy, and competition. These survey statements used the same

response scale shown above that had been used with the PALS survey items. Unlike the statements from the PALS subscales, teachers' responses to these statements about success and failure in mathematics were not used to calculate an overall mean value. Instead, I used the teachers' responses to each individual statement to consider which components of success (listed above) they seemed to view as more important than others.

Two different paper-and-pencil surveys were administered to the students of each teacher participant. The first student survey (see Appendix B) consisted of 26 short statements and students were asked to use the following scale to respond to each statement:

1 **2** **3** **4** **5**

NOT AT ALL TRUE SOMEWHAT TRUE VERY TRUE

All of the student survey statements (and the response scale shown above) were adapted from two subscales on the Patterns of Adaptive Learning Scales (Midgley et al., 2000). The first subscale, *Perception of Teacher's Goals,* provided information on whether students perceived their teachers as emphasizing mastery goals, performance-approach goals and/or performance-avoidance goals. All of the students' responses in each classroom were combined and used to calculate an overall mean for each teacher's perceived mastery goal, perceived performance-approach goal, and perceived performance-avoidance goal. The second subscale, *Achievement Goal Orientations,* was used to categorize students' personal goal orientations as mastery, performance-approach, or performance-avoidance. Once again, all of the students' responses in each classroom were combined and used to calculate an overall mean value for students' personal mastery goals, students' personal performance-approach goals, and students' personal performance-avoidance goals. Although the teacher scales from PALS were only available in two categories of orientations (mastery and performance), all of the student scales from PALS

were available in three different categories (mastery, performance-approach, and performance-avoidance).

In order to administer the surveys to the students, I followed the protocols outlined in the PALS manual (Midgley et al., 2000). I read through the directions with the students and used the statement "I like strawberry ice cream" as an example statement. I explained how they could choose any number between one and five, depending on how much they did or did not like strawberry ice cream. Once they understood how the scale worked, I read through each of the 26 statements and the students circled a number between one and five for each statement. As I read through the statements, students were allowed to ask questions about the wording or ask me to repeat the statements. The information from this student survey was used to see how students viewed their teachers' goals and instructional practices and how that compared with the students' own goals. This information was also used to make sense of how the teachers communicated views about success and failure in mathematics to their students.

The second student survey (see Appendix C) was based on a task adapted from Leatham and Hill (2010). This survey contained a table showing 27 different adjectives (e.g., brilliant, confident, and focused) and students were asked to choose five words from the list that they thought best described someone who was good or successful at math. I was able to administer this survey to some of the groups of students, but when it was not possible for me to do it in person, I provided detailed instructions for the teacher to follow. Either the teacher or myself started out the process by going over the list of words and making sure that students understood what all the words on the list meant. Once the students were clear on the meaning of the words, they were asked to circle or put a mark next to the five words they thought best described someone who was good or successful at math. They were also told that there were no right or

wrong answers and they would probably have different answers from their peers. Once students had completed the task, they turned in their surveys. The information from this survey was used in conjunction with a similar task that the teachers to compare how the teachers and their students viewed success in mathematics.

Classroom Observation Data

During the study, I observed and videotaped each participant teaching mathematics lessons on two different occasions. Once I decided on the four teachers for my case studies, I transcribed all of their classroom observations and used the Observing Patterns of Adaptive Learning Protocol (OPAL; Patrick et al., 1997) framework (see Appendix D) to code the transcriptions.

OPAL was developed by Patrick et al. (1997) as a tool to investigate both the explicit and implicit ways that teachers communicate an emphasis on mastery and/or performance goals to their students. There are nine categories in OPAL that focus on the various characteristics of instruction and classrooms related to achievement goal orientations: *Task, Authority, Recognition, Grouping, Evaluation, Time, Social, Help-Seeking, and Messages.* *Task* refers to how teachers structure tasks and learning activities in the classroom. *Authority* focuses on evidence of classroom rules, classroom management, and student autonomy. *Recognition* examines how, why, and when teachers recognize students in the classroom, with a special consideration of any instances of social comparison. *Grouping* focuses on the structure, purpose and extent of how group work is used in the classroom. *Evaluation* includes a consideration of both formal and informal assessments of students' progress and understanding, along with any statements made about success and failure. The use of time schedules and restrictions on the time allowed for classroom activities makes up the *Time* category. *Social* considers the teachers'

messages about student-to-student interactions and interactions that occur between the teacher and students. *Help-seeking* refers to what students do when they need help, who they go to for help, and what statements are made about getting and receiving help. The category of *Messages* includes any general comments made by the teacher about school, work expectations, and student behavior (Patrick et al., 1997).

Data obtained from using OPAL with classroom observations helped me to categorize the teachers' instructional practices as mostly mastery-oriented, mostly performance-oriented, or a more balanced combination of both. Classroom observations also provided information about how teachers communicated views about success and failure in mathematics to their students.

Interview Data

Teachers were interviewed three times over the course of the study. The first interview (*see Appendix E)* was semi-structured and focused on different characteristics of teachers' mathematics instruction along with factors that may have influenced their instruction. Characteristics of instruction that were explored in this interview included group work, evaluation practices, and lesson planning for mathematics. Teachers were asked about various factors that may have influenced their instruction (e.g., mathematics curriculum, administrators, colleagues, district policies, university courses, and professional development) and they were also asked to consider how their current mathematics instruction differed from their instructional practices during their internship year and during their first month or year of teaching. Data from this interview was used to help address the research question about the factors that seemed to be associated with whether the teachers used mastery-oriented and/or performance-oriented instructional practices in mathematics.

The second interview (*see Appendix F)* was semi-structured and focused on the teachers' personal views about success in mathematics, in addition to their perspectives on the views of their students, colleagues, and administrator(s). As part of the interview, participants completed a task (adapted from Leatham & Hill, 2010) where they were asked to choose five words from a list of 27 adjectives that they thought best described someone who was good or successful at math. This was the same activity the students completed in their second survey. After choosing the words, the teachers were asked to explain their choices and whether or not there were any words they disregarded. They were also asked to consider how other people they interacted and worked with at their school might complete the same task. Data from this interview was used to address the third research question about how teachers describe and communicate their views about success and failure in mathematics.

The third semi-structured interview (*see Appendix G)* used a mathematics story interview protocol (Drake, 2006; McAdams, 1993). In this interview, participants were asked to share information about their life experiences with mathematics including: high point, low point, turning point, single greatest challenge, positive influences, and negative influences. They were also asked to think about both a positive and negative future with mathematics. Information from this interview helped me identify factors that seemed to be associated with whether the teachers used mastery-oriented or performance-oriented instructional practices in mathematics.

Data Analysis

Survey Data

I used statistical software to calculate descriptive statistics (means and standard deviations) for the survey data. For each teacher, I used their responses on the teacher survey to calculate an overall mean for each of the following constructs: (a) mastery orientation to

instruction, (b) performance orientation to instruction, (c) perception of school mastery goal structure, and (d) perception of school performance goal structure. For each construct, I sorted the teachers from highest to lowest mean value. This allowed me to look for similarities and differences between the individual teachers. For each teacher, I calculated the differences between their mean values for mastery orientation to instruction and performance orientation to instruction. This provided some insight into whether the teachers seemed to prefer one orientation over the other or if they seemed to be using mastery-oriented and performance-oriented strategies in a more balanced approach. I conducted a paired-samples t-test to determine if these differences were statistically significant.

I also calculated the differences between teachers' perception of a school mastery goal versus their perception of a school performance goal. This provided insight into whether the teachers seemed to perceive their school as more focused on one goal or promoting both goals in similar ways. I conducted a paired-samples t-test to determine if these differences were statistically significant. In order to examine how the teachers' approaches to instruction compared to what they perceived as the focus at their school, I also calculated the difference between each teacher's specific approach to instruction (mastery and performance) and the perception of a matching school goal (mastery and performance). This data provided information about some teachers who may have experienced a conflict between their goals and what the school was promoting and other teachers who may have felt that the school was promoting goals in ways that were consistent with their own beliefs. Again, I conducted a paired-samples t-test to determine if these differences were statistically significant.

Using the data from the first student survey, I calculated descriptive statistics for the entire sample and also broke down the results by classrooms. Using the data from their

respective students, I calculated an overall mean for each teacher on the following constructs: (a) perceived teacher mastery goal, (b) perceived teacher performance-approach goal, (c) perceived teacher performance-avoidance goal, (d) students' personal mastery goal, (e) students' personal performance-approach goal, and (f) students' personal performance-avoidance goal. For each construct, I sorted the teachers' values from highest to lowest. This allowed me to look for similarities and differences between the individual teachers and the different constructs.

In order to compare how the students' personal goals compared to what they perceived their teachers to be emphasizing in the classroom, I calculated the differences between the values for students' personal goals (mastery, performance-approach, and performance-avoidance) and the students' perception of a matching teacher goal (mastery, performance-approach, and performance-avoidance). This data allowed me to look for places where students' personal goals seemed to match with what they perceived as their teachers' goals and places where the students' personal goals seemed to be different from what their perceived as their teachers' goals. I used a paired-samples t-test to determine if these differences were statistically significant.

I also compared the results from the teacher survey subscale on *Approaches to Instruction* and the student survey subscale on *Perception of Teacher's Goals* to see how the teachers' perspectives on their own instruction was similar or different to the students' perceptions of their instruction. It is important to note that I could not make a direct comparison due to the different breakdowns of the teacher scales (mastery and performance) and the student scales (mastery, performance-approach, and performance-avoidance).

For the second student survey, I used statistical software to calculate descriptive statistics about the words students chose to describe someone who was good or successful at math. I computed the percentage of students in each classroom and across the entire study who chose

each word and then compared the results for groups of students. The data from this survey was used in conjunction with the data from the second teacher interview to compare how the teachers and their students seemed to view success in mathematics.

Classroom Observation Data

I used HyperTranscribe software to transcribe all of the videotaped classroom observations for the four case study teachers. Then I coded the transcripts by hand based on the OPAL subscales (*Task, Authority, Recognition, Grouping, Evaluation, Time, Social, Help-seeking, and Messages).* I used the subscale headings as my primary codes and added in text to further explain each code when necessary. For example, when there was evidence of students working in groups, I applied the code *grouping* and then added in text to explain how the students were grouped. As I read through the observation transcripts, I applied the primary codes wherever it was applicable. After applying these codes and adding explanatory text, I went back through and labeled each coded section of text according to whether it showed evidence of mastery-oriented practices, performance-oriented practices, or both types of practices. Finally, I looked across the transcripts and made a master list of each teacher's use of mastery-oriented practices and performance-oriented practices.

I also coded the observation transcripts for evidence of teachers' and students' views about success and failure in mathematics. I used codes that correlated with the constructs in the teacher survey items about success in mathematics (i.e., natural ability, lack of natural ability, effort, understanding concepts, learning from mistakes, speed/accuracy, and competition). In this round of coding, I focused on explicit statements made by the teachers or students that related to any of the possible components of success. For example, if a teacher told his or her students that they could accomplish the mathematics task if they worked hard, I labeled the

statement with "effort." I also looked for places where teachers' practices or actions might implicitly communicate a view about success and failure in mathematics. For example, if a teacher was administering a timed math facts test, I would label that with the code "speed/accuracy."

Interview Data

I used HyperTranscribe software to transcribe all of the teacher interviews. Once the interviews were transcribed, I coded the interview transcripts by hand. I began by using the three main research questions as a basic coding framework: (a) descriptions of instructional practices, (b) factors associated with instructional practices, and (c) views about success and failure in mathematics. After doing an initial round of coding, I looked for patterns in the data and decided how to break the codes down further. I used the codes from the OPAL manual (*Task, Authority, Recognition, Grouping, Evaluation, Time, Social, Help-seeking, and Messages)* to further break down the descriptions of instructional practices and then categorize them as mastery-oriented, performance-oriented, or both. For the factors associated with instructional practices, I coded statements into the following categories: K-12 experiences, mathematics content courses, mathematics methods courses, student teaching, mathematics curriculum, administrators, colleagues, school expectations, district expectations, university courses, and professional development. In regards to views about success and failure in mathematics, I used the following codes: natural ability, lack of natural ability, effort, understanding concepts, learning from mistakes, speed/accuracy, and competition.

After analyzing the survey data, interview data, and observation data separately, I looked for correlations and discrepancies across the multiple sources of data for each individual teacher and for the group of teachers as a whole. For example, when teachers reported high values for a

mastery-oriented approach to instruction in the survey data, I looked for confirming and disconfirming evidence of mastery-oriented practices in the interview and observation data. I also looked for similarities and differences between the individual teachers and between groups of teachers (e.g., comparing teachers with different amounts of full-time teaching experience or comparing teachers who worked in the same context or very different contexts).

Validity of Data

In this study, I used four steps to establish the validity of the data including: (a) multiple sources of data, (b) multiple case studies, (c) member checks, and (d) peer review. First, I used multiple sources of data to strengthen the validity of the teachers' self-reported use of instructional practices (Stake, 2004). In particular, I used data from both the student surveys and classroom observations to provide additional information. Second, by including teachers who worked in a range of school/district settings and had some varied experiences during teacher preparation, I used a multiple case design featuring replication logic (Yin, 2003). This design allowed me to learn more about different kinds of factors that seemed to influence teachers' use of mastery- and/or performance-oriented instruction in mathematics. Third, I used member checking to confirm findings and interpretations as I wrote my case studies (Deyhle, Hess, & LeCompte, 1992). I routinely did member checks by contacting the case study teachers via email or phone to ask them to confirm or deny interpretations and findings. In this process, they often provided additional follow-up information related to the findings. Finally, I received feedback on my findings from multiple faculty members and doctoral students who were specialists in the areas of mathematics education and/or teacher education (Glesne, 2006).

Subjectivity of the Researcher

Although I purposefully chose teachers for this study who I had worked with as a way to ensure exposure to similar mastery-oriented practices, I recognize this choice included some potential issues with my own subjectivity. As their course instructor or field instructor, I developed personal relationships with these teachers, so it was possible that any observations or interpretations I made could have been influenced by my previous experiences. Since I had been a part of their teacher preparation experience, I was personally invested in the teachers' processes of learning to teach mathematics and their development as teachers. In order to address the issue of my subjectivity as the researcher, I included multiple sources of data that provided information on the students' and teachers' perceptions about what was happening in the classrooms. This allowed me to triangulate the data so that my characterization of the teachers' practices was not just based on my own observations and interpretations. For example, in order to describe whether the teachers were using mastery-oriented and/or performance-oriented instructional practices, I used data from teacher surveys, student surveys, teacher interviews, and classroom observations.

These multiple sources of data also addressed the potential issue of teachers planning something outside of their normal practices for their observed lessons. Since the teachers knew what kind of instruction I promoted in my own teaching, it was possible they could have incorporated some practices they did not normally use to impress me or meet some expectations they thought I had as their former instructor. If this did occur, then the use of multiple data sources should have allowed me to notice possible discrepancies in the data about instructional practices.

In the interviews, I asked the teachers about their experiences during the teacher preparation program. Although I did not specifically ask them about their experiences with me as a course instructor or a field instructor, some of them brought it up in their interviews. This raises another issue and potential bias in the data because it was possible that teachers might have talked about those particular experiences because I was the one who interviewed them. In order to be transparent about this potential issue in my reported findings, I report when teachers refer to a class or experience that involved me as a course instructor or a field instructor.

CHAPTER 4: CATEGORIZING TEACHERS' INSTRUCTIONAL PRACTICES

Overview

In this chapter, I use quantitative data from the teacher and student surveys to address the first research question about whether early-career upper elementary teachers who graduated from the same teacher preparation program used instructional practices that were mostly mastery-oriented, mostly performance-oriented, or a more balanced combination of both. I begin by using data from the teacher surveys to show the different categories of practices that the individual teachers reported with regards to their own mathematics instruction. Next, I explore whether the teachers seemed to perceive their schools as having more of a mastery-oriented or performance-oriented focus. Then I move on to exploring the data from the student surveys to see how the students perceived their teachers' goals for instruction and how those perceptions compared to their own personal goals as students.

In my analysis of the teacher and student survey data, I compared the results for all 10 teachers and identified patterns in the data. All of the teachers in the study reported a stronger mastery orientation than performance orientation and they were all perceived by their students to be more mastery-oriented than performance-oriented. In addition, the students in all 10 classrooms reported higher personal mastery-oriented goals for themselves than personal performance-oriented goals. This suggests that these early-career teachers had experiences in K-12 mathematics courses, teacher preparation, and/or their school and district contexts that led them to frequently enact mastery-oriented practices in their beginning years of teaching. Although the teachers appeared to be more mastery-oriented in their instruction, the data seemed to show that they were using certain performance-oriented strategies in the classroom more than others. Furthermore, while some teachers reported their schools to be focused on goals that were

similar to their own, other teachers perceived a school-wide goal focus that seemed to be in conflict with their instructional practices.

After presenting the survey results across the entire group of 10 teachers, I will focus in depth on two pairs of teachers who will be featured in the case studies in Chapters 5 and 6. These teachers exhibited some interesting patterns in the data and had some shared learning contexts (e.g., elementary mathematics methods courses, student teaching experiences, and full-time teaching settings) that had the potential to influence their instruction.

Teachers' Self-Report of Instructional Practices

All of the teachers in the study completed a survey where they responded to statements about their own achievement goal orientations toward instruction. There were four statements related to mastery orientation and five statements related to performance orientation. Each statement described a specific mastery- or performance-oriented practice that a teacher might use such as, "I consider how much students have improved in mathematics when I give them report card grades." Teachers reported their agreement or disagreement with each statement using a scale from 1 to 5, with 1 labeled as strongly disagree, 3 labeled as somewhat agree, and 5 labeled as strongly agree. Using their survey responses, I computed mean overall scores for each teacher's mastery-orientation and performance-orientation approach to instruction (PALS; Midgley et al., 2000). In addition, I calculated the differences between their overall mean scores for mastery and performance orientations and used a paired-samples t-test to determine if those differences were significant. The test revealed there was a statistically significant difference between the means for teachers' mastery orientation to instruction ($M = 3.45$, $SD = 0.57$) and teachers' performance orientation to instruction ($M = 2.10$, $SD = 0.68$); $t(9) = 5.21$, $p < .001$. In

Table 4, a positive (+) difference represents a higher mastery orientation and a negative (-) difference representing a higher performance orientation.

Table 4

Teachers' Reported Approaches to Instruction

Teacher	Mastery Orientation to Instruction Mean	Performance Orientation to Instruction Mean	Difference between Mastery and Performance
Andrea	3.75	1.40	+2.35
Diane	3.75	2.20	+1.55
Erin	3.75	2.20	+1.55
Jennifer	2.75	1.40	+1.35
Kelsey	4.25	1.80	+2.45
Luke	3.75	1.60	+2.15
Paul	2.50	1.60	+0.90
Rachel	3.50	3.40	+0.10
Samantha	2.75	2.40	+0.35
Theresa	3.75	3.00	+0.75
All Teachers: Mean *(SD)*	3.45 *(0.57)*	2.10 *(0.68)*	1.35 *(0.82)*

The summary of survey results shows that all of the teachers in the study reported more of a mastery orientation to instruction than a performance orientation. For teachers such as Kelsey, Andrea, and Luke, there were large differences between their mastery values and performance values (differences of 2.45, 2.35, and 2.15). This seems to suggest that these teachers favored using mastery-oriented strategies over performance-oriented strategies. Other teachers, such as Rachel and Samantha, had mastery and performance values that were much closer in value (differences of 0.10 and 0.35), so they may have used mastery- and performance-oriented strategies in a more balanced fashion.

In order to examine which instructional practices seemed to be most prevalent in the teachers' accounts of their instruction, I examined the teacher survey responses for each

statement. Tables 5 and 6 show the means and standard deviations for all the teachers in the study. The tables are organized by reported orientation to instruction (mastery or performance) and statements are listed in order from greatest to smallest mean values. A high mean value signifies that teachers strongly agreed with the statement about their mathematics instruction, while a low mean value signifies that teachers strongly disagreed with the statement. These values do not necessarily correlate directly with frequency of practices, as they would have if the teacher survey scale had been labeled with descriptions of frequencies (e.g., never, sometimes, always). As a researcher, I recognize that teachers in the study could have interpreted these survey statements and responses in different ways and similar survey responses do not necessarily mean that teachers were enacting the practices in the same ways or frequencies. I use the survey data in this chapter to explore patterns and general trends that seemed to appear among the teachers in the study. In later chapters, I use qualitative data from interviews and observations to explore these patterns in more depth and provide additional information about how the teachers enacted these practices in their classrooms.

Table 5

Teachers' Reported Mastery Orientation to Instruction – Survey Statement Summaries

Survey Statement – Mastery Orientation	Mean	SD
I make a special effort to recognize students' individual progress in mathematics, even if they are below grade level.	4.70	0.48
I give a wide range of assignments in mathematics, matched to students' needs and skill level.	3.20	1.03
I consider how much students have improved in mathematics when I give them report card grades.	3.10	1.45
During mathematics class, I often provide several different activities so that students can choose among them.	2.80	0.79

According to the teachers in the study (Table 5), the mastery-oriented practice they seemed to value the most or possibly use most often was making an effort to recognize students'

individual progress in mathematics, even if the students were below grade level. The mean value for this statement was extremely high ($M = 4.70$) and less spread out ($SD = 0.48$) than the other mastery-oriented and performance-oriented statements so these teachers seemed to agree that this practice was important. It is possible that teachers could have enacted this practice in different ways so the high overall mean does not signify that all the teachers used this practice in exactly the same way. For example, a teacher could recognize students' progress in a public fashion by telling the entire class how certain students had shown improvement or hanging up examples of work where students showed improvement. On the other hand, a teacher could recognize students' progress and growth in more private ways by providing individual feedback to students in writing or in one-on-one conversations. Although these two different approaches to recognizing students' individual progress may benefit (or not benefit) individual students in different ways, they are both focused on the importance of individual improvement and growth rather than on grades, scores, or doing better than other students.

The other three mastery-oriented practices addressed in the teacher survey (giving a wide range of assignments matched to students' needs and skill levels, considering students' improvement when giving report card grades, and providing students with a choice of several different activities during mathematics class) had overall mean values that were close in range and higher in value ($Ms = 3.20$, 3.10, and 2.80) than all the performance-oriented practices addressed in the survey. These results seem to suggest that the teachers considered these three mastery-oriented practices to be somewhat similar in importance and more valued than the performance-oriented strategies, but perhaps not quite as important as making an effort to recognize students' individual progress. The widest spread of the data ($SD = 1.45$) occurred with the statement about considering students' improvement when giving report card grades so this

practice seemed to vary more widely among the teachers. It is possible this variance may be due to some district requirements about how report grades are calculated and/or reported. For example, some districts may use a report card where there is a specific section to enter information about students' effort and improvement in mathematics. Other districts may use a report card where students receive just one grade for mathematics that is based on percentages.

Table 6

Teachers' Reported Performance Orientation to Instruction – Survey Statement Summaries

Survey Statement – Performance Orientation	Mean	SD
I give special privileges to students who do the best work in mathematics.	2.50	1.18
I point out those students who do well in mathematics as a model for the other students.	2.40	0.97
I display the work of the highest achieving students in mathematics as an example.	2.20	1.14
I encourage students to compete with each other in mathematics.	1.70	0.82
I help students understand how their performance in mathematics compares to others.	1.70	0.95

Although the means for the performance-oriented statements on the teacher surveys (Table 6) were lower than the means for the mastery-oriented statements, the range of values seemed to suggest that the teachers tended to use some performance-oriented practices more than others. The most prevalent performance-oriented practice reported by teachers was giving special privileges to students who do well in mathematics ($M = 2.50$, $SD = 1.18$), which was followed closely by pointing out students who do well in mathematics as a model for others ($M = 2.40$, $SD = 0.97$) and also displaying the work of students who do well in mathematics ($M = 2.20$, $SD = 1.14$). The statement about giving special privileges is another example of a practice that could be interpreted and enacted in very different ways, with some ways having a stronger performance-oriented aspect than others. For example, one teacher might give special privileges

or prizes to the students who earned the top three scores on a mathematics test while another teacher might ask a few of her students who did well in mathematics to work with some younger students who need extra tutoring at recess. In the first example, the special privileges are limited in number and dependent on students' high test scores, so this has a strong performance-oriented aspect. In the second example, there is a less of a focus on scores and more of a focus on helping other students, so it does not have as strong of a performance-oriented aspect.

The other two performance-oriented statements related to encouraging student competition and student comparisons had equally low means ($M = 1.70$) and similar standard deviations ($SDs = 0.82$ and 0.95) so the teachers in the study seemed to avoid using competitive practices in mathematics instruction.

In summary, all of the teachers in the study reported a stronger mastery orientation than performance orientation towards mathematics instruction. Since these teachers all graduated from the same teacher preparation program and were exposed to mastery-oriented practices in their elementary mathematics methods courses, it seems possible that the shared context of the teacher preparation program had some kind of influence on their use of mastery-oriented instructional practices. Although the teachers all reported a higher mastery-orientation than performance-orientation, there was enough variance in the values to suggest that individual teachers may have learned and appropriated some different ideas about mathematics instruction from the teacher preparation program and from various other contexts and experiences. These findings are consistent with the situated view of learning, which implies that learning is dependent on the contexts in which it occurs and how individuals make sense of the contexts and what they are learning. Further analysis of qualitative data in the upcoming case studies reveals

more information about what the teachers seemed to learn about mathematics instruction from these different contexts.

Teachers' Perceptions of the School Goal Structure

In addition to information about the teachers' reported approaches to instruction, the teacher surveys also provided information on how the teachers perceived the overall focus of mastery- vs. performance-oriented goals in their school contexts. Teachers rated their agreement or disagreement with seven statements related to a school mastery goal focus (e.g., "In this school: The importance of trying hard is really stressed to students") and six statements related to a school performance goal focus (e.g., "In this school: Students hear a lot about the importance of getting high test scores"). As with the other items on the survey, teachers rated their agreement/disagreement on a scale of 1 (strongly disagree) to 5 (strongly agree). The values were combined to come up with an overall mean value for each teacher's perception of a school mastery goal focus and a school performance goal focus (PALS; Midgley et al., 2000).

In order to consider whether teachers felt more of a focus on one goal, I calculated the differences between the means for the two different school goals (mastery and performance). A positive (+) difference represented a higher perception of a school mastery goal focus, while a negative (-) difference represented a higher perception of a school performance goal focus. On average, the teachers reported more of a perception of a school mastery goal focus ($M = 3.56$, $SD = 0.39$) than a school performance goal focus ($M = 2.95$, $SD = 0.88$), but a paired-samples t-test showed that the differences were not statistically significant ($t(9) = 2.22$, $p = 0.06$). Table 7 summarizes the overall results of this analysis, organized by the differences between the perceived school goals (largest to smallest).

Table 7

Differences Between Perceived School Mastery Goal and Perceived School Performance Goal

Teacher	Perception of School Mastery Goal Mean	Perception of School Performance Goal Mean	Difference
Jennifer	3.57	2.00	+1.57
Paul	3.57	2.17	+1.40
Kelsey	3.29	2.00	+1.29
Rachel	4.29	3.00	+1.29
Erin	4.00	3.00	+1.00
Samantha	3.57	2.67	+0.90
Diane	3.86	3.67	+0.19
Andrea	2.71	3.00	-0.29
Luke	3.29	3.83	-0.54
Theresa	3.43	4.17	-0.74
All Teachers: Mean *(SD)*	3.56 *(0.39)*	2.95 *(0.88)*	+0.61 *(0.87)*

Rachel perceived the highest mastery goal focus at her school ($M = 4.29$), while Andrea reported the lowest school mastery goal focus ($M = 2.71$). The means for school performance goal focus were more spread out with a high of 4.17 (Theresa) and a low of 2.00 (Kelsey). Theresa, Luke, and Andrea reported higher perceptions of a school performance goal focus (*Ms* = 4.17, 3.83, and 3.00) than a school mastery goal focus (*Ms* = 3.43, 3.29, 2.71), but the differences between those values were relatively small compared to the other teachers (-0.74, -0.54, and -0.29). Diane reported a higher perception of a school mastery goal ($M = 3.86$) than a school performance goal focus ($M = 3.67$) but she showed the smallest difference (0.19) between the two values. Jennifer, Paul, Kelsey, Rachel, Erin, and Samantha reported higher perceptions of a school mastery goal focus than a school performance goal focus, and they also had the highest differences between the two values (+1.57, +1.40, +1.29, +1.29, +1.00, and +0.90). Since the paired-samples t-test showed that the differences between the means were not statistically

significant, it seemed likely that many of the teachers perceived a somewhat balanced focus on both types of goals at their school.

In order to consider how teachers' reported approaches to instruction compared to what they perceived as school-wide goals, I combined all of the data into one table (Table 8) with the teachers arranged alphabetically. I calculated the difference between the mean values for their personal approaches to instruction and their perceptions of the matching school goal, with a positive (+) difference representing a higher value for their personal approach to instruction and a negative (-) difference representing a higher value for their perception of the school goal.

Table 8

Comparison of Teachers' Reported Approaches to Instruction and Perceived School Goals

Teacher	Mastery Goals			Performance Goals		
	Orientation to Instruction Mean	Perception of School Goal Focus Mean	Difference	Orientation to Instruction Mean	Perception of School Goal Focus Mean	Difference
Andrea	3.75	2.71	+1.04	1.40	3.00	-1.60
Diane	3.75	3.86	-0.11	2.20	3.67	-1.47
Erin	3.75	4.00	-0.25	2.20	3.00	-0.80
Jennifer	2.75	3.57	-0.82	1.40	2.00	-0.60
Kelsey	4.25	3.29	+0.96	1.80	2.00	-0.20
Luke	3.75	3.29	+0.46	1.60	3.83	-2.23
Paul	2.50	3.57	-1.07	1.60	2.17	-0.57
Rachel	3.50	4.29	-0.79	3.40	3.00	+0.40
Samantha	2.75	3.57	-0.82	2.40	2.67	-0.27
Theresa	3.75	3.43	+0.32	3.00	4.17	-1.17
All Teachers: Mean *(SD)*	3.45 *(0.57)*	3.56 *(0.39)*	-0.11 *(0.77)*	2.10 *(0.68)*	2.95 *(0.88)*	-0.85 *(0.78)*

In regards to mastery goals, six of the teachers (Diane, Erin, Jennifer, Paul, Rachel, and Samantha) reported a higher value for perception of school-wide mastery goals than personal mastery orientation to instruction. Considering that all of the teachers seemed to favor mastery-

oriented practices over performance-oriented practices, it does not appear that having a strong school-wide focus on mastery goals would necessarily present any conflict for these teachers. Andrea, Kelsey, Luke, and Theresa all reported a higher personal mastery orientation to instruction than school-wide focus on mastery goals. A paired-samples t-test showed that there was not a statistically significant difference between teachers' mastery orientation to instruction and their perception of school-wide mastery goals ($t(9) = 0.45$, $p = 0.67$).

All of the teachers, except for Rachel, seemed to perceive that their schools focused more on performance goals than they did in their own instruction. A paired-samples t-test showed that there was a statistically significant difference in the means for teachers' performance orientation to instruction and their means for perception of school-wide performance goals ($t(9) = 3.44$, $p = 0.007$). In some cases, the differences between teachers' means for performance orientation to instruction and perceived performance school goals were small in value, such as Kelsey (-0.20), Samantha (-0.27), Paul (-0.57), and Jennifer (-0.60). Since the differences were small, those teachers may not necessarily have felt that the school performance goal focus was in conflict with their own approaches to instruction. For the teachers who reported a larger difference and who also had high values for mastery orientations to instruction (e.g., Luke, Andrea, Diane, and Theresa), they may have experienced conflict with what their school was promoting and how they approached mathematics instruction. I will explore this hypothesis further in the upcoming case study chapters.

As part of my analysis, I compared the teachers in the study who taught at the same school or in the same district to see if they reported similar perceptions of goals in the shared teaching contexts. Andrea and Kelsey, who taught 5th grade at the same school during the study, seemed to have different perceptions about the goals that were emphasized school-wide. Andrea

perceived more of a performance-oriented focus (difference = -0.29) while Kelsey perceived more of a mastery-oriented focus (difference = +1.29) at the school. Jennifer and Theresa, who taught at different schools within the same district, also seemed to have different perceptions regarding their schools' focus on goals. Although they both reported similar means for a school-wide focus on mastery goals (*Ms* = 3.57 and 3.43), Theresa reported a much higher perception of a school wide focus on performance goals (*M* = 4.17) than Jennifer (*M* = 2.00).

In summary, there was wide variation as far as how the individual teachers perceived the school-wide focus on mastery vs. performance goals at their schools. For some teachers, the school-wide focus on goals seemed to be similar to what they emphasized in their own instruction. For other teachers (e.g., Luke, Andrea, Diane, and Theresa), there seemed to be a possibility that the school-wide goals were in conflict with the teachers' own personal goals for instruction. Finally, there were differences in how the pairs of teachers located at the same school and in the same district perceived the focus on goals in their shared contexts.

Students' Perceptions of Teachers' Instructional Practices

All of the students who participated in the study completed a survey where they provided information on how they viewed their teachers' goals and instructional practices. Students demonstrated their agreement (or lack of agreement) with 12 statements about their teacher by circling a number from 1 to 5 where 1 represented "not at all true," 3 was "somewhat true," and 5 meant "very true." The different statements were designed to measure students' perceptions of teachers' mastery goals, teachers' performance-approach goals, and teachers' performance-avoidance goals (PALS; Midgley et al., 2000). As mentioned in the methods section, the teacher survey scales available from the PALS materials were only broken down into mastery vs. performance goals, whereas the student scales were broken down into the three categories

mentioned above. Due to the differences between the teacher and student scales, I cannot make direct comparisons between the values teachers reported for their performance orientation to instruction and the students' reported perceptions of their teachers' performance-approach and performance-avoidance goals. The student survey information is still helpful, though, for providing insight into which goals the students perceived their teachers to be focusing on in the classroom and how the teachers' perceived goals related to the students' own personal goals.

For each teacher, all of the values for each statement related to a specific teacher goal (e.g., teacher mastery goal) were combined and the mean was calculated. Mean values could range from 1 to 5, with a value of 5 representing an extremely high perception of the degree to which a certain goal was emphasized and a value of 1 representing a perception that the goal was not emphasized at all. The summary data for students' perceptions of their teachers' goals is provided in Table 9. I arranged the mean values from greatest to smallest for each of the three goals (mastery, performance-approach, and performance-avoidance).

Table 9

Students' Perceptions of Teachers' Goals – Arranged Greatest to Smallest by Goal

Teacher	Perceived Teacher Mastery Goal Mean	Teacher	Perceived Teacher Performance-Approach Goal Mean	Teacher	Perceived Teacher Performance-Avoidance Goal Mean
Jennifer	4.64	Diane	2.98	Andrea	3.08
Rachel	4.55	Theresa	2.87	Luke	2.76
Kelsey	4.54	Kelsey	2.52	Jennifer	2.75
Diane	4.52	Rachel	2.43	Samantha	2.71
Theresa	4.36	Jennifer	2.33	Rachel	2.63
Paul	4.34	Samantha	2.10	Erin	2.61
Luke	4.24	Luke	1.95	Paul	2.32
Andrea	4.23	Andrea	1.75	Kelsey	2.16
Samantha	4.16	Paul	1.59	Diane	2.06
Erin	4.12	Erin	1.43	Theresa	1.72
All Teachers: Mean *(SD)*	4.37 *(0.18)*		2.20 *(0.52)*		2.48 *(0.41)*

According to the survey results, the students perceived the teachers in the survey as having relatively high mastery goals ($M = 4.37$, $SD = 0.18$) with individual teachers' means ranging from a low of 4.12 (Erin) to a high of 4.64 (Jennifer). The means for teachers' perceived performance-approach goals ($M = 2.20$, $SD = 0.52$) and performance-avoidance goals ($M = 2.48$, $SD = 0.41$) were lower and also much more spread out than the means for teachers' perceived mastery goals. The performance-approach goal values ranged from a low of 1.43 (Erin) to a high of 2.98 (Diane), while the performance-avoidance goal values ranged from 1.72 (Theresa) to 3.08 (Andrea). Since all of the means for teacher mastery goals were higher than all of the performance means (both approach and avoidance), this data suggests that the students perceived their teachers as being more mastery-oriented than performance-oriented. The wider spread of values for the two performance-oriented goals suggests that the teachers were perceived as using

some performance-oriented strategies but there seemed to be more variation from teacher to teacher than there was with mastery-oriented strategies.

All of the teachers in the study were perceived by their students to be emphasizing mastery goals more than performance-approach goals or performance-avoidance goals. As previously mentioned, the teachers had all reported using more mastery-oriented practices than performance-oriented practices so the student survey data provides confirming evidence for that pattern of instruction. Seven of the teachers (Andrea, Erin, Jennifer, Luke, Paul, Rachel, and Samantha) had performance-avoidance goal means that were higher than their performance-approach goal means, while the other three teachers (Diane, Kelsey, and Theresa) had the reverse with means for performance-approach goals that were higher than their means for performance-avoidance goals. As I discuss later, I have some concerns about the validity of the data regarding some of the students' reported perceptions of their teachers' performance-avoidance goals due to their expressed confusions over the related statements when I administered the survey.

In addition to being perceived as having a strong emphasis on mastery goals, three teachers (Diane, Kelsey and Theresa) were perceived as having the highest emphasis on performance-approach goals and the lowest emphasis on performance-avoidance goals. According to prior research, mastery goals are the most productive to promote in the classroom (Ames, 1992; Leonardi & Gialamas, 2002; Middleton et al., 2004; Wolters, 2004), but performance-approach goals combined with mastery goals have also been found to be productive for some students (Harackiewicz et al., 2002; Pintrich, 2000). Therefore, these three teachers seemed to be emphasizing productive goals for their students and de-emphasizing the usually maladaptive performance-avoidance goals.

In order to see which instructional practices within each goal category were perceived by the students as most prevalent, I examined the data for each individual survey statement. According to the survey results, the mastery-oriented practice that seemed to be perceived by the students as most dominant was teachers wanting their students to enjoy learning new things (M = 4.76, SD = 0.57). This practice was followed by teachers wanting students to understand their work and not just memorize it (M = 4.54, SD = 0.96), teachers giving their students time to explore and understand new ideas (M = 4.35, SD = 1.02), teachers recognizing students for trying hard in mathematics (M = 4.24, SD = 1.01), and teachers thinking mistakes are okay as long as students are learning (M = 4.04, SD = 1.31).

With regards to performance-approach practices, the two most prevalent practices were teachers letting students know who received the highest scores in mathematics (M = 2.55, SD = 1.58) and teachers pointing out which students received good grades as an example (M = 2.51, SD = 1.46). Since these practices are similar it makes sense that the means for these statements were extremely close in value. The standard deviations show that there was more variation among the teachers for the perceived use of these practices versus the mastery-oriented practices. The performance-approach practice that had a relatively low mean was teachers telling students how they compare to each other (M = 1.76, SD = 1.19).

As noted earlier, seven of the teachers had higher values for performance-avoidance practices than performance-approach practices. The two highest rated statements for performance-avoidance practices (Ms = 2.95 and 2.69, SDs = 1.56 and 1.52) were very similar in content because they both focused on teachers telling students that it was important to participate in discussions and/or answer questions in mathematics class "so it doesn't look like they can't do the work." Although these statements had means that were higher than the means for all of the

performance-approach practices, the survey results may not have reflected actual teacher practices.

When I administered the student surveys, many of the students had a hard time making sense of these two statements because of the complex wording. In multiple classrooms, especially ones with a large number of English Language Learners (ELLs), students asked me to explain both of these statements more than once because they were confused and unsure how to respond. There seemed to be two reasons for their confusion. First, they were confused by all the components of the statements and figuring out whether or not they agreed or disagreed. For example, they would agree with the first part of the statement, "My teacher tells us it's important to join in discussions and answer questions in mathematics class…" but then they were unsure about the second part of the statement and so they didn't know which number to circle. Second, I believe they were confused by the double negative in the second part of both statements, "so it doesn't look like we can't do the work." Based on the students' confusions and the fact that I saw no evidence of these performance-avoidance practices in any of my observations, the high values for these particular statements may not have been an accurate reflection of the teachers' perceived goals or practices. This potential issue may also explain why so many of the teachers, and not just the ones with a large number of ELLs, were perceived to be using performance-avoidance strategies more than performance-approach strategies.

Students' Personal Achievement Goal Orientations vs. Perceptions of Teachers' Goals

In addition to information about what students perceived as their teachers' goals for instruction, the surveys also provided data about students' personal goal orientations. Using overall mean scores for the students associated with each teacher, I compared the students' personal goal orientations with what they perceived as their teachers' goals for each of the three

categories (mastery, performance-approach, performance-avoidance). In Tables 10-12, the overall mean values from the student survey data are shown for perceived teacher goals and students' personal goals, in addition to the difference between those values. A positive (+) difference represents a higher reported student goal, and a negative (-) difference represents a higher perceived teacher goal.

As noted previously, students rated all 10 teachers highly as far as communicating mastery-oriented goals in their instruction. In Table 10, the data shows that students also reported high values for having a personal mastery goal orientation, ranging from overall mean values of 4.32 (Luke) to 4.82 (Erin). The differences show that most of the groups of students reported slightly higher personal mastery goals than perceived teacher mastery goals, but many of the differences were very small in value. A paired-samples t-test revealed a statistically significant difference between students' personal mastery goals and perceptions of teachers' mastery goals ($t(9) = 3.02$, $p = 0.015$). This data suggests that both the students and the teachers in the study seemed to be focused on mastery-oriented goals, but students were even more focused on mastery goals than the teachers. The students seemed to recognize that the teachers were communicating the value of mastery goals in the classroom, and the students appeared to have adopted mastery goals as a priority for themselves.

Table 10

Students' Mastery Goals vs. Perceived Teacher Mastery Goals

Teacher	Students' Personal Mastery Goal	Perceived Teacher Mastery Goal	Difference
	Mean	Mean	
Erin	4.82	4.12	+0.70
Andrea	4.65	4.23	+0.42
Samantha	4.46	4.16	+0.30
Diane	4.80	4.52	+0.28
Paul	4.58	4.34	+0.24
Theresa	4.56	4.36	+0.20
Luke	4.32	4.24	+0.08
Jennifer	4.66	4.64	+0.02
Rachel	4.52	4.55	-0.03
Kelsey	4.50	4.54	-0.04
All Teachers – Mean *(SD)*	4.59 *(0.15)*	4.37 *(0.18)*	0.22 *(0.23)*

In the survey results (Table 11), students in nine of the classrooms rated their teachers as having performance-approach goals that were lower in value than the students' personal performance-approach goals. The means for perceived teacher performance-approach goals ranged from 1.43 (Erin) to 2.98 (Diane). In regards to students' personal performance-approach goals, the means ranged from 2.62 (Erin) to 3.65 (Samantha) and were higher than the perceived teacher performance-approach goal means for all of the teachers except for Diane. The differences in means between the perceived teacher goals and the students' personal goal orientations were more spread out than they were for mastery goals. A paired-samples t-test revealed a statistically significant difference between students' personal performance-approach goals and perceptions of teachers' performance-approach goals ($t(9) = 3.90$, $p < 0.004$). Whereas the students and teachers seemed to be more similar with regards to mastery goals, in

this case it looked like some of the students tended to focus on performance-approach goals much more so than their teachers. This could be the result of students' prior experiences in mathematics classes or possibly experiences with peers, family members, or schooling in general.

Table 11

Students' Performance-Approach Goals vs. Perceived Teacher Performance-Approach Goals

Teacher	Students' Personal Performance-Approach Goal Mean	Perceived Teacher Performance-Approach Goal Mean	Difference
Samantha	3.65	2.10	+1.55
Luke	3.37	1.95	+1.42
Paul	2.98	1.59	+1.39
Erin	2.62	1.43	+1.19
Andrea	2.86	1.75	+1.11
Jennifer	3.10	2.33	+0.77
Rachel	2.98	2.43	+0.55
Kelsey	2.67	2.52	+0.15
Theresa	2.95	2.87	+0.08
Diane	2.70	2.98	-0.28
All Teachers – Mean *(SD)*	2.99 *(0.32)*	2.20 *(0.52)*	+0.79 *(0.64)*

The results for the performance-avoidance goal values (Table 12) were very similar to the results for the performance-approach goal values. The means for perceived teacher performance-avoidance goals ranged from a low of 1.72 (Theresa) to a high of 3.08 (Andrea), whereas the means for students' personal performance-avoidance goals ranged from 2.61 (Kelsey) to 3.61 (Samantha). Similar to the situation with performance-approach goals, the students' personal performance-avoidance goal values were higher than the perceived teachers' performance-avoidance goal values for all the teachers except for one (Andrea). The differences

between the means for perceived teacher performance-avoidance goals and students' personal performance-avoidance goals were more spread out than the differences for mastery goals, but less spread out than the differences for performance-approach goals. A paired-samples t-test revealed a statistically significant difference between students' personal performance-avoidance goals and perceptions of teachers' performance-avoidance goals ($t(9) = 3.81$, $p = 0.004$). As with the performance-approach goals, it seems that students in some classrooms seemed to be more focused on performance-avoidance goals than their teachers.

Table 12

Students' Performance-Avoidance Goals vs. Perceived Teacher Performance-Avoidance Goals

Teacher	Students' Personal Performance-Avoidance Goal	Perceived Teacher Performance-Avoidance Goal	Difference
	Mean	Mean	
Theresa	2.82	1.72	+1.10
Diane	2.99	2.06	+0.93
Samantha	3.61	2.71	+0.90
Paul	3.14	2.32	+0.82
Luke	3.40	2.76	+0.64
Kelsey	2.61	2.16	+0.45
Erin	3.04	2.61	+0.43
Rachel	2.90	2.63	+0.27
Jennifer	2.85	2.75	+0.10
Andrea	2.74	3.08	-0.34
All Teachers – Mean *(SD)*	3.01 *(0.30)*	2.48 *(0.41)*	0.53 *(0.44)*

Summary of Chapter Findings

All of the teachers in the study reported a stronger mastery orientation than performance orientation to instruction, and they were all perceived by their students to be more mastery-oriented than performance-oriented. Students in all 10 classrooms also reported high personal

mastery goals and lower personal performance goals (both approach and avoidance). Since the teachers in the study all graduated from the same teacher preparation program where they were exposed to mastery-oriented instructional practices in mathematics, it seemed possible that their strong focus on mastery-oriented instructional practices was in part a result of similar experiences in the program.

There was much more variation in relation to reported and perceived emphasis on performance-oriented strategies with this particular group of teachers. Some teachers were perceived by their students as using more performance-approach strategies, while other teachers were perceived as using more performance-avoidance strategies in mathematics. Students in 9 of the 10 classrooms rated their personal performance goals (both approach and avoidance) as higher than what they perceived as their teachers' emphasis on performance goals, so it seemed possible that students may have developed performance-oriented views from influences beyond their classroom teacher such as the school environment, previous teachers, and/or family members.

There was wide variation in how the teachers perceived the relative focus of mastery versus performance goals at their schools. For some teachers, the perceived school goals seemed to be aligned with their personal approaches to instruction, while for other teachers there seemed to be a significant discrepancy between the school goals and their own reported instructional goals. Since there was such variation with regards to the teachers' use of performance-oriented strategies, it seemed possible that the perceived school goals could have been a factor in their use of certain instructional strategies that were more performance-oriented.

In order to further explore the views and instructional practices of the teachers and learn more about the factors that seemed to be influencing their use of mastery- and performance-

oriented strategies, I used a case study approach to focus in depth on two pairs of teachers from the study. I selected pairs of teachers from the study who exhibited some interesting similarities or differences with regards to the quantitative data and shared some similar learning contexts (e.g., mathematics methods courses, student teaching experiences, and/or school setting for full-time teaching job) that had the potential to influence their instruction. According to my situated learning framework, learning is dependent on the social and physical contexts in which it occurs and teachers are constantly renegotiating meaning from experiences in those contexts as they develop their identities as professionals (Putnam & Borko, 2000; Lave & Wenger, 1991). Although I did not expect these teachers to learn the same things from their shared contexts, comparing the teachers in each pair allowed me to examine aspects of those common contexts that did (and did not) seem to influence their uses of mastery-oriented and performance-oriented instructional practices. I was also able to explore how other non-shared learning contexts seemed to influence the teachers' views and practices.

In the final section of this chapter, I introduce the two pairs of teachers featured in my case studies and provide an overview of their shared learning contexts and how the teachers compared with regard to the survey data. In Chapters 5 and 6, I focus in depth on each pair of teachers and use qualitative data from the observations and interviews to address the research question about factors that seemed to influence teachers' use of different instructional practices.

Overview of Case Study Teachers

Diane and Luke

According to the survey data, Diane and Luke had similar teaching profiles with the exact same mean for mastery orientation to teaching ($M = 3.75$), and performance orientation means somewhat close in value ($M = 2.20$ and 1.60). The results from the student surveys showed that

Diane and Luke were both perceived by their students as being more focused on mastery-oriented goals than performance-oriented goals. As a matter of fact, although Diane's mean values were slightly higher, the overall order (highest to lowest) of means for students' perceptions of the five mastery-oriented instructional practices was almost identical for the two teachers. First, both teachers were strongly perceived as wanting their students to enjoy learning new things in math. Next, both teachers were perceived as wanting their students to understand the mathematics content and not just memorize it, and in Diane's case they also perceived her (with the same frequency) to be providing them with time to explore and understand new mathematics concepts. Luke's students reported that he gave them time to explore and understand new ideas in mathematics, but with less frequency than wanting them to understand the mathematics content. Finally, both teachers were perceived as recognizing students for trying hard followed by the perception of mistakes being acceptable as long as students were learning. It seemed that Diane and Luke both favored using mastery-oriented practices over performance-oriented practices, and they were perceived to be using mastery-oriented practices in a similar fashion.

Diane and Luke were both in their second year of teaching during the time of the study. Diane was teaching 5th-grade mathematics and science at Cooper Elementary in Tennessee and Luke was teaching 4th grade at Northwest Elementary in Utah. Although they were in very different settings for their full-time teaching, they had shared some similar experiences during their teacher preparation program. Diane and Luke were classmates for both of their elementary mathematics methods courses so they were exposed to the same instructors and they completed the same assignments and in-class activities. In addition, during their year of student teaching, Diane and Luke both worked with cooperating teachers who had graduated from the same

teacher preparation program they were attending at the time. Their cooperating teachers seemed to use and promote mastery-oriented instructional practices and generally supported what was being taught and modeled through the teacher preparation program. In Chapter 5, I use qualitative data to explore how these shared contexts seemed to influence Diane and Luke's use of instructional practices in mathematics.

Since Diane and Luke were in very different school settings for their full-time teaching, I was also interested to see how their instructional practices might be influenced by their school contexts. Compared to the other teachers in the study, Diane and Luke both reported a high perception of performance goals at their schools (*Ms* = 3.67 and 3.83). Although they both had small differences (+0.19 and -0.54) between their values for the two types of perceived school goals (mastery and performance), Diane did report a slightly higher perception of a mastery focus at her school (*M* = 3.86) while Luke had one of the lower values in the study for a perceived school mastery focus (*M* = 3.29).

Diane's students reported high mastery goals (*M* = 4.80), low performance-approach goals (*M* = 2.70) and a mid-range value for performance-avoidance goals (*M* = 2.99). Diane's students seemed to be more mastery-oriented than performance-oriented. Since she perceived her school to have slightly more of a mastery-goal focus than a performance-goal focus, it was possible that the students' goal orientations had been influenced by Diane and also by the larger school context. Luke's students had the lowest value for mastery goals (*M* = 4.32) and the second highest values for both performance-approach (*M* = 3.37) and performance-avoidance goals (*M* = 3.40). These values suggest that Luke's students may have been operating under a multiple goal approach where they tended to favor more than one goal. Although Luke reported using primarily mastery-oriented strategies in his classroom, he perceived a stronger focus on

performance-oriented goals than mastery-oriented goals at his school. It was possible that in Luke's case, the school context had a strong influence on his students' personal goals. It was also possible that previous experiences students had with family members, peers and/or other teachers could have influenced their goals. Since Diane and Luke both reported a high mastery orientation with regards to teaching mathematics, I used data from the interviews and observations to examine how they dealt with the strong performance focus at their schools.

In Chapter 5, I explore these ideas and hypotheses about Diane and Luke further with the use of qualitative data from the interviews and observations.

Andrea and Kelsey

During the time of the study, Andrea and Kelsey were both first-year teachers at Draper Upper Elementary in Michigan. These two teachers reported high means for mastery orientation and the largest differences between their mastery and performance orientation values among all the teachers in the study. The results from the student surveys showed that Andrea and Kelsey were both perceived by their students as being more focused on mastery-oriented goals than performance-oriented goals. Therefore, it seemed that Andrea and Kelsey both had a strong preference for using mastery-oriented instructional practices and were perceived to be using mastery-oriented practices on a regular basis in the classroom. Since Andrea and Kelsey seemed to have similar ideas about mathematics instruction, I hypothesized that their instructional practices were influenced by some of their experiences with shared learning contexts during teacher preparation (i.e., elementary mathematics methods course) and/or their first year of full-time teaching (i.e., Draper Upper Elementary).

During their teacher preparation program, Andrea and Kelsey were classmates in their first elementary mathematics methods course. In that course, the two teachers were exposed to

the same instructional practices and completed the same assignments and in-class activities. They also had some experience working together in class on mathematical tasks and discussions about mathematics learning and instruction. As far as other university courses and student teaching, Andrea and Kelsey had relatively different experiences. Andrea was a Special Education major while Kelsey was a Child Development major, so they had different course requirements. In addition, Andrea spent her year of student teaching working with a 4th-grade general education teacher and a K-5 special education teacher, while Kelsey did her student teaching with a Kindergarten teacher. Through the interviews, I gathered information about the different ways these shared and non-shared learning experiences seemed to influence the two teachers' views and instructional practices.

Andrea and Kelsey both taught 5th grade at Draper Upper Elementary during the year of the study. Not only did they spend their first year of full-time teaching at the same school, but they also worked very closely together to plan all of their mathematics lessons. They met once a week after school to plan all of their lessons, gather any necessary resources, and prepare homework and other handouts for the upcoming week. Although they did all of their planning together and were teaching at the same school, Andrea perceived the school to be more focused on performance goals while Kelsey perceived more of a school-wide focus on mastery goals. I used data from the interviews to explore these differences in more depth.

In comparison to the other students who participated in the study, Andrea's students and Kelsey's students reported high personal mastery goals (*Ms* = 4.65 and 4.50), low personal performance-approach goals (*M* = 2.86 and 2.67), and low personal performance-avoidance goals (*M* = 2.74 and 2.61). With regards to students' perceptions of teachers' goals, Kelsey was perceived to have a slightly higher mastery focus (difference of 0.31) and a higher performance-

approach focus (difference of 0.77) than Andrea, while Andrea was perceived to have a higher performance-avoidance focus (difference of 0.92) than Kelsey. Andrea and Kelsey's students seemed to have similar personal goals and they viewed their teachers as promoting similar goals, with the biggest difference being between perceived performance-approach and performance-avoidance goals. Since Andrea and Kelsey were at the same school, it was possible that students' similar personal goal orientations were a result of the combined factors of the school context and the influence of their teachers.

In Chapter 6, I explore these ideas and hypotheses about Andrea and Kelsey further with the use of qualitative data from the interviews and observations.

CHAPTER 5: DIANE AND LUKE

Overview

In this chapter, I present a case study of two second-year teachers who worked in very different contexts but seemed to share similar mastery-oriented teaching practices and beliefs. In this case study, I address the research question about the factors that seemed to influence teachers' use of different instructional practices. I argue that Diane and Luke's focus on mastery-oriented teaching practices in mathematics was in large part due to the strong degree of alignment they experienced among their second mathematics methods course, their cooperating teachers' practices, and their own personal visions of teaching. For both teachers, those personal visions were informed by experiences they had with mathematics as K-12 students. Due to some aspects of their school and district contexts, Diane and Luke were supported and constrained in different ways as they tried to implement mastery-oriented practices in their classrooms as full-time teachers. Despite these differences in supports and constraints, both teachers seemed to be focused on using mastery-oriented teaching practices in their mathematics instruction.

In order to build my argument, I begin the chapter by providing some background on the school contexts in which the two teachers worked during the time of the study. Next, I use data from the observations to describe Diane and Luke's mathematics instruction and use of mastery-oriented practices. Then, I use interview data to show how Diane and Luke's use of mastery-oriented strategies seemed to be influenced by their experiences with their cooperating teachers, their second mathematics methods course, and their own visions of effective mathematics teaching (developed in part from experiences as K-12 students). Finally, I use interview data to explore how Diane and Luke's use of mastery- and performance-oriented strategies seemed to be

influenced by particular aspects of their school contexts including administrator expectations and school or district expectations related to student test scores.

Description of School Contexts

At the time of my study, Diane and Luke were both second-year teachers. Diane had spent both years teaching 5th-grade mathematics and science at Cooper Elementary in the Mountain (Tennessee) School District. The enrollment for Cooper Elementary in 2011-12 was listed as 741 students in grades PreK - 5th, with the following racial/ethnic breakdowns: 47.5% White, 31.2% African American, 18.9% Hispanic, 1.4% Asian/Pacific Islander, and 1.0% Native American/Alaskan. In addition, 74.3% of the students at the school qualified for free or reduced lunch and 8.45% were English Language Learners (ELLs).

In July 2010, Tennessee was awarded $500 million in Race to the Top funds from the federal government to implement a comprehensive statewide program focused on educational reform. As part of the reform efforts, the Tennessee State Board of Education increased the proficiency levels or "cut scores" for the state assessments used to measure student achievement. As a result, many schools saw their average scores decrease from 2009 to 2010. At Cooper Elementary, the percentage of students who scored proficient in mathematics decreased from 84.3% in 2009 to 28% in 2010. Diane began her first year of teaching (2010-2011) as the school was implementing some new reform efforts in mathematics including: reduced class sizes, required small group mathematics focus time, after-school targeted intervention, and increased mathematics professional development for teachers. During Diane's two years of teaching at Cooper Elementary, the mathematics scores on the state assessment showed tremendous growth. Overall, the percentage of students who scored proficient in mathematics increased from 28% in 2010 to 45.9% in 2011 to 60.5% in 2012. With respect to the grade level that Diane taught, the

percentage of 5th-grade students who scored proficient in mathematics increased from 20.5% in 2010 to 40.6% in 2011 to 75.6% in 2012.

Luke spent both years teaching at Northwest Elementary in the Fremont (Utah) School District. Luke's school was much less racially diverse than Diane's school with the following racial/ethnic breakdown: 85.9% White, 9.5% Hispanic/Latino, 1.9% Asian, 0.8% Multiple Races, 0.6% Pacific Islander, 0.6% African American, and 0.5% American Indian. The economic background of the students was also very different with only 31.5% of the students qualified for free or reduced lunch. The percentage of ELLs was similar to Diane's school with 6.5% at Luke's school.

As far as student achievement on state assessments, there was also a big difference between Diane's school and Luke's school. During the two years that Luke taught at Northwest Elementary, the school's overall mathematics test scores on the state assessment were consistently in the 80% proficiency range (83% in 2010, 83% in 2011, and 88% in 2012). Luke taught 2nd grade in his first year at Northwest Elementary, so his students did not take the state assessment that year. In his second year (2011-2012), he moved to teaching 4th grade so his students did take the state assessment. From 2010 to 2011, the percentage of 4th-grade students who scored proficient in mathematics had decreased from 86% to 81%. During the year that Luke taught 4th grade, the mathematics proficiency levels for students in that grade increased from 81% to 92%.

Despite the differences in their school contexts, Diane and Luke shared similar mastery-oriented views and enacted similar mastery-oriented instructional practices in their mathematics teaching. In the upcoming sections of the chapter, I describe the mastery-oriented instructional strategies I observed in their mathematics instruction and I explore the commonalities in their

teacher preparation experiences that might have accounted for their similar mastery-oriented views and practices.

Descriptions of Observed Instructional Practices

In this section, I use data from classroom observations to provide descriptions of Diane's and Luke's mathematics instruction. I observed both Diane and Luke using a variety of mastery-oriented strategies in their instruction. Diane focused on the importance of understanding the content rather than just giving a correct answer and she provided students with time and resources to explore new concepts and develop their conceptual understanding. Finally, she provided multiple opportunities for students to learn from each other and co-construct conceptual knowledge. In Luke's lessons, there were multiple ways for students to participate. He provided a variety of tools and strategies (e.g., manipulatives, real-world applications, and group work) to help students explore and develop their understanding of new concepts. Although Luke emphasized the importance of students understanding the content and being able to explain their thinking in various forms, he seemed to be more focused on procedural understanding. Finally, he communicated to students that mistakes were part of the learning process.

Diane's Mathematics Instruction

Diane was responsible for teaching both mathematics and science during her two-hour instructional blocks (one in the morning and one in the afternoon). Although Diane had flexibility with how she structured those instructional blocks, there were some minimum expectations in place at Cooper Elementary. She was required to do small group focus time in mathematics at least three times a week and teach STEM (mathematics and science integration) at least once a week. Diane described the purpose of the small group instruction as an

opportunity to reteach concepts students had not yet mastered, as shown by their proficiency scores on the quarterly benchmark tests.

In Diane's classroom, small group instruction occurred at the beginning of each instructional block (morning and afternoon) and lasted about 30-40 minutes. Using data from quarterly benchmark tests, Diane put students into three leveled groups based on their understanding of a particular benchmark concept. There was a list on the board that showed who was in each group and the order of the rotations, but groups were flexible as Diane sometimes changed groupings based on her observations and formative assessment data in order to best meet students' needs. Students always moved between three rotations during small group focus time: teacher center, computer center, and work center. For the teacher center, students met with Diane at a circular table near the front of the room. At the computer center, students completed online mathematics activities that Diane had individually assigned to them. Finally, at the work center, students either worked with the PE teacher (morning group) or they worked independently (afternoon group).

At the teacher center, Diane met with students at the circular table in the front of the room. She usually had a few problems for the students to work on related to the benchmark concept and she seemed to follow a similar routine of reading the problem out loud and asking some questions before having the students work on the problem in their mathematics journals. As they worked on the problem, Diane would scan their work and ask probing or guiding questions as needed. She pushed the students to move beyond just giving a numerical answer and instead focused on what the numbers in the answer really meant in terms of the context of the problem. During this time, she also seemed to give students the time they needed to work through the problems and was patient when they struggled with a concept. If some students

worked through the problems quicker than others and showed a clear understanding of the concept, Diane would send them back to their desks to do independent work while she continued working with students who needed more help.

After students completed the three small group rotations, they moved back to their table groups for the regular mathematics lesson. Diane described her teaching style as inquiry-based and she would often begin the lesson by giving the whole class a question or task to think about and discuss as a whole group. For example, in one lesson I observed, Diane put two triangles up on the screen and asked students to name the shapes and explain how they knew what they were called. After students named the shapes and shared some ways to describe the triangles, she asked them to work with their table groups to figure out what was the same about the two triangles. After students worked in their groups for a while, she called the class back together to have them share their ideas, as shown in the excerpt below ("S" stands for student and "D" stand for Diane):

D: Share what you think is the same about those two triangles.

S1: Right angle, acute angle and acute angle

D: So you're saying they both have one right angle and two acute angles?

S1: Yes.

D: Okay. (*Calls on another group)*

S2: They both have three angles and three sides.

D: They both have three angles and three sides. *(Calls on another group)*

S3: If you turn them they both have the same size edges.

D: So you think that their edges are the same length?

S3: Yes.

D: Okay. *(Calls on another group)*

S4: They have the same base line.

D: They have the same base line. What do you mean by base line? Can you point to it?

S4: (*Pointing to triangles on screen)* Both of these sides are the same length.

(Classroom Observation, February 2, 2012)

During this discussion, Diane made a point to revoice and/or clarify the ideas that were shared and she usually checked back with each group to make sure she had revoiced it correctly (Chapin, O'Connor, &Anderson, 2009). She did not evaluate the ideas in any way to say whether the groups were right or wrong, although it is possible some students could have interpreted her "okay" as evaluation. After this sharing of ideas, she asked the students to look through their other triangles and find one that followed the same rule they had come up with in their groups.

As students worked in their groups, she moved around the room listening to small group discussions and asking probing or clarifying questions as needed. Once again, she called the class back together to share their ideas. As students shared their thinking, she helped them clarify their language and use appropriate mathematical terminology such as the word angles instead of points. This ongoing cycle of whole class discussion, small group work, whole class discussion continued throughout the lesson as students worked with different sets of triangles. In one of the interviews, Diane told me she used group work on a daily basis because she felt that "some of the best ideas are built off each other." By the end of the lesson, the class had worked together to develop a list of the different type of triangles and their characteristics.

In another lesson I observed, Diane presented a large box of packing peanuts and told the students that the peanuts represented M&Ms. She explained that each student would reach into

the box with one hand and however many packing peanuts they grabbed, that would be the number of M&Ms they would get to eat. Then Diane asked students if they agreed with that particular method of deciding how much everyone should receive. Many students shouted out that it was not a fair method because people with different sized hands would grab different amounts. After some initial sharing of ideas, Diane asked the students to work in groups and develop a proposal for how to distribute the M&Ms fairly.

As students wrestled with the task, Diane never explicitly told them whether they were right or wrong. She would often ask questions that helped students clarify or push their thinking but she never told them a specific process or strategy to use. She also gave them plenty of time to explore and experiment with different strategies as they worked on the task. Many groups had lively discussions trying to agree on what their proposal should be and why. For example, in one group the students seemed to be arguing between proposing 19 and 20. One student had calculated the mean and his answer was "19 remainder 6" so he thought 19 would be a fair number. His teammate argued that 20 was better because most of the numbers in the set were in the 20s. The classroom discussion became even more spirited when each group shared their proposal with the whole class because students would respond to each group's proposal by asking questions and pushing for more explanation. In the following excerpt, the spokesman for the group I described previously ended up proposing to the class that 10 was a fair number of M&Ms for everyone ("S" stands for student and "D" stands for Diane):

D: How many M&Ms do you propose everybody in class get?

S1: I think everybody in class should get 10 because… I did the math and… six people without 20 M&Ms

D: How do you go from 20 to 10?

S1: Maria suggested that we all have 20 but if we do there will be six remainder… six people left out.

D: Okay

S1: And so we chose 10 because it's a fair amount for everybody so everybody has the same amount.

D: Does anybody have any questions?

S2: Why did you suggest 10?

S1: It's a fair amount.

S2: Why didn't you suggest 12 or 20?

D: I think he wants to see your math.

S2: I want to see how you figured it out. Put it up there.

(S1 puts his work on the document camera. It shows that he added a series of numbers to get 329 and then he divided 329 by 17 to get 19r6.)

S2: I have a question. I see that at the bottom of the page you have the number 19 remainder six. Why not give everybody 19 instead of 10?

S1: Well they (*pointing to his group)* were arguing that…

S2: But you're the defense on this case – why would they be arguing?

S1: 10 is… would be just enough for everybody.

(Classroom Observation, April 4, 2012)

In this discussion, students in the class expressed their confusion to this group and kept pushing them to explain where 10 came from and how that number related to their mathematical work that showed 19 remainder 6. Diane let the students respond to each other's ideas as much

as possible and she intervened only when necessary to keep the discussion on track or highlight an important point.

In summary, I observed Diane to be using a variety of mastery-oriented instructional practices. She emphasized the importance of understanding the mathematical concepts and not just providing a correct answer. Diane gave students time to explore and develop their understanding of concepts, whether it was in the large or small group setting. She provided multiple opportunities for students to work with their peers and learn from each other. In addition, she created a learning community where students responded to and evaluated each other's ideas so they were constructing conceptual knowledge together.

Luke's Mathematics Instruction

During the year of the study, all the 4th-grade teachers at Luke's school were required to ability group the students in mathematics based on pre-test data. About every six weeks, Luke and the other 4th-grade teachers gave their students a district-created pre-test on the topics for the upcoming block of instruction. They used the pre-test data to place the students into three groups (i.e., low, medium, and high). Since the tests covered different content for each six-week block of instruction, the groups changed each time based on how much individual students knew or didn't know about the particular topics. Luke always taught mathematics to the medium group. Other than the pre-test and post-test, Luke did not have any specific requirements about how he structured his hour of mathematics class. In an interview, he described his typical mathematics lesson routine as "warm-up, followed by an activity of some sort introducing a new concept, practicing with a new concept, and then they apply it on their own."

In both lessons I observed, Luke began mathematics class by having students work independently on some warm-up problems. As students worked on the problems, Luke walked

around and answered questions or provided help as needed. Then he brought the students together as a whole group and called on students to provide the answer and/or explain the steps for each problem. As students provided responses, he charted the answers or steps on the Smart Board. He also used a variety of participation structures to involve multiple students including asking for thumbs up or thumbs down to show agreement/disagreement or asking the whole class to respond chorally.

In the interviews, Luke talked about how he tried to incorporate real-word examples of mathematics concepts into his lessons because he had found that meaningful as a K-12 student. I saw evidence of this in the lesson on circles when students examined six pictures of real-world objects (basketball, Ferris wheel, pizza, pie, crop circle, and thermometer) and identified whether the highlighted part represented a radius or diameter for the two-dimensional circular representations shown in the picture. In both lessons I observed, Luke also had his students use hands-on materials and work together in groups to complete tasks and explain their thinking.

During his lessons, Luke guided the whole-class discussion but he seemed to create multiple opportunities for students to participate and explain their thinking. He used individual whiteboards as a way to have students share their thinking and solutions to mathematics problems in written form. In addition to calling on individual students or asking for whole-class choral responses, he also incorporated a lot of partner and group talk. Here is an excerpt from a whole-class discussion as students worked on the following problem: "Show me a group where 3/10 of a pile of 20 Starbursts are orange. How many Starbursts are orange?" ("L" stands for Luke and "S" stands for student)

L: What is the first thing that you are going to do? Turn to a partner and tell them.

(Students talk to their partners)

L: What's the first thing we are going to do?

S1: Get 20 Starbursts.

(Luke gives them time to count out their Starbursts.)

L: Second step, what am I going to do? Turn to the person next to you and share.

(Students talk to their partners)

L: What's my second step?

S2: Look at the denominator and make that many equal groups.

L: How many equal groups am I going to make? Thumbs up if you know.

(Multiple students show thumbs up)

L: How many equal groups – say it together.

Ss: 10.

(Classroom Observation, February 10, 2012)

Although this example does show Luke utilizing partner talk in his classroom, it also shows that he seemed to be focused on procedures in his mathematics teaching as the students were required to follow a set of prescribed steps to solve the problem. I will explore this in further detail later in this section. From this example, it also seemed that the classroom talk routine was somewhat procedural as Luke continuously repeated the cycle of asking a question, asking students to talk to a partner, and then calling on a student for a specific response.

In one of the interviews, Luke showed me an example of a rubric that was used to evaluate teachers in his district. This particular rubric was focused on student engagement and teachers were evaluated on three things: how many times they provided opportunities for students to respond (group, choral, and individual), the ratio of positive (praise) interactions to negative (reprimand) interactions, and the number of students who were on task versus the

number of students who were off task. Teachers received an overall numerical score based on the sum of the values from the three categories. It seemed possible that Luke's more procedural-oriented instruction may have been partially influenced by these district expectations. This rubric only took into account the number of students who participated or the number of students on task, rather than the quality of students' contributions in terms of how they made sense of the mathematical concepts.

In the same lesson on fractional parts of a number, Luke noticed that multiple students seemed to have the same misconception and were getting similar wrong answers. He tried to communicate to the students the view that mistakes were part of the learning process by saying, "The answer is 12, but let's see how we got there. Some of us had six and some of us had three, which is okay. I want you to understand where we need to go here." Luke used a diagram to show how six and three were valid numbers in the process because students had to put the Starbursts into six groups of three in order to solve the problem. Since the problem required finding 4/6 of 18, Luke explained that students would need to go one step further and count up the number of Starbursts in four of the groups. After providing his explanation, he went back to the students who had originally said six or three and asked them if they understood where "they went a little different." Even though Luke seemed to be emphasizing that mistakes were okay, he also seemed to be emphasizing that students needed to follow the prescribed steps in order to solve the problem.

Although Luke seemed to be using many mastery-oriented practices, the classroom examples highlighted here provide evidence that he was more focused on procedural understanding and less focused on inquiry and conceptual understanding than Diane. In the lesson on fractional parts of a number, he wrote the steps on the board that he wanted students to

follow in order to solve the problems. There was no opportunity in that particular lesson for students to explore the problem on their own or use varied strategies. Instead, Luke walked them through the steps with an example problem and then asked them to follow the steps with a new problem. This was very different from what I observed in Diane's classroom, where she allowed students more time to explore, share their own ideas, and use a variety of strategies. Although Luke created multiple opportunities for students to participate in whole-class discussions, those discussions seemed to be more teacher-guided and less student-led than the discussions in Diane's classroom.

As mentioned previously, Luke's instruction may have been influenced by how teachers were evaluated in the district (e.g., engagement being viewed through quantity rather than quality). It is also possible that his instruction was influenced by constraints related to time and content coverage. Luke only had an hour for mathematics class and that time was not flexible since students switched between the 4th-grade classrooms for mathematics. Diane, on the other hand, had two hours for instruction so she had more time for student exploration within a mathematics class. Luke also had to make sure he covered the required content within a certain timeframe since all the 4th-grade teachers gave the unit post-test on the same day. Diane had more flexibility and could adjust the pacing of her units as needed as long as students were prepared for the quarterly benchmark tests. Therefore, it is possible that Luke's instruction may have looked different if he had had more time and flexibility with regards to pacing. It is also possible that Luke had more of a procedural understanding of the concepts he was teaching, and so his own understanding influenced the way in which he taught the concepts.

In the second lesson I observed on radius and diameter, Luke stressed multiple times the importance of being able to explain the mathematical concepts and not just provide a correct

answer. First, in the whole class discussion, Luke drew various lines within a circle diagram and for each line he asked students to show "thumbs up" if they thought it was the radius (or diameter) and "thumbs down" if they did not think it was a radius (or diameter). After students responded with their thumbs, he called on students to explain their reasoning. Second, in the group activity, students had to explain to their group members whether their diagram showed a radius or diagram and provide their mathematical reasoning. Third, in the independent practice, students looked at real-world pictures of circular objects and wrote down whether the labeled part of the picture was a radius or diameter and also an explanation of why they categorized it that way. Finally, in a whole class discussion, Luke went over the independent practice activity with the whole class and focused on having students share their explanations.

In summary, I observed Luke using a variety of mastery-oriented instructional practices in his mathematics classes. He provided students with opportunities to participate and share their ideas in multiple ways. Luke used hands-on materials, real-world connections, and group work as tools to help students explore and understand new concepts. In his instruction, Luke focused on having students understand the mathematical concepts and explain their thinking in written and verbal forms, but he focused more on procedures and less on inquiry than Diane. Finally, Luke communicated that mistakes were part of the learning process in mathematics.

Factors Associated with Instructional Practices

In this section, I use data from the teacher interviews and observations to examine the different factors that seemed to influence Diane and Luke's instructional practices. Using a situated view on learning, I explore what these two teachers seemed to learn about teaching mathematics from the contexts they participated in as both students and teachers. I argue that Diane and Luke's use of mastery-oriented strategies in mathematics seemed to be strongly

influenced by some similar experiences and contexts they encountered in their teacher preparation program. During their year of student teaching, these two teachers experienced a strong sense of alignment among what they learned from their second mathematics methods course, what they learned from their cooperating teachers, and their own personal visions of mathematics teaching (which seemed to be somewhat influenced by previous experiences as K-12 students).

Diane and Luke did not necessarily experience that same sense of alignment when they began their full-time teaching careers. Their use of mastery- and performance-oriented practices in mathematics seemed to be somewhat influenced by particular aspects of their school and district contexts. Diane's use of mastery-oriented instruction was encouraged by her vice-principal but the school-wide focus on student test scores seemed to influence her use of some performance-oriented strategies. Luke's use of mastery-oriented strategies lessened in his first year of teaching due to constraints and pressures he perceived from the curriculum and his principal. In his second year, after switching grade levels and not experiencing the same constraints, he seemed to increase his use of mastery-oriented practices in mathematics.

Teacher Preparation Program

Diane and Luke had a variety of experiences during their teacher preparation program that seemed to shape their mathematics instruction. Diane's experience of feeling confused and lost in a Calculus class helped her realize how detrimental it can be when teachers move quickly through mathematics concepts and do not address students' questions and misconceptions. On the other hand, she valued both of her elementary mathematics content courses because they helped deepen her conceptual understanding of the concepts she would be teaching. In particular, she found the second mathematics methods course to be very helpful for developing

her discussion techniques in mathematics. Luke experienced a turning point when he created the mathematics unit plan for his second elementary mathematics methods course. At that point, he realized he could teach mathematics in a way that resonated with his overall philosophy of teaching, which involved using real-world, project-based applications of mathematics. Finally, both Diane and Luke experienced a strong degree of coherence between and among what they learned about teaching mathematics in their second elementary mathematics methods course, their cooperating teachers' mathematical instruction, and their own personal views about teaching mathematics. In the rest of this section, I provide more detail on this theme of coherence and the teachers' associated experiences.

When Diane started the university teacher preparation program, she planned to major in mathematics and become a high school mathematics teacher. Those plans abruptly changed when she had a frustrating experience with an instructor in a Calculus course. The instructor was not a native English speaker and he spent most of the class writing on the chalkboards without talking. According to Diane, every once in a while he would say to the class the same five words, "Understand? Very good, moving on." Even though Diane and many other students in the class were confused, the instructor would move on to the next chalkboard and continue writing without providing any explanation or letting anyone ask questions. Diane worried that subsequent university mathematics courses might be similar in nature, so she dropped that course and switched her teaching major to social studies. As a result of this experience, she explained that she never wanted to be the kind of teacher who moved on when her students were confused. Instead, she wanted to be available to answer questions and help them when they struggled.

Although Diane had that frustrating experience with the Calculus course, she did have productive experiences in both of the elementary mathematics content courses that were taught

by the Mathematics Department. She explained that she valued both courses because they were focused on "the understanding of why does mathematics really work." This mastery-oriented idea of developing deep conceptual understanding in mathematics was a recurring theme for Diane and she traced it back to some of her own experiences as a K-12 student.

Diane described an experience from 4th grade that she remembered vividly in which the teacher was trying to explain the concept of volume and she did not understand his explanation.

> Length times width times height. Okay. I don't get it. I don't get it. Well, you fill the cubes. What do you mean? I don't get it. I don't get what you're asking me to do. Why am I filling this box with cubes? It doesn't make any sense to me. I think that probably led to the – why am I doing this?
>
> (Diane, Interview, April 4, 2012)

Diane did not want to just *do* the process; rather, she wanted to also understand *why* the process worked and what it meant. She remembered feeling extremely frustrated because the teacher just kept explaining volume over and over again in exactly the same way. Eventually, Diane was sent to work with another teacher who was able to answer her questions and explain the concept in a way that made sense and helped her develop a conceptual understanding of volume. Diane highlighted these types of experience as leading her to focus on asking those why questions in order to make sense of what she was learning in mathematics.

As a learner, Diane experienced a high point in mathematics when she tested into Honors Pre-Calculus as a junior in high school. Although she had not previously taken any advanced mathematics classes, Diane desired the challenge and believed she was capable of the work. She felt successful when she scored high enough to be placed in the class and she found the class itself to be a productive learning experience. Diane's teacher understood that she had a strong

desire to understand the reasoning behind the mathematical procedures and concepts so she would take time to sit with Diane and explain why the formulas worked. It was not a situation in which Diane could not do the problems on her own, but instead an opportunity for her to take charge of her learning and make sure she developed a strong conceptual understanding of the mathematical concepts. Diane felt that her own success with mathematics developed from having deep conceptual understanding, so she believed in using mastery-oriented practices focused on developing understanding with her own students.

As a K-12 student, Diane seemed to be focused on mastery goals related to understanding content deeply. Although her teachers in elementary school did not always provide adequate explanations, she felt that her later success with learning and teaching mathematics resulted from her focus on asking why and developing conceptual understanding. In her own words, "It's probably led to a lot of my success with math – knowing why." In my observations of Diane's teaching, I saw her using mastery-oriented practices emphasizing understanding so her interpretations of experiences she had as a K-12 student seemed to have influenced her vision and enactment of effective mastery-oriented teaching practices.

Diane and Luke both described specific experiences from their second elementary mathematics methods course that helped them develop their own mathematics instruction. I was the course instructor for this particular class, which occurred during the first semester of their fifth year in the teacher preparation program. During that year, Diane and Luke spent one day a week at the university for methods courses and the other four days in their student teaching placements (except for a few weeks each semester when they were in their placements five days a week).

Diane talked about how her second mathematics methods course, in conjunction with her cooperating teacher, helped her develop effective discussion techniques that probed students' thinking and allowed them to develop conceptual understanding. She appreciated that I had modeled how the teachers should get their students to think, and how they should ask questions so the students "come to it by themselves." Diane described this strategy as an inquiry approach to teaching mathematics and she saw her cooperating teacher using the same technique.

> He seemed to agree with more of an inquiry style – kind of probing, getting it out of kids as opposed to feeding them the information. It was nice to watch him do it and be like – oh yeah, that was what I just learned about [in the mathematics methods course]. Okay, that's what it looks like. Now, can I try?
>
> (Diane, Interview, February 2, 2012)

Although a focus on developing understanding is a characteristic of a mastery orientation to teaching, the use of a more inquiry-based discussion approach to develop that understanding is not something that has been specifically connected to mastery-oriented practices in current literature. As mentioned in the previous section, Diane and Luke were both focused on helping their students develop understanding of mathematics concepts but Luke seemed to be much more focused on developing procedural understanding rather than conceptual understanding. There also seemed to be an important difference in how they structured their discussions with Diane using a more inquiry-based approach that allowed students to share their ideas and respond to each other and Luke using a more teacher-guided approach in which students followed a procedure and responded primarily to the teacher.

Diane also described an experience where she talked to her cooperating teacher about what she was learning in the second mathematics methods course.

> I remember the discussion book that we had with the discussion methods and the probing questions and different kinds of questions. I remember taking that to him [cooperating teacher] and we talked through that and he's like – that's ideally what you would want, a balanced assortment of questions that kind of elicit student ideas.
>
> (Diane, Interview, February 2, 2012)

Diane seemed to feel a strong sense of alignment and consistency between what she learned in her second mathematics methods course and what she learned from observing and talking to her cooperating teacher. There also seemed to be alignment with her personal vision of effective mathematics instruction, which she felt had been influenced by some of her own experiences with mathematics as a K-12 student. In the following interview excerpt, she described her experience during student teaching: "I could teach how I wanted. I was able to develop that. I learned how to question. That was the one thing that I always wanted to learn, how to get it out of kids." Diane felt that during her student teaching experience she was able to teach in the way that she had envisioned, which was using a more discussion-based inquiry approach to help students develop conceptual understanding of mathematics concepts. This matched up with what she saw being modeled in her second mathematics methods course and in her cooperating teacher's classroom.

Luke explained that he experienced a turning point in his vision of mathematics teaching as he developed the mathematics unit plan required for the second elementary mathematics methods course. Luke wanted to make the unit integrated and project-based, based on some

positive experiences he had with mathematics learning as a K-12 student. During high school, Luke had two mathematics teachers who incorporated a lot of group work and projects that applied real-world concepts to mathematics class and Luke had enjoyed learning in that environment. They also used the textbook as more of a resource than the driving force behind their daily instruction. Luke described the influence of these experiences on his teaching, "I think a lot of the things that I try to implement [as a teacher] are things that were successful for me, or things that I took a lot out of as a student and try to then replicate that."

After some initial struggle to find a way to achieve his goals, Luke designed a project-based unit that integrated mathematics and art. Luke said that in creating and teaching that particular unit he experienced a turning point because he realized, in his words, "I can do this, I can incorporate my overall teaching ideas into math. I think that before that point it was kind of still separate entities." His realization that he could teach mathematics in a way that resonated with his personal beliefs was further validated when he interviewed his students at the end of the school year and found out how much that particular unit had impacted their learning and enjoyment of mathematics.

Similar to Diane's experience, Luke was placed with a cooperating teacher who had graduated from the same teacher preparation program. He explained how his cooperating teacher had influenced his current teaching practices, "His influence on a lot of the things that I do is still prevalent. From the student-led conferences to approaching mathematics with an application viewpoint." He went on to describe how he worked with his cooperating teacher to apply mathematics to real-life situations in order to make mathematics more authentic and interesting for students. This represents a mastery-approach to teaching mathematics with a focus on making the content meaningful and enjoyable for students. Luke seemed to have

incorporated this approach into his vision of effective teaching based in part on his experiences as a K-12 student and it seemed to resonate with what his cooperating teacher was focused on in the classroom.

Luke described a strong sense of consistency between what he learned in his mathematics methods course, what his cooperating teacher modeled and encouraged in the classroom, and his own personal beliefs about teaching.

> I was very fortunate that I felt like he [cooperating teacher] was totally in line. There was not a missing beat at all. I think he has constant interns in there and I think his thought process for why to have interns in there was great because he wants to know what's going on in the teacher preparation program and he incorporates that. I didn't feel there was any disconnect. It was like going to [the second mathematics methods] class and I saw what he [cooperating teacher] was doing and it was very similar and what I was trying to do with my personal – like starting my personal beliefs on teaching – was very in line with what he was trying to do and also with [the teacher preparation program].
>
> (Luke, Interview, February 10, 2012)

Luke's cooperating teacher seemed to communicate that he enjoyed having student teachers so he could learn from them and continue to use practices consistent with what the teacher preparation program promoted. Luke seemed to view a strong sense of coherence, or what he referred to as being "in line," among what he learned in his second mathematics methods course, what he learned from his cooperating teacher, and his own personal beliefs about teaching.

In summary, Diane and Luke's mathematics instruction seemed to be influenced by several experiences during their teacher preparation program. Diane's painful memories of a

Calculus instructor provided her with a constant reminder of the teacher she never wanted to be, so she made a point of allowing her students plenty of time to explore and understand new ideas while also providing opportunities for them to ask questions and get further clarification as needed. Diane appreciated her elementary mathematics content courses because they focused on conceptual understanding in mathematics, which was something she had come to value from her own experiences as mathematics learner. Based on what she learned from her second mathematics methods course and her cooperating teacher, Diane developed her discussion techniques in mathematics to probe students' thinking and help them develop conceptual knowledge of mathematics concepts. These instructional practices were all mastery-oriented in that they emphasized the importance of understanding the mathematics concepts and providing time for exploration.

Luke's experience with designing and teaching his integrated, project-based mathematics unit for the second mathematics methods course allowed him to realize that he could teach mathematics in a way that incorporated his personal beliefs about teaching, which had likely been shaped by his own experiences as learner of mathematics. Luke worked with his cooperating teacher to develop ways to apply mathematics to real-world situations so that students would be more interested and view the tasks as more meaningful. His emphasis on making mathematics interesting and relevant was consistent with mastery-oriented practices.

Diane and Luke experienced a strong connection between three important components of their student teaching experiences: (a) the second elementary mathematics methods course, (b) their cooperating teachers, and (c) their personal beliefs and practices, which had been shaped by their own experiences as K-12 students. Both teachers saw an overlap between these three components in that similar ideas were being promoted, modeled, and used. The two teachers

experienced some parallels with regards to the first two components in that they were both in the same elementary mathematics methods course and they both had cooperating teachers who had graduated from the program and were teaching in ways that Diane and Luke felt were consistent with what the program promoted.

According to a situated view of learning, the multiple contexts and situations in which people learn are an important part of shaping the learning that actually happens (Putnam & Borko, 2000). Although Diane and Luke were exposed to mastery-oriented practices in their elementary mathematics methods course, their learning and application of mastery-oriented practices in their own teaching seemed to be a result of the multiple contexts and experiences they encountered during their student teaching year. They were placed in classroom settings in which they saw an experienced teacher using mastery-oriented practices and they were allowed to experiment with their own use of mastery-oriented practices. These experiences provided them with the opportunity to use the instructional practices they learned about in a supportive environment, get real-time feedback from their cooperating teachers and students, and then reflect on and adapt their own philosophies of teaching mathematics.

School and District Contexts

Although Diane and Luke seemed to develop beliefs and practices during teacher preparation that were primarily mastery-oriented, they experienced different kinds of supports and constraints in their full-time teaching contexts that seemed to influence their use of mastery- and performance-oriented practices. Diane felt supported by her vice principal to focus on mastery-oriented practices and teach mathematics in much the same way she had taught during student teaching, but school expectations around student test scores influenced her use of some performance-oriented strategies that were in conflict with her beliefs. In his first year, Luke felt

constrained by the 2nd-grade curriculum and perceived principal expectations and found himself teaching mathematics in ways that were inconsistent with his beliefs and how he had taught during student teaching. When Luke moved to teaching 4th grade in his second year, he no longer felt the same curriculum constraints and was able to teach in ways that were consistent with his beliefs and how he had taught during student teaching. Although he did not agree with the strong emphasis on test scores at his school, Luke felt that his students' strong performance on mathematics post-tests seemed to validate his teaching practices in the eyes of his principal. In the rest of this section, I provide more detail on these various supports and constraints.

Although Diane had three administrators at her school (principal, vice principal, and academic coach), her main source of support was Mary, the vice principal. When I visited Cooper Elementary, Mary told me how impressed she was with Diane's mathematics instruction and how she wished more teachers at the school would change their instruction and teach more like her. In fact, during Diane's first year at the school, Mary often brought in graduate students or other teachers to observe her teaching. Mary also repeatedly videotaped Diane's mathematics instruction so she could show the lessons to other teachers as examples. Diane explained that while she used more of an inquiry- and discussion-based approach to teach mathematics, many of the other teachers in the building seemed to use more of a direct instruction approach focused mainly on procedures and correct answers. Even though Diane was new to the school and taught in a way that was very different from the other teachers, she seemed content with being a renegade since she had the strong support of her vice principal and she felt confident that she was teaching in the way that was best for her students.

Diane viewed her first year of full-time teaching as similar to her student teaching year in that she taught two mathematics lessons each day, and she constantly worked on fine tuning the

inquiry and discussion approaches she had previously developed. She described a variety of mathematics curriculum resources at her disposal but there seemed to be no expectations about using any of the resources in a certain way. Diane felt she had the freedom to use the resources provided by the school or her own resources to teach the content in the way she thought was best as long as she covered all the required mathematics concepts.

At Cooper Elementary, there was a strong focus on testing in mathematics. Students completed benchmark tests three times a year on Scantron sheets, and they also completed a computer-based test called Learning Link three times a year. Additionally, the students completed the state assessment at the end of the year. After Diane listened to me administer the student survey to her class, she told me that her students would most likely rate her highly with regards to the practice of publicizing who received the highest test scores. As it turned out, Diane's students did rate her very highly on that practice ($M = 4.00$). Diane explained that due to the strong test score focus at her school, she was required to publicly talk about students' performance on the benchmark tests by listing off students' names and proficiency scores. She did not agree with this performance-oriented practice and she would have much rather preferred to talk to students about their benchmark scores on a more individual and private basis. In order to try to focus less on the actual score (performance focus) and more on the students' progress (mastery focus), she made a point of recognizing when students showed improvement in their proficiency levels. She would announce that a student had shown improvement and ask the entire class to give them a round of applause as a way to acknowledge the student's progress. This approach resonated with Diane's response on the teacher survey that she made an effort to recognize students' individual progress in mathematics, even if they were below grade level.

Although Diane was comfortable with being a renegade and teaching in the way she believed was best, Luke felt pressured in his first year of full-time teaching to do what the rest of the 2nd-grade teachers did because he thought that was what his principal expected of him.

> I felt like I had to conform. Especially not knowing when people would come in, the principal or other people, and if the kids were doing something that they weren't supposed to be doing, how that would reflect on me. Or if they were too loud, how that would reflect on me. So I think I was more worried about what administration would think if they came in rather than if the kids were getting the most out of it.
>
> (Luke, Interview, February 10, 2012)

Whereas Diane's vice-principal was extremely supportive of her mathematics instruction and used her as a model for other teachers, Luke felt that his principal did not provide him with much positive feedback about his instruction during his first year of teaching. Instead, he remembered receiving feedback about multiple things he was not doing that seemed insignificant to him.

> It was usually, "Well, you're not doing this and you're not doing this." And it was really small things like - you're not using your microphone. It had nothing to do with instruction at all. It was just tiny little things that I thought were really trivial.
>
> (Luke, Interview, February 10, 2012)

Luke was so frustrated that he actually initiated a conversation with his principal and asked, "When you hired me, I'm just wondering if I'm the teacher that you thought I was?" Although she responded that he was the teacher she thought he was, she did not provide any follow-up explanation or offer any further positive comments.

Luke also felt constrained by the mathematics curriculum during his first year of teaching. The materials for 2nd grade included disposable student workbooks that the school had to pay for each year. He explained, "I really felt constrained by those disposables. They paid a lot of money for them and I felt like if I didn't use them then that would be a reprimand of sorts." He seemed to feel pressured to have the students fill out the workbook pages in mathematics class every day so that he would not be reprimanded by the principal for wasting the school's money. Although Luke believed strongly in having students work together in groups, discuss the mathematics, and explore mathematics with real-world applications, he did not incorporate any of those mastery-oriented practices into his instruction during his first year of teaching. Instead, he found himself standing in front of the class, going through examples of problems and then having the students complete the workbook pages. During that year, Luke seemed to experience conflict between his vision of effective mathematics teaching and what he was actually doing in the classroom.

When Luke moved to 4th grade for his second year of teaching, there were no disposable workbooks for that grade so he no longer felt confined by having to fill out workbook pages every day. He also felt more comfortable teaching the content since he had done his student teaching in a 4th/5th-grade classroom. As a result of these changes, Luke found that he was able to use a more mastery-oriented approach to teaching in his second year, much like he did during his student teaching experience. He explained that he felt he had "more control of the meaningfulness of the activities they're doing [in mathematics]." He incorporated group work, explorations, manipulatives, projects, and real-world connections as much as possible.

As mentioned previously, Luke and his 4th-grade teammates were required to use district-created pre-tests to group their students into three leveled groups (high, medium, and low) for

each block. At the end of each block, the students took a post-test and the principal's expectation was that teachers should be able to help all the students in their group improve their test scores. Luke explained that his principal placed a very strong emphasis on these particular tests and the percentage increase in students' scores. In fact, when I met Luke's principal during my first visit to the school, she made a point of telling me that he was a fantastic teacher because his students had shown high levels of growth in their post-test scores.

Although the strong focus on test scores did not necessarily affect Luke's use of certain instructional practices (other than how the students were grouped), he did experience an unexpected benefit from his students showing tremendous growth on their post-test scores. Luke felt that, in his second year, his principal seemed to view him as an exemplary teacher due to these test score results. Since he spent the majority of his first year worried about job security and how his principal viewed him as a teacher, it was a relief for Luke to feel that worry and pressure lessen in his second year.

> What I'm doing is obviously showing some success. It's not perfect by any means but – and I'm not saying I can't take advice from somebody saying, well this is what you should do or whatever. But it feels good that you know that what you're doing, the stuff that you're planning and spending time on planning, is not only showing success for the kids but when administration or anybody else comes in they have that in mind already before they come in. So it kind of makes it a little less hectic and fearful I guess.
>
> (Luke, Interview, February 10, 2012)

Even though Luke did not agree with the focus on test scores, he felt the results seemed to validate and provide evidence that the mastery-oriented practices he was using in his 4th-grade

classroom, and had used previously during student teaching, were helping students learn the mathematics content.

In summary, during their first year of full-time teaching, Diane and Luke had very different experiences with teaching mathematics due to varied support from administrators. Diane was able to continue teaching in the mastery-oriented style she had developed during her student teaching because she had the support of her vice-principal and the freedom to plan her instruction in the way she thought was best. Luke, on the other hand, felt a disconnect between his student teaching experience and his first year of teaching due to perceived constraints based on the curriculum and principal expectations. Although Luke did not necessarily describe using more performance-oriented strategies, he did indicate that he used mastery-oriented strategies less often in his first year of teaching. These examples illustrate how school administrators can be an integral part of the context that a beginning teacher experiences and learns from in his or her first year of teaching. Beginning teachers have to negotiate the expectations of their school administrators and whether those expectations support or conflict with their own developing practices and identities as mathematics teachers.

In addition, perceived district and school expectations also seemed to have an influence on Diane and Luke's uses of mastery- and performance-oriented instructional practices. Although Diane personally disagreed with the practice, she was required to publicize students' test scores and levels of proficiency. Diane's students clearly perceived her to be using this performance-approach practice, but she tried to put a mastery-oriented spin on it by focusing on students' improvement. When Luke moved from 2nd to 4th grade, he did not feel the same school and administrator expectations about using the curriculum in a certain way so he felt free to incorporate more mastery-oriented practices into his instruction. Although the focus on test

scores at his school did not necessarily influence his instruction in a certain way, it did seem to influence how his principal viewed him as a teacher. As a result of Luke's scores showing remarkable growth in student learning, the principal seemed to view him as a talented teacher deserving of praise.

Visions of Effective Teaching

During the interviews, I asked the teachers how closely their instruction resembled the way they envisioned themselves teaching mathematics. Although Luke experienced some challenges during his first year, he felt that in his second year he was teaching in the way he had envisioned teaching mathematics. In his first year at Northwest Elementary, Luke did not teach mathematics the way he wanted due to the constraints he felt from the student workbooks and his principal's expectations. During his second year of full-time teaching, Luke believed that he was teaching exactly the way he had envisioned teaching math. He described the process of balancing his own views about teaching with various school and district expectations as being similar to making a Venn diagram.

> It was kind of like making this Venn diagram where you had on the one side this idea that you wanted to have and on the other side you had this idea that the district and the school building wanted you to have and you kind of had to find the medium ground in there.
>
> (Luke, Interview, February 10, 2012)

Luke found it difficult in the beginning to look at that Venn diagram and, in his own words, ask himself, "How do I take what I've been taught and what I believe in and incorporate that so I continue to get paid?" He also described the circles in the Venn diagram as constantly moving so the district circle would get bigger when a district person came in to observe him and he

emphasized certain practices they were looking for, and once they left the personal circle expanded as he emphasized practices that he believed were best for students.

Diane, on the other hand, felt that her instruction during student teaching was closer to her vision of effective mathematics teaching, and the main reason she cited was the huge focus on test scores at Cooper Elementary.

> I think the style that I wanted to obtain, the inquiry style, the questioning styles, was something I developed during my [student teaching] internship. But in terms of actually being able to teach how I believe, my [student teaching] internship was a little more true to that than this is down here.
>
> (Diane, Interview, February 2, 2012)

During student teaching, she did not remember experiencing school or district pressures related to test scores that influenced her instruction in any significant way. In fact, Diane said that the state assessment was hardly mentioned except during the weeks when the students actually took the test. There were no pep rallies or countdowns to the test date at her student teaching school, as there were at her current school in Tennessee. As a student teacher, Diane felt the freedom to teach in the way she believed was best, based on what she learned from her mathematics methods course and her cooperating teacher. At Cooper Elementary, Diane felt the pressures of school and district expectations about test scores and required teaching practices. Although she focused on using mastery-oriented instructional practices in mathematics, she was also required to implement some performance-oriented practices that went against her personal beliefs. Diane described her single greatest challenge in teaching mathematics to be "playing by the rules" when she did not agree that the rules and requirements provided the best learning opportunities for her students. Examples of playing by the rules for Diane included being required to publicize

students' test scores and use those scores to group students for mandatory small-group focus time.

Although Diane and Luke experienced a great deal of coherence between different learning contexts focused on mathematics instruction during their year of student teaching, they both experienced a disconnect and lack of coherence in their full-time teaching contexts. Luke's image of a Venn diagram with constantly moving circles illustrated his attempt to balance his own vision of effective mathematics teaching with school and district expectations. Diane described her struggle as having to play by the rules and follow school and district expectations that were in direct conflict with her beliefs. In both cases, the experiences the teachers had during their teacher preparation program seemed to prepare them for using mastery-oriented strategies in mathematics instruction, but did not necessarily prepare them for navigating the different pressures and expectations about instruction they would experience once they started their full-time teaching.

Summary of Chapter Findings

Diane and Luke appeared to have similar views and practices related to mastery-oriented instruction in mathematics, but they varied with regards to performance-oriented instructional strategies. Using a situated learning view, I describe the factors that seemed to influence their views and practices.

In developing their visions of effective mathematics teaching and the kinds of teachers they wanted to become, Diane and Luke utilized some personal experiences they had as K-12 students. By discovering what worked and did not work for them as students, they formulated a vision of effective teaching that incorporated some mastery-oriented practices. Based on experiences in elementary school, Diane learned the importance of focusing on conceptual

understanding in mathematics while providing multiple explanations and strategies. Luke's positive learning experiences with some high school mathematics teachers helped him see the importance of incorporating project-based learning with real-world applications.

During the final year of their teacher preparation program, Diane and Luke both experienced a strong degree of alignment among: (a) their second elementary mathematics methods course, (b) their cooperating teachers, and (c) their personal beliefs and practices. They were in the same mathematics methods course that year so they were exposed to the same mastery-oriented instructional practices. In addition, they both had cooperating teachers who had graduated from the same teacher preparation program and were modeling and encouraging the use of mastery-oriented instructional practices. This situation allowed Diane and Luke to see the practices they were learning about in the mathematics methods course modeled daily in their student teaching classrooms. Both teachers felt that the practices being modeled in the mathematics methods course and in their student teaching classrooms also resonated with their own personal visions of effective mathematics teaching, which had been influenced in part by their experiences with mathematics as K-12 students. As a result, Diane and Luke were able to observe and experiment with using mastery-oriented instructional practices on a regular basis in a supportive environment. This opportunity allowed them to further develop and refine their visions of effective mathematics teaching. These experiences seemed to be associated with Diane and Luke's use of mastery-oriented practices in their mathematics instruction.

When Diane and Luke began their careers as full-time teachers, they experienced some new pressures and expectations that seemed to influence their use of mastery- and performance-oriented instruction in mathematics. In his first year of teaching, Luke felt constrained by the mathematics curriculum and his principal's expectations for how he should be using the student

workbooks. Due to these perceived constraints, he found himself straying from his vision of effective mathematics teaching and using less mastery-oriented strategies. For example, he was no longer using group work, discussion, or real-word applications of mathematics as he had done often during his student teaching. Diane, on the other hand, felt that her vice-principal supported and actively encouraged flexibility with the curriculum and use of mastery-oriented teaching strategies in mathematics. For example, she was encouraged to pick and choose from the wide variety of curriculum resources at her disposal and to continue her focus on using an inquiry and discussion-based approach to help students develop conceptual understanding in mathematics. As a result, she was able to teach according to her vision of effective mathematics teaching.

School expectations related to students' performance on district and state assessments seemed to have different types of influences on Diane and Luke's experiences during their full-time teaching. Diane found herself forced to use some performance-oriented strategies she did not agree with such as publicizing students' test results from benchmark tests. Consequently, she felt that these pressures and expectations moved her away from her vision of effective mathematics teaching. In his second year, Luke moved to 4th grade and, due to the absence of a student workbook, he no longer felt the same demands to use the curriculum in a certain way. He moved back towards his vision of effective mathematics teaching as he incorporated the mastery-oriented strategies he had used during student teaching (e.g., group work, explorations, manipulatives, projects, discussions, and real-world applications). When his principal praised him for his students' growth on post-test scores, Luke felt that his vision of effective teaching and his use of mastery-oriented strategies had been validated to some degree.

In conclusion, I argue that Diane and Luke's focus on using mastery-oriented instructional practices in mathematics seemed to be heavily influenced by the strong degree of

alignment they experienced among their second mathematics methods course, their cooperating teachers, and their own personal beliefs about teaching. As a result of what these two teachers learned from those aligned contexts, they developed their identities as teachers in relationship to the use of mastery-oriented teaching practices in mathematics, such as emphasizing the importance of understanding, effort, group work and applying mathematics to real-life. When they moved to their full-time teaching contexts, they did not experience that same sense of alignment as they were faced with some performance-oriented constraints and expectations. Diane and Luke had to renegotiate their identities as teachers and decide how to meet the school and district demands while also trying to stay consistent with their visions of effective mathematics teaching. In their second year of teaching, both teachers seemed to have found ways to address what was expected of them but yet still maintain their identities as teachers who focused on mastery-oriented practices in order to provide the optimum learning experiences for their students in mathematics.

CHAPTER 6: ANDREA AND KELSEY

Overview

In this chapter, I present a case study of two teachers who had very different paths during their teacher preparation experience but ended up teaching 5th-grade mathematics at the same school (Draper Upper Elementary) during their first year of teaching. In this case study, I address the research questions about factors that seemed to influence teachers' use of different instructional practices. I argue that Andrea and Kelsey's active participation in certain communities of practice seemed to have a strong influence on their learning and use of mastery-oriented teaching practices in mathematics. During student teaching, Andrea was an active participant in the multifaceted community of practice around mathematics instruction at her school setting. Kelsey did not have the same kind of experience with a community of practice during student teaching, but she did learn content and teaching strategies from her university mathematics content and methods courses. When Andrea and Kelsey ended up teaching at the same school, they created their own two-person community of practice focused on mathematics teaching. Through this community of practice, Andrea and Kelsey shared what they had learned from their previous experiences and worked together to develop their mathematics instruction and their identities as teachers of 5th-grade mathematics. This community of practice was especially important for their learning and development since Andrea and Kelsey experienced a lack of support and resources for teaching mathematics from their administrators at Draper Upper Elementary.

In order to build my argument, I begin the chapter by providing some background on the school where the two teachers worked during the time of the study. Next, I use data from the observations to describe Andrea and Kelsey's mathematics instruction and use of mastery-

oriented practices. Then, I use interview data to show how Andrea and Kelsey's use of mastery-oriented strategies seemed to be strongly influenced by Andrea's participation in a community of practice during her student teaching experience and the two-person community of practice that Andrea and Kelsey created during their first year of teaching at Draper Upper Elementary. Finally, I use interview data to explore how a lack of expectations, support and resources related to mathematics instruction in the school context prevented Andrea and Kelsey from fully enacting their visions of effective mathematics teaching.

Description of School Context

At the time of the study (2011-2012), Andrea and Kelsey were both in their first year of full-time teaching at Draper Upper Elementary in the Greenwood (Michigan) School District. Andrea had actually worked at the school as a long-term substitute teacher during the previous school year, so she was not brand new to the school setting. She had finished her student teaching experience a few weeks early (March 2011) and was hired as a long-term substitute through the end of that school year. During the summer of 2011, Andrea and Kelsey were both hired to be 5th-grade teachers at Draper Upper Elementary for the 2011-2012 school year.

Draper Upper Elementary was one of two upper elementary schools in the district that served 5th- and 6th-grade students. The Greenwood School District had recently reconfigured its school buildings so Draper Upper Elementary had only been in existence since August 2010. The reconfiguration of the schools happened very quickly over the summer of 2010 so teachers from various elementary and middle schools were moved to Draper Upper Elementary.

During the 2010-2011 school year, Draper Upper Elementary had 892 students, with 453 students in 5th grade and 439 in 6th grade. The racial/ethnic breakdowns for the students were as follows: 63.8% White, 30.8% African American, 3.6% Hispanic, 1.1% Asian, 0.6% Multiracial,

and 0.1% American Indian. In addition, 56.8% of the students qualified for free or reduced lunch. Although Draper Upper Elementary had made Adequate Yearly Progress (AYP) in mathematics and reading for both 2010 and 2011, there was a big difference between the scores for the two subjects. I will focus on 5th grade since that is the grade that Andrea and Kelsey were teaching, but the 6th-grade scores showed similar patterns. In 2010, 32% of 5th-grade students were proficient in mathematics, while in 2011, 31% were proficient in mathematics. For reading, 60% of 5th-grade students were proficient in 2010 and 59% were proficient in 2011. Although the students' test scores were much lower in mathematics than they were in reading, the administrators at Draper had decided that the primary focus at the school should be on reading. As a result, there were many expectations for teachers related to reading instruction and almost no expectations for mathematics instruction. This was a frustration for both Andrea and Kelsey, and I will explain this in further detail later in the chapter.

Although Andrea and Kelsey ended up teaching the same grade level at the same school, they had very different paths during their teacher preparation program due to the requirements for their different teaching majors. In the upcoming sections, I will describe their use of similar mastery-oriented instructional practices and explore how their participation in certain communities of practices seemed to contribute to those similarities.

Descriptions of Observed Instructional Practices

In this section, I use data from classroom observations to provide a description of Andrea's and Kelsey's mathematics instruction. Both Andrea and Kelsey used similar mastery-oriented strategies in their instruction. They both focused on the importance of understanding the content by continually asking students to explain their thinking and reasoning, whether in a whole-class discussion or in small-group work time. Andrea and Kelsey provided their students

with time to explore concepts and develop their understanding by working on tasks with partners or groups. Both teachers tried to create multiple ways for students to participate in lessons and have an active part in the construction of conceptual knowledge through strategies such as individual whiteboards, partner/group discussions, showing thumbs up/down for agreement/disagreement, and having students share their ideas out loud or on the Smart Board. Andrea and Kelsey incorporated the use of authentic real-world problem solving tasks to help the students see the importance of mathematics beyond the classroom. In my observations, I also saw Andrea and Kelsey explicitly communicating some messages related to mastery-oriented goals. In particular, I saw Kelsey telling students that everyone makes mistakes and students should learn from those mistakes to develop their understanding. She also communicated to students that mathematics could be challenging but they were capable of figuring out the problems and achieving success through hard work, discussion, problem solving and working together. Andrea told students that it was important to ask questions when students were confused or they needed help.

Mathematics Workshop Approach

Since Andrea and Kelsey did all of their planning together, I was able to see how they enacted the same lesson in each of their two classrooms. On my first visit, they were both using a mathematics workshop approach to teach a lesson on exponential notation. This approach utilized a whole-class mini-lesson following by students working together in groups to complete activities. During the small group work time, the teachers would either work with a specific group or move around to work with multiple groups.

Kelsey's mathematics workshop lesson. In the lesson I observed on exponential notation, Kelsey began by having students look at some equations on the Smart Board (e.g., 3^2 =

3 x 2 = 6) and then discuss with their table group whether they agreed or disagreed with the equations and why. As students discussed the problems in their groups, Kelsey walked around to each group so she could listen to student thinking and ask clarifying or probing questions. After students talked in table groups, Kelsey brought them back together as a whole class and asked students to share their ideas. After a student shared an idea, she would turn to the whole class and ask if they agreed or disagreed. Here is an example from the classroom discussion ("K" stands for Kelsey and "S" stands for student):

K: Table 3. Do you agree? Why or why not?

S1: We do not agree because three to the second power is – it would be three times three not three times two.

K: Okay. So they're saying three to the second or three squared equals three times three, which equals – did you tell us?

S1: Nine.

K: Nine not three times two. Anyone else agree with them?

(Many students raise their hands.)

K: Anyone else disagree with them?

(No one raises his or her hands.)

K: So did our tables say that they did not agree with this [3^2 = 3 x 2 = 6]? Yes, that's what I heard when I was walking around.

(Classroom Observation, January 30, 2012)

In this example, Kelsey restated the idea shared by the student who was speaking on behalf of his group. She did not evaluate the answer, but instead asked the whole class to decide if they agreed or disagreed with what was shared. After the rest of the students showed their agreement

with what the student (S1) had said about 3^2 not being equal to 3 x 2, Kelsey confirmed that was what she heard table groups say when she was walking around. This was an example of how Kelsey involved the students as active members of the learning community and provided them with opportunities to respond and evaluate each other's ideas.

After the mini-lesson, Kelsey called a few students by name to move over to the kidney-shaped table to work with her. The rest of the students worked independently or with a partner/group of their choice to complete the assigned pages in their Everyday Mathematics student workbook. Students were allowed to work anywhere so they were spread around the room with some sitting on the carpet and others working at desks. A couple of students who Kelsey did not call by name asked to join her small group so she ended up with eight students at the table.

Kelsey started her work with the small group by asking them, "Okay, so what do we feel? Tell me what we are thinking about this [exponential notation] so far?" After some students shared, Kelsey launched into the first problem in the student workbook. As she worked with this group, she never rushed them or told them what to do, but instead she asked them a lot of guiding and probing questions. At one point, Kelsey commended a student (Amanda) who had checked her work and was able to figure out where she had made a mistake and what she had done wrong.

> See, do you know what, that's great Amanda. You said - okay, this is how I tried to figure it out myself and then you said – okay, maybe I should check my answer. And you went back and checked it. Excellent.
>
> (Classroom Observation, January 30, 2012)

She then asked the student to explain her thinking process to the rest of the group so they could learn from her process. Kelsey made a point of praising this student's efforts by saying, "I liked her thinking – what was in her brain." She also emphasized to the small group that it was okay to make mistakes. Kelsey worked with this group until the time for mathematics class had ended.

Andrea's mathematics workshop lesson. Andrea's lesson on exponential notation began with all the students seated on the carpet for the mini-lesson. She started by putting a couple of problems on the Smart Board and asking students to solve them on their individual whiteboards. As they worked, Andrea walked around and observed what they were doing on their whiteboards and sometimes asked questions. She had a few students go up to the Smart Board to write out their solutions and explain their thinking to the class. After students explained their thinking, Andrea would ask follow-up questions to the rest of the class to see if they understood what the mathematical notation meant. The following is an excerpt from the classroom discussion ("A" stands for Andrea and "S" stands for student):

A: Okay. Hillary, can you explain what you wrote over there?

S1: Yeah. I did two to the fourth power because there were four twos. Instead of writing two times two times two times two – you just put the four to represent there's two fours…

A: There's…

S1: Four twos.

A: There's four twos. Is it [3×2^4] saying three times two times four?

(Some students raise their hands.)

A: Larissa, why is that not right?

S2: It's kinda like the four is kinda like a replica…

A: Can you repeat that a little louder again?

S2: I was saying it's like the four is like a little replica of all the four twos that's on the chart and so then you don't have to write all four twos so you want to add that because it's kinda like… it's like there's four twos right there…

A: So when you are saying replica you're kind of saying it…

S2: It's repeated four times

A: It's repeated four times. Okay.

(Classroom Observation, January 30, 2012)

In this example, Andrea had Hillary explain what she had written on the Smart Board. Hillary made a mistake ("two fours" instead of "four twos") as she was explaining but she seemed to catch her own mistake and clarified her contribution. Then Andrea asked the class a follow-up question to see if they understood the notation. Larissa responded with an explanation that was slightly hard to follow, but Andrea asked her to clarify what she meant by "replica" in order to help other students understand Larissa's explanation. In this way, Andrea showed that she listened to and valued students' ideas and explanations.

As with Kelsey's mathematics workshop lesson, Andrea seemed to involve the students in understanding some of the key mathematical ideas and notations by having them respond to and evaluate different ideas. At one point in the lesson, a student raised her hand to tell Andrea she did not understand something that was shown on the Smart Board. Andrea went back and worked through the exponential notation problem step-by-step and checked in with the student at each step to make sure she understood the use of notation. Once she was sure the student had cleared up her confusion, Andrea commended the student for stopping the lesson to ask a

question by saying, "All right. I like that you stopped me right there so you could keep up." She seemed to be communicating to students the importance of asking for help when they were confused about something.

For the rest of the lesson, students worked with a partner or a group of their choice to complete the pages in the student workbook. They were allowed to spread around the room and work wherever they wanted so there were students on the carpet, at their desks, at the kidney-shaped table, and sitting on the tile floor in the corner of the room. Instead of working with just one group, as Kelsey had during her mathematics workshop lesson, Andrea continuously moved around the room and went from group to group. She often returned to some groups multiple times but usually only spent a few minutes with each group so she could get to as many as possible. Andrea said that she tried to get to at least three-fourths of the students every day during this part of the mathematics workshop lesson.

Problem-Solving Group Project Lesson

When I first interviewed Andrea and Kelsey in January 2012, they mentioned that they always let students work in partners or groups during mathematics workshop time but they had not done much in the way of using problem-solving group projects or leveled activities. This was something they had planned to incorporate into their lessons as the year progressed. When I observed in March 2012, both teachers were using real-world group projects focused on the concept of area but they had developed different projects to use in each of their classrooms.

Andrea's problem-solving group project lesson. Andrea designed a project in which students worked in groups to measure different parts of the classroom and hallway. She gave the project a real-world application by explaining that she was going to share the measurements with

Kelsey so she could figure out whether all of her teaching materials would fit if she switched classrooms. The following excerpt shows how Andrea launched the problem:

> We are going to be in groups and you guys are expert measurers for finding the area in this room. Remember how I talked about [Kelsey] wanting to come down here next year and how we don't know if all her stuff will fit? So we're going to take some measurements and then we'll figure a little bit out tomorrow during our read-in and then we'll send her the information.
>
> (Andrea, Class Discussion, March 29, 2012)

The students had worked with Kelsey and her students before and they knew that the two teachers hoped to have their classrooms next to each other the following year, so this was an authentic context for the students.

Andrea designed the problem as a tiered task, so she grouped the students and had three different versions of the measuring task that were appropriate for the different students' skills and abilities. Before the students began their group task, she did a mini-lesson review on the concept of area and had the students help her measure and calculate the area of the Smart Board in the classroom. During this mini-lesson, Andrea involved students in the discussion by having them share ideas with a partner and/or the class. She also had some students actively involved in helping her measure the dimensions of the Smart Board and calculate the area.

For the measuring task, students had to work together to measure various items (e.g., desks, textbooks, rug, door, hallway, etc.) and show their work for calculating the area. Much like in the mathematics workshop lesson I observed, Andrea moved around from group to group. Sometimes she would just listen in to see what groups were doing and other times she would intervene if she wanted to ask questions or noticed groups were having trouble working together.

At the end of the lesson, Andrea called the students back together and had them sit on the carpet. She asked them to reflect on their group work and think of three things that went well and one thing they could improve on for next time. Students shared that they did well with things such as: problem solving, teamwork, helping each other, and working together to figure out the correct answer. Some students also talked about how much they enjoyed the problem-solving task because it allowed them some freedom in how to approach the task and they were able to tackle a challenging question such as how to measure the hallway when it was an irregular shape. When students shared what they could improve on, it usually had to do with not working together as a group or communication issues. As groups shared, Andrea affirmed what they said and emphasized the importance of cooperation and working together. The following is an excerpt from the conversation as a group shared what they needed to work on (A = Andrea, S = students):

S1: We compared people to other people.

A: What do you mean?

S1: Like our group split on that one and then you made us come back together.

A: How did that help you in the end?

S1: To stay at one place so two people don't feel left out.

A: Right, and you weren't the only group that did that, you know. Two people were still kind of multiplying and figuring out the area of one and two other people had moved on. And then we had to say, you know what, we're all in a group so we should probably stick together on one measurement, right?

(Classroom Observation, March 29, 2012)

Throughout the mini-lesson and activity, Andrea praised the students for their thinking and/or their efforts. She ended the lesson by telling the class that they "really did an awesome job" and she observed "good conversations" happening within all the groups. Andrea asked the students to give themselves a round of applause because "pretty much everyone was on task the whole time."

Kelsey's problem-solving group project lesson. For Kelsey's project, she had her students work in groups to decide on the ideal size for a reading cushion for them to use in their classroom. She made this an authentic real-world task by telling the students that her mom had some extra fabric left over from the chair she had covered for Kelsey's classroom and she wanted to use it to make reading cushions for the students. So, in addition to figuring out the ideal size for a reading cushion, the students had to use the information provided to figure out how many cushions Kelsey's mom could make with the fabric and rubber foam she had available.

In order to launch this task, Kelsey had the students gather on the carpet at the back of the room. She framed the context of the problem by reading a letter that her mom had written to the students explaining the task. "Dear Room 100. I need your help. There is fabric left over from the cowboy chair. Would you enjoy having some reading cushions to use when you're sitting and reading in the classroom?" Kelsey then reviewed the concept of area with the students and had them read through the task sheet together and talk about the different steps. She kept stressing the real-world connection to the problem by showing pieces of the fabric that matched the chair she was sitting on and talking about how the students would get to use the reading cushions and benefit from their work as "mathematicians."

As students began working on the task in their groups, Kelsey moved around constantly between groups as Andrea did during her problem-solving lesson. She would often sit with a group for a few minutes and ask them questions to see what they were thinking or what they had figured out. The following excerpt provides examples of the questions Kelsey asked as she worked with one group. I could not hear what the students said in response, but this is still helpful for showing how Kelsey interacted with students and groups during the lesson.

K: Then what did you do?

(S1 explains her process.)

K: What were you thinking? What was going through your head?

(S1 explains her thought process.)

K: Finding the area of what?

(S1 responds.)

K: That's all right. Do you know what? If you're taking it in your own way and you are still trying to figure out the answer to the problem, that's okay.

(S1 responds.)

K: It's challenging but there's an end goal, isn't there? So, if you think this is the idea, now what is the area?

(Classroom Observation, March 29, 2012)

In this example, Kelsey asked a lot of questions to learn about what the student was thinking and what she had done to try to solve the problem. She also affirmed that the task was challenging and it was acceptable if students needed more time to figure out the problem using the strategies that made sense to them. If students were struggling, Kelsey would ask them to tell her what they knew, what they were confused about, and what questions they had already asked their

group. She always encouraged them to talk to their group members and work together. Many times I heard Kelsey acknowledge that the task was challenging and it was normal to struggle and have to try different strategies in order to figure it out.

At the end of the lesson, Kelsey brought the students back together as a whole class to sit on the carpet and talk about the task. She referred to them all as mathematicians and emphasized how great it was that different groups were solving the problems in different ways because "we all solve problems differently in our heads and with our groups."

In summary, I observed Andrea and Kelsey to be using a variety of mastery-oriented strategies in their mathematics instruction. They both emphasized the importance of understanding the content by focusing less on correct answers and more on students' explanations of their thinking and reasoning. Students in both classrooms were given time to explore new concepts and they had multiple opportunities to work with peers to develop their conceptual understanding. Andrea and Kelsey also provided many ways for students to share their ideas or ask questions so that their voices were heard and their ideas were valued. Through group problem-solving activities, both teachers incorporated real-world applications of mathematics that were engaging and authentic for the students. Kelsey, in particular, emphasized the value of mistakes in the learning process and the importance of effort for success in mathematics. Andrea communicated the importance of asking for help when students were confused.

Factors Associated with Instructional Practices

In this section, I use data from the teacher interviews and classroom observations to examine the different factors that seemed to influence Andrea and Kelsey's instructional practices. Using a situated view on learning, I explore what these two teachers seemed to learn

about teaching mathematics from the contexts they participated in both as students and teachers. I argue that Andrea and Kelsey's mathematics instruction and use of mastery-oriented strategies as 5th-grade teachers at Draper Upper Elementary seemed to be strongly influenced by the community of practice Andrea participated in as a student teacher and the community of practice Andrea and Kelsey created as first-year teachers.

Andrea and Kelsey had very different experiences during teacher preparation. As a student teacher, Andrea was an active participant in a multifaceted community of practice at her school. She had the opportunity to work closely with a variety of teachers including: her general education cooperating teacher, her special education cooperating teacher, another classroom teacher at the school, another student teacher at the school, and other teachers in the school district. Through this community of practice, Andrea learned how to adapt the Everyday Mathematics curriculum and use a mathematics workshop approach to teaching. She also learned how to utilize co-planning, co-teaching and targeted small-group instruction to maximize students' learning in mathematics.

As a contrast, during Kelsey's student teaching, she did not perceive any opportunities to work with communities of practice focused on mathematics teaching at her school. In order to plan and teach mathematics to her kindergarten students, she relied on what she had previously learned from her experiences in her mathematics content and methods courses. When Andrea and Kelsey began their first year of full-time teaching at Draper Upper Elementary, they created their own community of practice where they could share and learn from each other. In this community of practice, Andrea shared with Kelsey the knowledge she had gained about adapting the Everyday Mathematics curriculum, using a math workshop approach, and teaching mathematics to upper elementary students. Andrea and Kelsey also worked together to integrate

things they had learned as classmates in their first mathematics methods course. As a result of this community of practice, Andrea and Kelsey were able to further develop their mathematics instruction and their identities as teachers of 5th-grade mathematics.

Teacher Preparation Program

Andrea and Kelsey's experiences in the teacher preparation program were different from Diane and Luke's in that they did not experience the same strong sense of alignment or coherence between their mathematics methods courses, their cooperating teachers, and their visions of effective mathematics teaching. Instead, Andrea and Kelsey seemed to have a few separate and disconnected experiences in the program that provided them with opportunities to develop their knowledge and practice related to teaching mathematics. Andrea thought the two mathematics content courses helped her develop a better understanding of mathematics concepts and the first mathematics methods course was helpful for learning some practical strategies related to teaching mathematics. The strongest influence on her mathematics instruction, however, seemed to be her participation as a student teacher in a community of practice at her school. Kelsey, on the other hand, found her two mathematics content courses to be particularly helpful for developing her understanding of both mathematics content and mathematics pedagogy, especially with regards to the concepts she taught in kindergarten during student teaching. She also had productive learning experiences in her two mathematics methods courses, although she did not view the strategies related to upper elementary students as being helpful at that time due to her focus on younger children. During student teaching, Kelsey did not have the same opportunities as Andrea to participate in any communities of practice around teaching mathematics, so she relied on what she had learned from her previous experiences as a student in the mathematics content and methods courses. In the rest of this section, I provide more detail

on these experiences during teacher preparation that seemed to shape Andrea and Kelsey's use of mastery-oriented practices in mathematics.

Andrea valued what she learned in the two required mathematics content courses but she experienced frustration with the instructors from the Mathematics Department who taught the courses because they would get angry when students did not understand the mathematics concepts and they also did not always show up on time. This frustration with teachers who did not help struggling students seemed to be a consistent theme for Andrea and it may help explain why she was so focused on helping her struggling learners. Andrea particularly enjoyed the content focus in these courses because it helped her to understand the difference between algebra and geometry. Since her high school mathematics courses had been taught in an integrated fashion, she said that she had not previously understood what was considered an algebra concept and what was a geometry concept.

Kelsey seemed to find the two mathematics content courses to be fun, challenging, and incredibly worthwhile. She had the same instructor for both courses and she appreciated the fact that he created an engaging and supportive classroom environment that made learning mathematics enjoyable, even when the concepts were challenging.

> Those classes made me look at math really differently because we thought about – well, how do you teach this? The concepts were so basic but I hadn't thought about it that way since I was 10 and you're not thinking about the teaching aspect. I think that it really helped me push forward and it really helped me with my kindergarten stuff.
>
> (Kelsey, Interview, March 29, 2012)

These mathematics content courses seemed to help Kelsey strengthen both her learning and teaching of mathematics, and she felt like they were particularly useful in helping her teach mathematics to the kindergarten students in her student teaching placement.

Kelsey also had productive learning experiences in her two elementary mathematics methods courses, but she felt like she did not get everything she could have out of those two courses because her mindset was so focused on teaching kindergarten. For example, there was an emphasis on how to teach fraction concepts (e.g., multiplying and dividing with fractions) in the first elementary mathematics methods course, but Kelsey said she moved that information "to the back of her mind" because she did not anticipate ever using that content with her students. Once Kelsey found out that she was teaching 5th grade at Draper Upper Elementary, she went back through all her materials from the elementary mathematics methods courses and even contacted her former mathematics methods course instructors for ideas and support. Because I was the course instructor for Kelsey's first mathematics methods course, I can personally attest to the fact that she did contact me to get ideas and resources once she found out she was teaching 5th grade.

Andrea mentioned that she enjoyed the first elementary mathematics methods course that she took with Kelsey because she felt like "it was a really good transition into going into the teaching." As previously mentioned, I was the course instructor for that particular class. Andrea did not seem to have a productive learning experience in her second elementary mathematics methods course taught by the Special Education Department. This course was meant to combine mathematics and special education methods so the students were prepared to teach mathematics in either a general education or a special education setting. Andrea described it as "another [university] course where it's all psychology and it wasn't really any actual things to take with

you." Andrea seemed to feel that she did not learn much from that particular course because the teacher focused on the psychology of teaching and did not provide any practical strategies related to teaching mathematics. In the second elementary mathematics methods course that was taught by the Teacher Education Department, students were required to plan and teach a two-week mathematics unit. In the second mathematics methods course taught by the Special Education Department, however, Andrea and the other students were not required to create a mathematics unit or any mathematics lesson plans. She did end up designing a mathematics unit on her own and shared it with her university field instructor, but the only feedback Andrea received was on the basic organization of the unit as opposed to anything about the mathematics content or teaching.

As a Special Education major, Andrea spent her year of student teaching working in two different settings at the same school. She spent the first half of the year working with a classroom teacher in a 4th-grade general education classroom, and the second half of the year working with a special education teacher who provided support to students in grades K-5. In the 4th-grade general education classroom, Andrea and her cooperating teacher co-taught mathematics using a workshop approach with the Everyday Mathematics curriculum. Andrea would usually teach the mini-lesson to the whole class and then the students were broken into leveled groups so that Andrea and her cooperating teacher could move around to work with different groups of students. Andrea's cooperating teacher also co-taught reading and writing with another 4th-grade teacher in the school who had a student teacher. The 4th-grade classroom teachers would combine the two classes and divide all the students into leveled groups so the four adults (two cooperating teachers and two student teachers) could do targeted instruction with small groups of students.

During her student teaching, Andrea also had the opportunity to participate in a yearlong mathematics professional development workshop with both of her cooperating teachers. The purpose of the professional development was to bring general education and special education teachers together to focus on how they could support K-5 students in learning, thinking, and reasoning about mathematics.

> Both my mentor teachers were with me so it was really great because we could take exactly what we learned and do it in the classroom and it was nice because we were able to talk about it together and work together and make sure we were getting everything ready for the next session.
>
> (Andrea, Interview, April 24, 2012)

Andrea found this professional development workshop to be extremely powerful because she and her cooperating teachers were able to take what they learned from the sessions, work together as a team, and try out the new strategies in their classrooms. She also explained that during the professional development workshop, she was able to share some of her own knowledge with the other teachers. According to Andrea, "I had a lot more of the book research knowledge from newer studies on math teaching so they were learning stuff from me." Andrea was not just attending the workshop as a passive observer, but instead she was sharing her own knowledge and actively working with her two cooperating teachers to implement ideas from the professional development into the classroom.

Andrea felt very strongly about the benefits of using a mathematics workshop approach, targeted small group instruction, and co-teaching with other adults because she had actively participated in using these practices during her student teaching and she had seen positive results with student learning and engagement. Participation is an important component of situated

learning because learning occurs through participation in communities of practice. Andrea did not just observe these practices being modeled, but instead she participated fully with her cooperating teachers (and others) in a community of practice focused on teaching and learning mathematics. According to Wenger (1998, 2000, 2011), communities of practice are defined by three characteristics: (a) joint enterprise (i.e., the domain), (b) mutual engagement (i.e., the community), and (c) shared repertoire (i.e., the practice).

In this case, the community of practice Andrea participated in centered on a joint enterprise or shared domain of interest related to teaching and learning elementary mathematics. The members of this community of practice, including Andrea and her two cooperating teachers, were all mutually engaged as they worked closely together to learn and experiment with new strategies for teaching mathematics. Andrea worked alongside her general education cooperating teacher to co-plan and co-teach mathematics. Through this experience, she learned how to adapt the Everyday Mathematics curriculum and use a mathematics workshop approach. Andrea also worked with her general education cooperating teacher, another classroom teacher, and another intern to co-teach and provide targeted small-group instruction for multiple subject areas. In addition, Andrea participated in a yearlong professional development workshop focused on mathematics instruction with both of her cooperating teachers and teachers from various schools throughout the district. Through this professional development experience, she learned more about different strategies that general education and special education teachers could use to work together and improve mathematics instruction. In the process of learning and improving their practices as mathematics teachers, Andrea and her cooperating teachers developed a shared repertoire of strategies and tools to implement a mathematics workshop approach and support their students in learning, thinking, and reasoning about mathematics.

As a student teacher, Kelsey had a very different experience than Andrea because she did not perceive any opportunities to participate in communities of practice focused on teaching and learning mathematics at her school. She started teaching mathematics from the very first day of school and never actually observed her cooperating teacher lead or co-teach any mathematics lessons. Kelsey did not remember receiving much guidance or feedback on her mathematics instruction from either her cooperating teacher or her university field instructor during that year, so she was pretty much on her own as far as planning and teaching mathematics lessons. The school where Kelsey did her student teaching did not offer any mathematics professional development opportunities for teachers and she did not experience any collaboration with other teachers in the building around mathematics instruction. As a result, Kelsey had to rely on the foundation she had developed through her participation as a student in her mathematics content courses, mathematics methods courses, and previous field experiences to plan lessons, reflect on her teaching, and make improvements throughout her student teaching experience. Although the learning opportunities in her school and district were limited, Kelsey did search out other ways to develop her practice such as conferences and workshops. Although many of these options were costly or time-consuming for a student teacher, Kelsey was able to attend a one-day mathematics education conference to get some new ideas for her mathematics instruction. In addition, she participated in some other conferences that were not mathematics-specific.

In summary, Andrea and Kelsey's mathematics instruction seemed to be influenced by different kinds of experiences during their teacher preparation program. Andrea had some positive learning experiences in her mathematics content courses and one of her mathematics methods courses but she seemed to learn a great deal about teaching mathematics through her active participation in the community of practice at her school during student teaching.

Throughout her participation in this community of practice, Andrea was able to learn about specific strategies and develop her mathematics teaching practice. When Andrea and Kelsey started working together at Draper Upper Elementary, Andrea was able to share what she learned from these experiences with Kelsey in their newly created community of practice.

Kelsey felt that she learned a lot about teaching mathematics from her participation as a student in her mathematics content and mathematics methods courses. Although she found the mathematics content courses more applicable to the grade level she focused on in student teaching, the things she learned in her mathematics methods courses turned out to be especially helpful when she ended up teaching 5th grade at Draper Upper Elementary. As a student teacher, Kelsey did not have opportunities to participate in any sustained communities of practice focused around learning and teaching mathematics. She did not plan or discuss mathematics teaching on a regular basis with her cooperating teacher or her university field instructor and there was no professional development or collaboration with other teachers at the school where she was placed.

Mathematics Curriculum and Planning

Draper Upper Elementary used Everyday Mathematics as the adopted curriculum for both 5th and 6th grade. Based on their previous experiences, Andrea and Kelsey began their first year of full-time teaching with very different background knowledge about the mathematics curriculum and how to plan lessons for upper elementary students. Andrea had used Everyday Mathematics with 4th-grade students during her student teaching and with 5th-grade students when she worked as a long-term substitute teacher at Draper Upper Elementary. Therefore, Andrea was familiar with the curriculum for the actual grade level she was teaching and she knew what her 5th-grade students would have been exposed to in mathematics the previous year.

Kelsey had never used the Everyday Mathematics curriculum and she also had never planned or taught mathematics to upper elementary students. As new teachers at Draper, Andrea and Kelsey were not provided with any professional development opportunities related to the mathematics curriculum or mathematics instruction. By creating their own community of practice where they met on a regular basis to share ideas, plan lessons, and examine student work, Andrea and Kelsey were able to learn from each other and further develop their mathematics instruction.

Andrea had learned how to adapt Everyday Mathematics for use in a workshop approach when she worked alongside her cooperating teacher to implement mathematics workshop on a daily basis in her student teaching placement. She was used to planning mini-lessons and thinking about how to use formative assessment data to group students for targeted instruction. Kelsey had never used or been exposed to a workshop approach for teaching mathematics and she had not done much differentiated instruction in mathematics. Kelsey described a typical mathematics lesson in her kindergarten classroom during student teaching as the following:

> I would sit at the ELMO [document camera] and I would have the math pages – we used Scott-Foresman – and I would sit at the ELMO and I would do the pages with them and we would all do the same thing.
>
> (Kelsey, Interview, January 30, 2012)

Once Andrea and Kelsey found out that they were both teaching 5th grade at Draper Upper Elementary, they decided to work together on planning. One day a week, they met after school and planned out a week's worth of instruction. This served as the joint enterprise for their community of practice. For mathematics, they would look through the curriculum resources and pacing guide as they developed lesson plans, formative assessments, and homework assignments.

Since Kelsey was not familiar with the Everyday Mathematics curriculum or the mathematics workshop format, Andrea helped acclimate her to the curriculum and how to format a lesson for upper elementary students.

> I say - how do you do this? How do you do that? And her having the background in 4th grade has really helped her know what they should know here. So I just say, okay, well how do we do this? And she helped me kind of format – okay, do a small group mini-lesson, then go into groups, and so I'm still trying to figure out how best to structure it all.
>
> (Kelsey, Interview, January 30, 2012)

Andrea had used Everyday Mathematics with 4th-grade students, so she was able to help Kelsey understand what students should have been exposed to the previous year and how they could build on that in their lessons. Andrea also helped Kelsey format a plan for using a mathematics workshop approach in her classroom through the use of mini-lessons and targeted small groups. These lesson plans, formative assessments, homework assignments, and lesson formats are all examples of the shared repertoire they developed within their two-person community of practice focused on teaching mathematics. Andrea was able to share with Kelsey what she had learned about teaching mathematics from her participation in the community of practice at her student teaching placement, and this sharing of knowledge and ideas helped Kelsey develop her practice as a 5th-grade teacher of mathematics.

As the year progressed, Kelsey became more comfortable with the curriculum, the grade level, and the use of mathematics workshop so she experimented with her approach in different ways. For example, Kelsey used formative assessment data to decide how to strategically group students for workshop time. She used to always call on the students who were struggling with

the concepts to meet with her first during workshop time, but she found that some of those students were not attempting to make sense of the mathematics concepts on their own because they relied too much on Kelsey's help. She also realized that she was spending most of her small group time with the struggling students and she was neglecting her more advanced students who needed to be challenged. As a way to experiment with addressing these concerns, Kelsey decided to call the more advanced students over first so she could check in with them and see how they were doing before she sent them off to work on their own. She also decided to tell the students who were struggling with the concepts to spend at least five minutes working on their own before they worked with her and she instructed them that she was not going to help them unless they had tried to make some sense of the problem and they had something written down on their papers.

In essence, Andrea and Kelsey created their own two-person community of practice focused on the shared domain of teaching 5th-grade mathematics. They were mutually engaged as they met on a regular basis to plan and share ideas so they could learn from each other and improve their instruction. In addition to developing a shared repertoire of lesson plans and other resources, they also looked at student work and discussed students' understandings and misconceptions of the mathematical concepts. Although Andrea shared a lot of knowledge and expertise in the beginning due to her previous experiences with the curriculum and upper elementary students, working collaboratively with Kelsey was a positive learning experience for her because, in her own words, "We bounce a lot of ideas off each other. So that's nice." By having someone to meet with on a regular basis to discuss her teaching and share ideas, Andrea was able to work on strengthening her own practice as well as helping Kelsey. Since Andrea and Kelsey had the shared experience of the first elementary mathematics methods course, they also

worked together to incorporate ideas and strategies they had learned in that class such as using fraction strip manipulatives to teach fractions in conceptual ways or incorporating problem-solving group tasks such as the ones they used in their observed lessons on area.

Lack of Support, Expectations and Resources for Mathematics

As first-year teachers, Andrea and Kelsey did not receive much guidance or support from their school administrators and they were frustrated with some of the school-wide expectations the administrators had implemented at the school. Teachers at Draper were not supposed to team or co-teach so there was an overall lack of collaboration and cohesion among teachers in the building. The administrators had chosen to focus on reading instruction to the degree that there was a dire lack of professional development and resources for teaching mathematics. In addition, Andrea and Kelsey had only been observed once each and they had received no constructive feedback on their teaching.

There were two administrators at Draper Upper Elementary: the 5th-grade principal (Mr. Lowe) and the 6th-grade principal (Ms. Smith). According to Andrea and Kelsey, neither principal was well-liked or well-respected by the teachers at the school. About 15 teachers (out of 30) had left Draper the previous year and much of that turnover was attributed to teachers' frustrations with the administrators. The two principals had specific responsibilities for their respective grade levels. For example, Mr. Lowe was responsible for handling behavior issues for 5th-grade students and evaluations of 5th-grade teachers. There were other school-wide issues the principals likely decided together, such as the focus for school-wide professional development.

Andrea and Kelsey expressed frustration and disappointment with the administrators for a variety of reasons. First of all, teachers were not supposed to be co-teaching and teaming of any kind (where students switch between teachers for different subjects) was highly discouraged.

According to Kelsey, the directive came from the deputy superintendent who had focused his dissertation research on teaming and found that teaming had no positive benefits for student achievement. Many teachers in the school and district were upset with this decision and the teachers' union ended up getting involved. After some deliberations, a decision was made that teachers who had teamed in the past could write proposals in order to seek approval to team again. Unfortunately, this did not apply to Andrea and Kelsey since they were first-year teachers in the district. As mentioned previously, Andrea had experienced co-teaching during her student teaching and she recognized the benefits of teachers working together to address the needs of their students. Andrea and Kelsey were already planning all of their lessons together and they often talked about their desire to combine their two classes and co-teach, but their school or district administrators did not encourage this practice.

When the school district decided to reconfigure schools and Draper Upper Elementary was created in the summer of 2010, teachers were pulled from various elementary and middle schools to work at the new school. Many of the 6th-grade teachers had previously taught in a middle school setting in which they were responsible for only teaching one or two subjects, and suddenly at Draper they were told that teaming was not allowed and they had to teach all subjects.

> There's a big separation between the 5th- and 6th-grade teachers because a lot of the 6th-grade teachers taught in middle school and this is supposed to be an upper elementary, so they're not doing the switching of classes and they want to because there's teachers that have been teaching for 25 years and only taught math and now they're doing reading and writing and social studies and that's not really what they even went to school for because a lot of them don't have the

> certification to do enclosed classroom but somehow they were grandfathered in to be able to do so.
>
> (Andrea, Interview, January 30, 2012)

As far as the 5th-grade teachers at the school, many of them had previously taught elementary grades other than 5th so they were brand new to the grade level and to teaching 5th-grade mathematics. When Kelsey was asked if there was any collaboration between teachers at the school, she responded:

> Very little. And that's disappointing just because there's 15 5th-grade teachers and Andrea and I are here, we're the last ones to leave and the first ones to get here sort of thing. And everyone just leaves, and they have families to take care of and I understand that but I just wish there was more time where we could get together and say, how are you doing this?
>
> (Kelsey, Interview, January 30, 2012)

Andrea and Kelsey both described an overall lack of collaboration and cohesion between teachers at the school, both across and within grade levels.

Another frustration that Andrea and Kelsey experienced with the administrators was the lack of focus on mathematics instruction. As mentioned previously, the scores on the state assessment showed that students at Draper were doing much worse in mathematics than they were in reading, but the administrators decided to focus exclusively on reading. Teachers had very specific expectations for reading instruction including: a required 2-hour literacy block every day, classroom anchor charts for each reading strategy, common pre- and post-tests for each reading strategy, and lunchtime tutoring focused on reading intervention. There were no such expectations in place for mathematics.

All of the professional development meetings at Draper had been focused on reading and writing so there were no opportunities for teachers at the school to talk about mathematics or work together to improve their teaching practice in mathematics. There was one optional after-school session offered late in the spring where a retired teacher came in to talk about mathematics, but Andrea and Kelsey did not find it to be helpful and only one other teacher from the school attended the session besides them. In addition to a lack of mathematics professional development, there was a lack of resources for teaching mathematics. Andrea and Kelsey had both used mathematics manipulatives on a regular basis in their first mathematics methods course and during their student teaching, so they recognized how manipulatives could be a powerful tool for developing students' conceptual understanding. In fact, the Everyday Mathematics curriculum had lessons that required the use of specific manipulatives such as number cards, base ten blocks, and shape templates. Unfortunately, Andrea and Kelsey were not provided with any mathematics manipulatives and they found themselves borrowing from other teachers or repeatedly asking their principal for materials. As a result of not having the necessary materials, Andrea and Kelsey had to adjust the timing or enactment of some mathematics lessons.

As first-year teachers, Andrea and Kelsey were supposed to be formally observed by Mr. Lowe multiple times, although they were unclear if it was supposed to be six or eight observations. Since Kelsey's classroom was near the front of the building, Mr. Lowe dropped into her room a few times informally and he did one formal observation of a reading lesson. Andrea's classroom was in the back corner of the school, so she did not have many people dropping by informally. In fact, Mr. Lowe had only been in her classroom once to do a formal observation of a reading lesson. Therefore, in their first year of full-time teaching, these two

teachers had only been formally observed once for reading and neither of them received any feedback from Mr. Lowe about those observations and their teaching.

In summary, Andrea and Kelsey did not find their administrators to be effective or helpful leaders. They felt a lack of support for teacher collaboration, mathematics instruction, and their own development as teachers. Whereas other teachers in the study felt constrained by the expectations of their administrators or districts, Andrea and Kelsey seemed to have a lot of freedom to experiment with mathematics instruction. It is possible that if more expectations for mathematics were in place, they might not have been able to incorporate a mathematics workshop approach or the use of real-world problem solving activities. On the other hand, if there were expectations for teachers to collaborate or opportunities for professional development in mathematics, then Andrea and Kelsey might have been able to learn and develop their mathematics instruction from participating in additional communities of practices besides the one they had created together.

Summary of Chapter Findings

Although Andrea and Kelsey had very different experiences during teacher preparation, they seemed to have some similar views about instruction and they used (and were perceived to be using) similar practices in their classroom. Both teachers focused on emphasizing understanding, improvement, enjoyment, and effort in their mathematics instruction. They also provided their students with time to explore new ideas and develop conceptual understanding. Andrea and Kelsey utilized a mathematics workshop approach so they could provide targeted instruction based on students' individual needs and students could benefit from working with their peers in partners or small groups. Their use of these mastery-oriented practices seemed to

primarily be the result of their participation in specific communities of practice along with the influence of some courses during teacher preparation.

Although Andrea developed knowledge of mathematics content and pedagogy from the university mathematics content courses and her first mathematics methods course, it seemed that the multi-faceted community of practice she participated in as a student teacher heavily influenced her mathematics instruction. In one facet of the community of practice, Andrea worked with her general education cooperating teacher to co-plan and co-teach mathematics. It was through that experience that she developed her skills related to using the Everyday Mathematics curriculum and implementing a mathematics workshop approach. In another facet of the community of practice, Andrea worked with her cooperating teacher, another classroom teacher, and another student teacher to combine two classrooms and use a co-teaching and targeted small groups approach for instruction. In yet another facet of this community of practice, she attended a yearlong professional development workshop with both of her cooperating teachers (general education and special education) and teachers from all over the district. This experience helped her to further refine her mathematics workshop approach and other mathematics instructional strategies related to both general education and special education. In this multidimensional community of practice, Andrea was able to actively participate as a teacher. This allowed her to constantly develop and improve her mathematics instruction based on what she was learning and the feedback she received from the other teachers and her students. Through this process, Andrea also developed her own identity as a mathematics teacher.

When Andrea and Kelsey began their full-time teaching at Draper Upper Elementary, they created their own community of practice so they could help each other with planning and

teaching all subjects, including mathematics. Up until that time, Kelsey had always thought that she would be teaching younger children. Her identity had revolved around being a kindergarten teacher so she had focused all her efforts during teacher preparation on strategies for teaching mathematics to younger children. When she accepted the job at Draper, Kelsey had to change her mindset and identity to focus on teaching 5th-grade mathematics. In the beginning, Kelsey depended on Andrea a great deal to help her plan mathematics instruction. Andrea was able to share all the things she had learned in her previous community of practice about mathematics workshop, Everyday Mathematics, targeted small group instruction, etc. Since Kelsey and Andrea had been in their first mathematics methods course together, they did have some shared learning experiences from that course that they were able to incorporate into their teaching. In their two-person community of practice, it may have started with Andrea sharing more of her knowledge but, as Kelsey became more confident and comfortable with her new identity as an upper elementary teacher, she shared more of her own ideas and suggestions. Both teachers found this community of practice they had created to be invaluable because they were able to learn from each other in order to develop their mathematics instruction.

Andrea and Kelsey also found their self-made community of practice to be extremely beneficial because there were no other communities of practice focused on mathematics at their school. Since the administrators did not allow teaming and co-teaching, there seemed to be a lack of collaboration between teachers. Due to a school-wide focus on reading, there was also a lack of professional development, manipulatives, specialists, and other resources for teaching mathematics. Andrea and Kelsey had never been observed teaching mathematics so they had received no feedback on their mathematics teaching, even though they were only in their first year of full-time teaching. Basically, there were no structures or resources in place at Draper

Upper Elementary to help teachers work on examining or improving their mathematics instruction so Andrea and Kelsey relied on their two-person community of practice to help them develop their practice and their identities as mathematics teachers.

CHAPTER 7: VIEWS ABOUT SUCCESS IN MATHEMATICS

Overview

In this chapter, I use data from the teacher surveys, interviews and classroom observations to address the third research question about how teachers in the study described and communicated their views about success in mathematics. I also use quantitative data from the student surveys to examine how the students viewed success in mathematics. In order to provide an in-depth analysis of these research questions using multiple data sources, I focused on the two pairs of teachers that were featured in the previous case studies. I argue that Diane and Luke seemed to have similar views about success in mathematics (consistent with a mastery orientation and a growth mind-set) and their students seemed to perceive them to be communicating those views in similar ways. Andrea and Kelsey, on the other hand, seemed to have similar mastery-oriented views but differed with regards to more performance-oriented components of success, and their students seemed to perceive them to be communicating different views about success in mathematics. Although Diane, Luke, and Andrea all seemed to communicate views consistent with a growth mind-set while Kelsey seemed to have elements of both a growth and fixed mind-set, survey results provided evidence that students in all four classrooms may have had beliefs about success that were consistent with both fixed and growth mind-sets.

I begin the chapter with an overview of survey results related to all of the teachers' views about possible components of success in mathematics. When possible, I also include an overview of survey results showing students' perceptions related to the different components of success. For each set of case study teachers, I present specific data from teacher surveys, student surveys, teacher interviews, and classroom observations that relates to the different components

of success in mathematics. I also explore the teachers' and students' responses to the success in mathematics word list activity. Once again, I bring in any additional related data from surveys, interviews and observations.

Teachers' Views about Success in Mathematics

In the teacher surveys, the participants responded to different statements about success and failure in mathematics. As with the other items on the survey, teachers rated their agreement and/or disagreement with each statement using a scale of 1 (strongly disagree) to 5 (strongly agree). The statements focused on seven different possible components of success (and failure): understanding, learning from mistakes, effort, speed/accuracy, natural ability, lack of natural ability and competition. The three statements related to understanding, learning from mistakes, and effort are consistent with a mastery orientation to instruction. In particular, the statement on effort is directly related to a growth mind-set (Dweck, 2006, 2010). The four statements focused on speed/accuracy, natural ability, lack of natural ability and competition are more consistent with a performance orientation to instruction. Although natural ability and lack of natural ability are related, I decided to include these two separate statements to see if there was any difference in how the teachers responded. One of the statements focused on the importance of having natural ability for success, while the other statement focused more on the lack of ability causing struggles or failure in mathematics. These two statements related to natural ability and a lack of natural ability are directly related to a fixed mind-set (Dweck, 2006, 2010).

Table 13 summarizes the data for all 10 teachers and orders the components of success from highest to lowest means. Overall, the teachers' responses showed the strongest agreement with the three components that were consistent with a mastery orientation to instruction. Teachers in the study chose understanding the concepts as the most important component of

success in mathematics ($M = 4.80$, $SD = 0.42$), followed closely by learning from your mistakes ($M = 4.60$, $SD = 0.52$). The next component of success the teachers chose was a focus on effort and working hard ($M = 4.20$, $SD = 0.79$). This particular component of success is consistent with a growth mind-set, where ability can be developed through effort. Since the teachers in the study had rated themselves as more mastery-oriented than performance-oriented, it made sense that they would identify these three statements as important components of success. According to the survey results reported in Chapter 4, the students seemed to perceive their teachers to be focusing on these three components of success: understanding ($M = 4.54$, $SD = 0.96$), learning from mistakes ($M = 4.04$, $SD = 1.31$), and effort ($M = 4.24$, $SD = 1.01$).

Table 13

Teachers' Views about Possible Components of Success in Mathematics

Component of Success	Survey Statement	Related Orientation to Instruction	Mean	Standard Deviation
Understanding	Students will be successful in mathematics if they try to understand the concepts instead of just focusing on getting correct answers.	Mastery	4.80	0.42
Learning from Mistakes	Making mistakes in mathematics is an important part of the learning process.	Mastery	4.60	0.52
Effort	Any student can be successful in mathematics if they work hard.	Mastery	4.20	0.79
Speed & Accuracy	It is important for students to be able to solve mathematics problems quickly and accurately.	Performance	3.20	0.63
(Lack of) Natural Ability	Some students will always struggle with mathematics no matter how hard they work.	Performance	2.90	0.88
Natural Ability	Natural ability is more important than effort for success in mathematics.	Performance	1.70	0.67
Competition	Students will be successful in mathematics if they focus on trying to do better than other students in the class.	Performance	1.30	0.48

The components of success that are consistent with a performance orientation showed more variation among the teachers in the study. The average score for the component of speed and accuracy fell in the middle of the range ($M = 3.20$, $SD = 0.63$), so the teachers in the study seemed to think there was some value to being fast and correct, although they varied on how much they valued this component. As with other survey statements, it was possible that teachers could have interpreted the statement in different ways. Some teachers might have been thinking about the importance of students being able to quickly and accurately recall their multiplication and division facts so they could focus their time on other aspects of challenging mathematics problems. Other teachers may have been thinking about the importance of students being quick and accurate so they could perform well on state assessments in mathematics.

The two statements related to natural ability came next, but they were not very close to each other in overall mean scores. The statement about a lack of natural ability causing students to struggle had an overall score that fell in the middle of the range ($M = 2.90$, $SD = 0.88$), while the statement about natural ability being important for success was on the low range ($M = 1.70$, $SD = 0.67$). So even though the teachers rated effort as more important that natural ability, some of them seemed to think there would be students who would struggle no matter how hard they worked. These two statements about natural ability are related to a fixed mind-set in which intelligence is considered a fixed trait. Although the teachers seemed to show evidence of a growth mind-set with their responses to the survey statement about effort, it appeared that some of them may have also had beliefs related to a fixed mind-set.

The low mean value for the final component of competition ($M = 1.30$, $SD = 0.48$) suggests that the teachers in the study did not believe that students should focus on trying to perform better than their peers as a way to achieve success in mathematics. Although the

teachers may not have intended to promote competition, the student survey results reported in Chapter 4 showed that some of them were perceived to be using performance-approach practices that could be considered competitive in nature, including letting students know who received the highest scores in mathematics ($M = 2.55$, $SD = 1.58$) and pointing out the students who received good grades as an example ($M = 2.51$, $SD = 1.46$). It is possible that pointing out who received the highest test score or the best grades in mathematics can promote a competitive classroom environment but perhaps some of the teachers in the study viewed those practices as providing motivation for students to improve rather than creating competition. Another possibility, as was the case with Diane, is that some teachers may not have personally believed in those types of competitive practices, but there may have been district or school expectations they had to follow related to publicizing test scores and grades. This situation would be consistent with survey data that showed some teachers perceived much more of a performance goal focus in their schools compared to their own mastery-oriented approaches to instruction.

Although the teachers in the study overall reported more of a mastery orientation ($M = 3.45$, $SD = 0.57$) than a performance orientation to instruction ($M = 2.10$, $SD = 0.68$), the range of values for performance orientation seemed to indicate that the teachers were using some performance-oriented strategies in their classrooms. It seemed possible that the teachers who agreed or somewhat agreed with the importance of speed and accuracy for success in mathematics were the same teachers who were implementing more performance-oriented practices. In order to test this hypothesis, I examined the individual teachers' survey responses and found that the three teachers who rated speed and accuracy the highest were actually the three teachers who had the highest overall means for mastery orientations to instruction (Kelsey, Diane, and Luke). It could be that these teachers were thinking of speed and accuracy in a way

that was less performance-oriented, as evidenced by the fact that they all gave the lowest possible value to competition as a component of success. A more performance-oriented view related to the importance of speed and accuracy could lead a teacher to use practices such as having students compete against each other to see who is the fastest or who gets the most answers correct, while a more mastery-oriented view might direct teachers to focus on having students improve their own speed and accuracy without comparing themselves to others.

In order to further explore how the teachers communicated their views about success and how their students viewed success in mathematics, I spend the rest of the chapter focusing in depth on the case study teachers previously discussed in Chapters 5 and 6.

Diane and Luke

In this section, I use data from surveys and interviews to explore Diane and Luke's views about success in mathematics. I also examine their students' views about success and students' perceptions about how their teachers seemed to be communicating messages about success in the classroom. I provide evidence that Diane and Luke seemed to have similar views about success that were consistent with both a mastery orientation to teaching and a growth mind-set. Although their students reported high personal mastery goals and perceived the two teachers to be communicating mastery-oriented views, some of the students also seemed to adopt views that were consistent with a fixed mind-set.

Components of Success

In the teacher survey, Diane and Luke reported almost identical responses related to their views of different possible components of success and failure in mathematics. Diane and Luke both strongly agreed (value of 5) that: (a) students would be successful in mathematics if they tried to understand the concepts instead of just focusing on the correct answers and (b) making

mistakes in mathematics was an important part of the learning process. These two statements relate to mastery-oriented instructional practices and are partially reflected in two of the student survey statements ("My teacher wants us to understand our math work, not just memorize it" and "My teacher thinks mistakes in math are okay as long as we are learning"). In the student survey results, Diane and Luke had very similar overall means for the statement about understanding (M_{Diane} = 4.67, SD_{Diane} = 0.85, M_{Luke} = 4.50, SD_{Luke} = 1.04) and the statement about learning from mistakes (M_{Diane} = 3.97, SD_{Diane} = 1.26, M_{Luke} = 3.96, SD_{Luke} = 1.10). This data seemed to show that they were both perceived to be communicating these views about success in mathematics to their students in similar ways.

For the next component of success related to effort, ("Any student can be successful in mathematics if they work hard"), Luke assigned a value of 5 and Diane a value of 4. This data seemed to suggest that these teachers believed in aspects of a growth mind-set where ability or intelligence is malleable and can be increased incrementally through effort (Dweck, 1996, 2006, 2010). This idea about the importance of effort also relates to mastery-oriented practices and is reflected in one of the student survey statements ("My teacher recognizes us for trying hard in math"). Again, both teachers had high overall means for this practice (M_{Diane} = 4.33, SD_{Diane} = 0.99, M_{Luke} = 4.00, SD_{Luke} = 0.98) so their students seemed to perceive them to be focused on recognizing student effort in mathematics class.

Diane and Luke both rated the importance of speed and accuracy in mathematics equally high with a value of 4. This component of success does not fall under mastery-oriented practices and could be viewed as being related to competitive, performance-oriented practices such as having students compete against each other in timed mathematics tests or games. On the other

hand, Diane and Luke did not seem to be viewing speed and accuracy in terms of competition because they assigned the lowest value (1) to the survey statement about competition as a necessary component of success ("Students will be successful in mathematics if they focus on trying to do better than other students in the class"). Therefore, Diane and Luke could have been thinking of speed and accuracy in non-competitive and less performance-oriented terms. Unfortunately, there were no statements on the student surveys that related to speed and accuracy so it was unclear how the students perceived their teachers to be focusing on this particular component of success in mathematics.

In my observations of Diane and Luke, I did not see evidence of a focus on speed and accuracy during their mathematics lessons. In the interviews, both teachers did explain that they had students practice their mathematics facts in a timed setting, but for different reasons. Diane chose to have her students do timed tests while Luke was required by the district to implement timed tests.

In Diane's classroom, students completed a 60-second multiplication facts test on a daily basis until they had passed all twelve tests (for numbers 1-12). Once students had passed all their tests, she wrote their names on the board under the heading "All Stars." Although Diane was required to publish the names of the students who had reached proficiency on their benchmark tests, in this case, it was her personal choice to publicize the names of the students who completed all their multiplication facts tests. This could be another reason why Diane's students rated her relatively high ($M = 4.00$) on the performance-oriented practice of publicizing which students get the highest scores on a mathematics test.

Luke, on the other hand, did not agree with doing timed mathematics facts tests and had originally made the choice not to use this practice in his classroom. In the middle of his second

year at Northwest Elementary, he was instructed to implement timed tests for mathematics facts in his classroom. Luke stated in the interviews that his school district placed a strong emphasis on speed and accuracy and he was also required to do a timed reading fluency practice in his classroom on a regular basis. Luke did not make an effort to publicize the results of any of these timed tests.

Considering how different the student demographics and state assessment scores were for Diane and Luke's schools, it seemed possible that students' abilities to recall their mathematics facts may have been quite different. Perhaps Diane focused on recalling mathematics facts quickly because she viewed that to be a common weakness among her students, whereas Luke might not have seen the same weakness in his own students.

Finally, Diane and Luke rated the two statements about success being related to natural ability equally low. They both assigned a 2 to the statement related to a lack of natural ability causing students to struggle and a 1 to the statement about the importance of natural ability for success in mathematics. These results seem to be consistent with the previous finding that they focused on a growth mind-set rather than a fixed mind-set.

Success in Mathematics Word List Activity

As part of the study, the teachers and students both completed an activity where they looked at a list of 27 adjectives and chose the five words they thought best described someone who was successful in mathematics. The teachers completed the activity as part of an interview, so they were also asked follow-up questions about their views and the views of people they worked with in their school.

Diane chose the following five words: curious, imaginative, interested, open-minded, and patient. She described being curious as "wanting to know why" and this fit with her common

theme of focusing on developing understanding in mathematics. She explained imaginative and interested as being connected because students "have to be interested in what's going on and imagine where they're going to use it, why they're going to use, what they're going to use it for." Diane expressed the importance of being open-minded to see that mathematics is everywhere, and not just in mathematics class. Finally, she talked about the importance of being patient "because you don't always get it the first time." This connects with Diane's focus on allowing students enough time to explore mathematics concepts and not moving on to new concepts if students are confused.

Luke could not settle on five words so he ended up with the following six words on his list: resourceful, organized, imaginative, creative, open-minded, and persistent. He described being resourceful as "using different things that you already know to understand things you don't know" and he talked about using manipulatives or researching things online as examples of being resourceful in mathematics. In his teaching, he tried to use a variety of resources to help students develop their understanding of mathematical concepts. For Luke, being organized in mathematics was important so you could follow your steps or find your mistake if you got something wrong. In his teaching, he tried to model how to be organized in mathematics by using diagrams and charting students' responses on the Smart Board. Luke described being imaginative as being able to connect what you are learning in mathematics to familiar situations so that you are making mathematics more meaningful and authentic instead of just doing what the teacher tells you to do. His focus on real-world applications of mathematics in his teaching seemed to be related to helping students make those connections. He saw creative as being tied in with resourceful because "if you can find a way that's going to help you understand it better, then you need to be more creative with that and you need to be able to figure out things that

aren't there if somebody's not telling it to you." Luke considered open-minded as being open to other people's suggestions about finding solutions or understanding concepts. Finally, he talked about the importance of being persistent so that you keep trying and don't give up, even if you are confused or struggling to understand a concept.

In comparing Diane and Luke's responses, there seem to be some common ideas. Diane's explanation of being patient and Luke's explanation of being persistent both focused on the idea that it takes time and effort to be successful in mathematics. This is consistent with a growth mind-set. Luke's view of being imaginative along with Diane's views of being imaginative and open-minded all touched on the idea of seeing mathematics as something beyond the classroom and making real-world connections.

Table 14

Students' Choices for Success in Mathematics Word List Activity – Diane and Luke

Diane's students (n = 33)		Luke's students (n = 27)		Total Students (n = 238)	
focused	66.7%	brilliant	51.9%	focused	62.2%
teachable	63.6%	focused	37.0%	teachable	50.8%
brilliant	60.6%	patient	33.3%	brilliant	50.8%
gifted	60.6%	teachable	33.3%	gifted	38.7%
open-minded	45.5%	gifted	29.6%	confident	37.0%
confident	42.4%	confident	25.9%	open-minded	29.4%
interested	42.4%	creative	25.9%	patient	28.2%
patient	30.3%	humble	25.9%	interested	24.4%
independent	27.3%	obedient	25.9%	motivated	20.2%
careful	21.2%	organized	25.9%	independent	19.3%
motivated	21.2%				

Table 14 summarizes the top ten words chosen by Diane's students, Luke's students, and all the students who participated in the study. (Eleven words are shown for Diane due to the fact that careful and motivated had the same percentage.) The words are shown with the percentage of students in each group who chose the word and listed in order from greatest to smallest

percentage. One clear pattern in the data is that the same six words (focused, teachable, brilliant, gifted, confident and patient) show up in the top ten words for Diane's students, Luke's students, and the entire group of students who participated in the study. It is impossible to know exactly what the students were thinking when they chose those words and the students could have interpreted the words in many different ways, but there does seem to be an important difference between the words brilliant and gifted versus the other four words (focused, teachable, confident, and patient) with regards to mind-sets about ability and intelligence.

The words brilliant and gifted are often used in a way that implies someone is inherently good at something or was born that way, rather than working hard to achieve a level of success or ability. This is consistent with a fixed mind-set where one believes that ability or intelligence is a fixed entity that cannot be changed. The other four common words (focused, teachable, confident, and patient) do not carry that same connotation of being inherently smart or talented and could relate more to a growth mind-set. For example, if you are patient and focused on learning the mathematical concepts, then you could increase your mathematical abilities and understanding through your own effort.

Performance goal orientations are usually associated with a fixed mind-set, while mastery goal orientations are usually associated with a growth mind-set (Ames, 1992; Ames & Archer, 1988; Dweck & Leggett, 1998; Middleton & Spanias, 1999). Based on the percentages of students who chose the six common words (focused, teachable, brilliant, gifted, confident and patient), it seemed likely there were some students in Diane and Luke's classrooms who believed in aspects of both fixed and growth mind-sets. For example, in Diane's classroom over 60% of the students chose focused, teachable, brilliant, or gifted. Since the percentage was so high, it is likely that many students in the class chose some or all of those four words. By choosing

brilliant or gifted, a student seems to communicate a belief in a fixed mind-set, while choosing focused or teachable could relate to a growth mind-set. This could help explain why students in both classrooms reported high means for personal mastery goals but they also reported means for certain personal performance goals that were relatively higher than what they perceived their teachers to be focused on in the classroom.

In Diane's classroom, the students reported an overall mean for personal performance-avoidance goals ($M = 2.99$) that was higher than their perception of Diane's focus on performance-avoidance goals in her instruction ($M = 2.06$). In Luke's classroom, the students reported an overall mean for personal performance-approach goals ($M = 3.37$) that was higher than their perception of Luke's focus on performance-approach goals ($M = 1.95$) in his instruction. These differences in means seem to suggest that students' personal goals may have been influenced by additional factors beyond their current teachers' goals and practices.

As mentioned previously, Diane and Luke reported a strong preference for using mastery-oriented strategies and they seemed to subscribe to a growth mind-set. Survey results showed that their students perceived them to be focused on mastery-oriented goals more than performance-oriented goals. These two teachers were also perceived to be emphasizing components of success in mathematics that were consistent with a mastery-orientation and a growth mind-set (e.g., the importance of effort, working to understand the concepts, and accepting mistakes as part of the learning process). Although Diane and Luke's students seemed to have mastery-oriented goals that were consistent with what their teachers were promoting and communicating in the classroom, the survey results seem to show that students in both classrooms may have also been focused on performance goals and adopted elements of a fixed mind-set.

As students move through elementary school, they are exposed to a variety of people and contexts that can influence their beliefs and views of success. Much as the teachers in the study learned different things about mathematics instruction from the various contexts they encountered, the students also learned about what it means to be successful in mathematics through the various contexts they experienced. Students in Diane and Luke's classrooms might have believed success was dependent on inherent ability based on messages they received from previous teachers. When asked how other teachers in their school might respond to the success in mathematics word task, both Diane and Luke felt some teachers at their schools would likely choose gifted or brilliant because, as Diane described, they believed students "can either do it or they can't." Although both teachers adopted a growth mind-set, they seemed to think that some of their colleagues subscribed to more of a fixed mind-set. Other possible influences on students' views of success and personal learning goals could have been some of the performance-oriented strategies that were emphasized at Diane and Luke's schools (e.g., publicizing students' test scores and proficiency levels or grouping kids by ability) and messages about success they heard outside of school from family members, peers, and the media.

In summary, Diane and Luke expressed similar views about success in mathematics that were consistent with a mastery orientation to teaching and a growth mind-set. Student survey data confirmed that students perceived both teachers to be emphasizing the importance of understanding the content, accepting mistakes as part of the process, and putting in effort to be successful in mathematics. Diane and Luke viewed speed and accuracy as important components of being successful in mathematics but they seemed to have some different ideas about related practices. Whereas Diane incorporated daily timed multiplication facts tests into her practice by choice, Luke only implemented the practice due to district requirements.

Although these teachers did not think natural ability was required for success in mathematics, many of their students seemed to exhibit elements of a fixed mind-set where one believed you had to be brilliant or gifted to be successful in mathematics. Although Diane and Luke used more mastery-oriented than performance-oriented strategies and they tried to communicate views about success in mathematics that were consistent with a growth mind-set, their students' beliefs seemed to be influenced by a combination of contexts and previous learning experiences.

Andrea and Kelsey

In the last part of this chapter, I use data from surveys and interviews to explore Andrea and Kelsey's views about success in mathematics. I also examine their students' views about success and students' perceptions related to how their teachers seemed to be communicating messages about success. I provide evidence that Andrea and Kelsey had similar mastery-oriented views regarding the importance of understanding, effort, learning from mistakes and minimizing competition. The two teachers showed differences with regards to the more performance-oriented components of speed/accuracy and ability/lack of ability, with Kelsey showing more aspects of a fixed mind-set and Andrea showing more of a growth mind-set. The student survey responses also showed some differences with regards to the messages the teachers were communicating about success in mathematics with Andrea focusing less on the value of mistakes and Kelsey focusing more on the potentially competitive practice of pointing out which students received high grades or test scores.

I begin with a discussion of the teachers' survey responses related to possible components of success in mathematics. I also include data from student surveys, teacher interviews, and classroom observations that relates to the different components of success in mathematics. Next, I explore the teachers' and students' responses to the success in mathematics

word list activity. Once again, I bring in any additional related data from surveys, interviews and observations.

Components of Success

In the teacher survey, Andrea and Kelsey showed some similarities and differences related to their views of possible components of success and failure in mathematics. They both seemed to agree that in order to be successful in mathematics, students should: (a) try to understand the concepts rather than just focus on correct answers, (b) recognize that making mistakes is an important part of the learning process, (c) work hard, and (d) not focus on trying to do better than other students in the class. These views about emphasizing understanding, effort, and learning from mistakes while de-emphasizing competition are consistent with a mastery orientation to instruction. In particular, the focus on effort is consistent with a growth mind-set, where intelligence or ability can be improved with effort. Although the two teachers reported consistent beliefs with regards to these components of success, the student survey results seemed to show that Andrea and Kelsey were not perceived to be communicating all these views to their students in the same way.

Andrea and Kelsey were perceived by their students to be strongly emphasizing effort (*Ms* = 4.57 and 4.29) and understanding (*Ms* = 4.22 and 4.77). In my observations of their teaching, I saw evidence of both teachers communicating these views to their students in explicit and implicit ways. They both made a point of praising students for their efforts during mathematics class and focusing on students' explanations more so than correct answers.

The two teachers were perceived as focusing on learning from mistakes and competition in different ways. Kelsey (*M* = 4.39) was perceived to be emphasizing the value of mistakes in the learning process more often than Andrea (*M* = 3.22). In my visits to Kelsey's classroom, I

observed her talking to students explicitly about the value of mistakes. She made a point of commending a student who had checked her work, realized her mistake, and ended up with a better understanding of the concept. Kelsey had this student share her thinking with the other students so they could learn from her process. When she asked the students if it was acceptable to make mistakes in mathematics, one of the students responded by saying, "everybody makes mistakes." Kelsey asked if he was quoting her, so it seemed that this was an explicit message she shared regularly with her students.

In my visits to Andrea's classroom, I did hear some discussion of mistakes in the second lesson I observed, but it was more about catching your mistakes rather than the value of mistakes as part of the learning process. At the end of the problem-solving lesson on area, Andrea asked the students what they did well in their groups. Multiple students said they compared their work and when they had different answers they worked together as a group to figure out the correct answer. Andrea agreed that it was important to work together to agree on one answer and she asked the students if they found a lot of mistakes when they compared answers. Many of the students said they did find multiple mistakes and Andrea responded by saying, "Silly ones, right?" This response seemed to imply that their mistakes were "silly" so students should not have made them in the first place. Although Andrea seemed to believe that making mistakes was an important part of the learning process in mathematics, I did not see her explicitly communicating that message to her students in the same way that Kelsey did.

Although both Kelsey and Andrea did not think that students should focus on trying to do better than other students in order to be successful with mathematics, Kelsey was perceived by her students to be using some performance-approach practices that could be viewed as encouraging this type of behavior. In particular, Kelsey had higher mean values than Andrea for

calling attention to the students who received the highest test scores (*Ms* = 3.29 and 1.48) and pointing out students who earned good grades as an example (*Ms* = 2.71 and 1.74). Although I did not see any evidence of these practices in my observation of Kelsey's teaching, she did tell me about two practices she used that year that could have influenced students' perceptions in this area. She had what she called the "100% Club," which basically entailed an announcement of students who received a score of 100% on tests or assignments. Kelsey would announce their name as she handed back papers to the students. She later realized this was not a good idea when some students told her how disappointed they were when they never made it into the 100% Club. The other practice Kelsey used in her classroom was a "Sharing Spot" bulletin board where each student had a spot and they could hang up whatever they wanted to display. Some students chose to hang graded mathematics assignments or other graded work, while other students put up drawings and other non-graded artifacts.

Andrea and Kelsey seemed to have some different ideas about the importance of ability/lack of ability and speed/accuracy for success in mathematics. Kelsey seemed to place more importance on natural ability or lack of ability than Andrea did. Kelsey agreed (value of 4) with the statement that "some students will always struggle with mathematics no matter how hard they work" and she somewhat agreed (value of 3) that "natural ability was more important than effort" for success in mathematics. Andrea, on the other hand, disagreed (value of 2) with both statements. These results provide evidence that Kelsey might have had some beliefs consistent with a fixed mind-set while Andrea was focused on more of a growth mind-set. Kelsey also agreed (value of 4) that it was important "for students to be able to solve mathematics problems quickly and accurately" while Andrea disagreed (value of 2) with the same statement.

Focusing on differences in natural ability, speed and accuracy is consistent with a performance orientation to instruction. In particular, the focus on natural ability, or lack of natural ability, is consistent with a fixed mind-set where ability or intelligence is considered something you are born with that cannot be changed or improved. Kelsey's survey responses seemed to show that she had beliefs about success in mathematics that were consistent with both a growth mind-set and a fixed mind-set. As a matter of fact, Kelsey assigned the same exact value of 4 to the statements about the value of mistakes and the importance of speed and accuracy. At first glance, those statements seem to be contradictory in nature because if you are accurate then you should not make mistakes. It seems possible that a teacher could value speed and accuracy with regards to quick recall of mathematics facts, but perhaps allow students time and space to make mistakes with problem-solving activities or explorations of new content. In my observations, I never saw Kelsey focusing on speed and accuracy during her mathematics lessons. Instead, I saw her giving students time to explore, encouraging them to try different strategies until they figured out what worked, and communicating the value of mistakes. In addition, Kelsey did not used timed tests for mathematics facts in her classroom.

One possible explanation for the differences in the two teachers' views about natural ability could be Andrea's background in special education. During teacher preparation, Andrea learned how to work with students who had different learning disabilities and learning challenges. As part of this experience, she learned various teaching strategies and had multiple field experiences where she worked in a special education setting. In particular, Andrea's experience during student teaching with the community of practice at her school allowed her to work in conjunction with her general education cooperating teacher and her special education cooperating teacher to find effective ways to meet the varied needs of students in mathematics.

During teacher preparation, Kelsey did not have any specific coursework or field experiences focused on students with special learning needs. It was possible that Andrea believed she had developed a toolbox of strategies for helping students with special needs be successful in mathematics, while Kelsey might not have learned those types of strategies or approaches so she thought there would always be some students who would struggle in mathematics.

In one of the interviews, Andrea described how her views about speed and accuracy differed from other teachers in the school, and she attributed the differences to her special education background. In the beginning of the year, the teachers at Draper Upper Elementary were required to do timed tests for mathematics facts. Some teachers continued to do timed tests throughout the year and posted lists showing the students who had mastered their facts. Andrea felt that doing timed tests for mathematics facts in 5th grade was a waste of time and resources, in addition to being embarrassing for the students who did not have their facts memorized.

> There's going to be those kids that never really memorize them. If they use their multiplication chart at this point, what's the big deal? And I think that comes from my special education background. If they need a calculator, let them do it.
>
> (Andrea, Interview, March 29, 2012)

Another possible explanation for some of the differences in the two teachers' views about success in mathematics could be due to their different experiences with teaching mathematics to upper elementary students. Before teaching at Draper Upper Elementary, most of Kelsey's experiences with teaching mathematics occurred in a kindergarten classroom. Expectations for success in kindergarten could be very different than expectations for success in 5th grade. Kelsey admitted that teaching 5th-grade mathematics was quite a shift in thinking for her because she had been so focused on teaching younger children throughout her teacher preparation program.

Success in Mathematics Word List Activity

As mentioned previously, the teachers and students both completed an activity where they looked at a list of 27 adjectives and chose the five words they thought best described someone who was successful in mathematics. When Andrea first completed the word list task, she thought of one student in her class who had been successful with mathematics and chose five words that described that particular student: focused, independent, organized, patient, and teachable. She went on to add other words that described additional successful students: confident, introverted, and passionate. Andrea also added in some words and phrases of her own including: cooperative, background knowledge, problem solving, and methodical.

Kelsey approached the word list task by thinking of a few different students in her class who were successful with mathematics and choosing a word that applied to each student. Her list of words included: organized, confident, interested, curious, and resourceful. Kelsey spent a lot of time in the interviews talking about the importance of confidence for success in mathematics. She had noticed that the students in her class who were really confident tended to be the ones who were successful in mathematics. She also talked about a student in her class who used to hate mathematics, but after he started working with a tutor and boosted his confidence, his outlook on mathematics and himself as a learner became much more positive.

Kelsey specifically talked about making an effort to build her students' confidence in mathematics. She tried to acknowledge their feelings when a task was challenging, while also letting them know that she believed they were capable of completing the task.

> And then I always say, "Well, I'm still learning" or I say, "You know, this is hard for me too." So validating their feelings if they're not confident. I do that a lot. I prepped them for the lesson later and I said, "It's going to be a challenge but I

> know that you can do this and it's something that I am pushing you farther in and you're going to be working in a group so you're going to be able to work together." So I'm trying to build their confidence by saying, "I know this is hard but I know you can do it" sort of thing.
>
> (Kelsey, Interview, March 29, 2012)

In the beginning of the year, Kelsey used to rush to her students' aid if they struggled, but she realized that her behavior was fostering "learned helplessness" rather than building their confidence. Based on this realization, she changed her practice and encouraged students to spend time working on a task before they asked for help and she made a point of not rushing to their aid at the slightest sign of struggle. Kelsey also tried to communicate that it was okay to struggle and try a variety of strategies in order to solve a problem. All of these practices are consistent with fostering a growth mind-set in students.

As an elementary student, Kelsey was not very confident in her own mathematical abilities. She experienced a major turning point in middle school when she had a teacher who was passionate about mathematics and helped her feel confident and successful in the subject. As a result of that experience, Kelsey modeled herself after that teacher and tried to foster the same kind of confidence in her own students.

As a teacher, Kelsey struggled with her own confidence related to teaching 5th-grade mathematics. She did not feel confident with the content because she had never taught mathematics to upper-elementary students and she was not sure how best to teach the concepts. In the middle of the school year, Kelsey asked her students to fill out a survey about what was going well and what she could improve on in her teaching. On the survey, many of Kelsey's students listed mathematics as the area she needed to work on. Although this data did not

improve her confidence with respect to teaching 5th-grade mathematics, she recognized that mathematics was an area she definitely needed to work on. This was actually one of the reasons Kelsey was so frustrated with the lack of professional development and teacher collaboration around mathematics at Draper Upper Elementary. She had the desire to learn more and improve her mathematics instruction, but there were no learning opportunities provided at her school. Luckily, Kelsey had the community of practice she had developed with Andrea, which provided her with a powerful learning experience around teaching mathematics.

Table 15 summarizes the top ten words chosen by Andrea's students, Kelsey's students, and all the students who participated in the study. (More than ten words are shown for Andrea's students since there were multiple words chosen by 17.4% of the students.) The words are shown with the percentage of students in each group who chose the word, and listed from greatest to smallest percentage. In my analysis of the data that follows, I focus first on what appears similar across the sets of students and then on any notable differences in the data.

Table 15

Students' Choices for Success in Mathematics Word List Activity – Andrea and Kelsey

Kelsey's students	(n = 31)	Andrea's students	(n = 23)	Total Students	(n = 238)
brilliant	90.3%	focused	73.9%	focused	62.2%
focused	77.4%	brilliant	60.9%	teachable	50.8%
gifted	61.3%	gifted	52.2%	brilliant	50.8%
confident	41.9%	teachable	34.8%	gifted	38.7%
teachable	41.9%	obedient	30.4%	confident	37.0%
passionate	29.0%	patient	30.4%	open-minded	29.4%
diligent	25.8%	persistent	26.1%	patient	28.2%
interested	25.8%	confident	21.7%	interested	24.4%
resourceful	22.6%	resourceful	21.7%	motivated	20.2%
motivated	19.4%	interested	17.4%	independent	19.3%
		open-minded	17.4%		
		organized	17.4%		
		passionate	17.4%		

Six words (focused, teachable, brilliant, gifted, confident, and interested) showed up in the top ten for all three groups of students. These same six words showed up in the top ten for Diane's students and all of the words, except for interested, also showed up in the top ten for Luke's students. As mentioned in the previous section, there seems to be noteworthy differences between the words brilliant and gifted versus the other four words (focused, teachable, confident, and interested) in terms of mind-sets regarding intelligence. Brilliant and gifted imply more of a fixed mind-set (i.e., ability or intelligence is a fixed entity) while the other four words seem to refer to traits that could be controlled or changed with effort (i.e., more consistent with a growth mind-set). Performance goal orientations are usually associated with a fixed mind-set while mastery goal orientations are usually associated with a growth mind-set. More than half of the students in Andrea and Kelsey's classrooms chose the words brilliant, focused and/or gifted. Since such a large percentage chose the two words associated with a fixed mind-set, it seemed likely that those students could also have adopted some performance-oriented goals with relation to mathematics. The word focused, along with other words in the top ten choices for Andrea and Kelsey's students (e.g., persistent, diligent, and resourceful) seemed to imply more of a growth mind-set where students could increase their abilities and achieve success through effort. The students who chose these words may have adopted some mastery-oriented goals for mathematics, while students who chose words associated with both mind-sets might have adopted both mastery- and performance-oriented goals.

Although Kelsey did not choose the words brilliant or gifted, she did have survey responses that seemed to show at least a partial belief that natural ability, or lack of natural ability, could be a factor for success in mathematics. As mentioned previously, it seemed possible that Kelsey had some beliefs related to both a fixed mind-set and a growth mind-set.

The students' responses to the success in mathematics word list activity suggest that at least some of them also had beliefs related to both fixed and growth mind-sets. Over 90% of Kelsey's students chose the word brilliant so there was some agreement among the students that you have to be brilliant to be successful in mathematics. In an interview, Kelsey described where she thought students learned messages about success in mathematics:

> I think just society as a whole and I mean, I don't want to stereotype but they always say, "well, the smart kids, they're good at math" or certain cultures are better at math. I think that's what they hear and that's what they see on TV and that's what they hear from their parents. And if their parents aren't good at math or they're not confident, then they don't feel brilliant in math.
>
> (Kelsey, Interview, March 29, 2012)

Although there were some similarities across the three groups of students shown in Table 15, there were some notable differences as well. Almost one third (30.4%) of Andrea's students chose the word obedient. This word did not show up in the top 10 for either Kelsey's students or the entire set of students. In fact, only 3.2% of Kelsey's students chose the word obedient so there seemed to be some different ideas in the two classrooms about the importance of obedience for success in mathematics. Some of Andrea's students seemed to think that it was important to do whatever the teacher told them to do in order to be successful in mathematics. This may relate to why Andrea was perceived to be communicating performance-avoidance goals more than Kelsey (*Ms* = 3.08 and 2.16). The survey statements related to perceptions of teacher performance-avoidance goals were all phrased in a way that the teachers were "telling" the students to do something. For example, "My teacher tells us that it is important that we don't look stupid in mathematics class." If students in Andrea's class thought they had to do

everything the teacher said, that belief might have led them to pay special attention to any messages they perceived their teacher to be communicating.

Another notable difference between the data for Andrea and Kelsey's students was the fact that almost twice as many students in Kelsey's class chose the word confident (41.9% versus 21.7%). Considering that Kelsey made a special effort to develop students' confidence in math, this provided some evidence that her efforts may have been getting through to at least some of her students since they emphasized, more so than Andrea's students, the importance of confidence for success in mathematics.

In summary, Andrea and Kelsey shared similar views with regards to the importance of understanding, effort, learning from mistakes, and minimizing competition. Their students perceived them to be emphasizing the importance of effort and understanding in similar ways so the teachers seemed to be communicating messages that were consistent with a growth mind-set. As far as the other two components of success, Kelsey was perceived to be emphasizing the value of mistakes more than Andrea but Kelsey was also perceived to be using some performance-oriented practices that could promote competition. The two teachers reported different views about the importance of natural ability (or lack of ability) and speed/accuracy for success in mathematics. Kelsey's views that natural ability and speed/accuracy were important seemed more consistent with a performance-orientation and a fixed mind-set. Therefore, Kelsey seemed to have aspects of both a growth and fixed mind-set. The results from the student surveys showed that students had beliefs about success in mathematics that also showed aspects of both a growth and fixed mind-set. It seemed possible that some of the differences in the teachers' views about components of success could be due to their different experiences in teacher preparation regarding special education and teaching upper elementary.

Although Andrea and Kelsey exhibited a lot of similarities in their views, there were some areas where they seemed to differ. Kelsey was seen to be emphasizing the value of mistakes more than Andrea, but she was also perceived to focus on grades and test scores more often. These differences seemed to be due to explicit messages and practices that Kelsey had decided to use in her classroom. First of all, she explicitly talked to the students about the value of mistakes. This particular focus on mistakes as part of the learning process may have been due to her own experiences in mathematics and/or her strong desire to help students develop their confidence in mathematics. Secondly, Kelsey announced the names of students who received scores of 100% on tests and they became members of the 100% Club. She later realized that this practice was not helpful for building up the confidence of the students who never received a score of 100% and were therefore excluded from the club.

Another difference between the teachers was that Andrea was perceived to be communicating some performance-avoidance goals and some of her students seemed to think obedience was important for success in mathematics. These two things may or may not have been related, but at least some of Andrea's students seemed to feel that she was explicitly telling them what they should do. For example, they perceived her to communicate an expectation that they should participate in discussions and answer questions so it did not look like they were unable to do the math work. Since Andrea focused strongly on developing understanding, it was possible that some of her messages or directives were misunderstood. In her lessons, she tried to involve a variety of students to gain insight into their thinking and understanding of the concepts. She may have told them that she wanted them to participate so she could learn more about their

understanding, but students may have interpreted that to mean that she wanted to make sure they could do the work and so they perceived her to be communicating performance-avoidance goals.

Summary of Chapter Findings

As reported in Chapter 5, Diane and Luke seemed to have similar views and practices related to mastery-oriented instruction in mathematics which were likely influenced by the strong degree of alignment they experienced among their second mathematics methods course, their cooperating teachers, and their own personal beliefs about teaching. In this chapter, I provided evidence that these two teachers also seemed to share similar views about success in mathematics that were consistent with a mastery orientation to teaching and a growth mind-set. Although the students in both classrooms seemed to perceive Diane and Luke to be communicating these views about success in similar ways, the survey results suggest that the students themselves may have subscribed to elements of both growth and fixed mind-sets.

In Chapter 6, I argued that Andrea and Kelsey also seemed to have similar mastery-oriented views and practices, which were likely influenced by their participation in certain communities of practice centered around teaching mathematics. In this chapter, I provided evidence that although these two teachers seemed to share some similar mastery-oriented and growth mind-set views about success in mathematics, they were perceived to be communicating these views to their students in different ways. Due in part to some explicit messages and practices in her classroom, Kelsey was perceived to be emphasizing the value of mistakes for learning (i.e., mastery-oriented belief) and competition (i.e., performance-oriented belief) more than Andrea. In addition, Kelsey seemed to have some beliefs about success in mathematics that were consistent with more of a fixed mind-set and a performance orientation to teaching. Therefore, Andrea seemed to subscribe to a growth mind-set while Kelsey exhibited aspects of

both a growth and fixed mind-set. It seemed possible that the differences in the teachers' views about success and related practices could have been due to the different learning experiences they had during teacher preparation around special education and working with upper-elementary students in mathematics. Although Andrea and Kelsey seemed to have some different views about success in mathematics, the survey results suggest that students in both classrooms may have subscribed to elements of both fixed and growth mind-sets.

CHAPTER 8: DISCUSSION

Research Question 1: Teachers' Use of Mastery- and Performance-Oriented Practices

Overall, the 10 teachers in the study reported a stronger mastery orientation than performance orientation in mathematics, and they were all perceived by their students to be more mastery-oriented than performance-oriented. Since mastery goals have been shown to be beneficial for students' learning (Ames, 1992; Leonardi & Gialamas, 2002; Middleton et al., 2004; Perry, 2011; Wolters, 2004), these findings provide evidence that these early-career, upper elementary teachers promoted beneficial learning goals for their students in mathematics.

The students in all 10 classrooms also reported high personal mastery goals and lower personal performance goals. Since the teachers were perceived to be emphasizing mastery goals more than performance goals, these results are consistent with previous research that showed students' personal goal orientations can be influenced by the goal orientations that teachers emphasize in the classroom (Lau & Nie, 2008; Maehr & Midgley, 1991; Meece et al., 2006; Midgley, 2002; Patrick & Ryan, 2008; Wolters, 2004). Based on the data collected, I do not know what the students' orientations were prior to entering these classrooms, so it is possible that they could have come in with strong mastery orientation goals that were not necessarily influenced by the goal orientations of the teachers who participated in the study.

Although the teachers were primarily focused on mastery-oriented strategies in mathematics, there were some performance-oriented strategies being used by some of the teachers. The most common performance-oriented strategies used by teachers in the study involved pointing out students who did well on tests or assignments and also displaying the work of the highest achieving students. The use of these performance-oriented practices was confirmed by multiple sources of data including teachers' self-report, students' perceptions

and/or classroom observations. It is possible that the use of these practices could create a competitive classroom culture and promote less beneficial performance goals, but the case studies revealed that some teachers who used these practices were not always doing so by choice or had changed the use of those practices. For example, Diane was required to publicize students' quarterly benchmark test scores, while Kelsey had abandoned the use of her "100% Club" after realizing how it had negatively affected some students in her classroom.

Research Question 2: Factors Associated with Teachers' Use of Instructional Practices

Although the teachers in the study were similar in that they all focused on mastery-oriented practices in their mathematics teaching, they differed in how they learned and developed those practices. Through the use of a situated learning perspective, I conceptualized each teacher's learning-to-teach experiences as a "single trajectory through the multiple contexts of teacher education" (Borko et al., 2000, p. 196). In the upcoming sections, I summarize the different learning trajectories of the four teachers featured in the case studies (Diane, Luke, Andrea, and Kelsey) and highlight the factors that seemed to be important for their learning and development of mastery-oriented practices in mathematics.

Diane's Learning Trajectory

During her year of student teaching, Diane seemed to feel a strong degree of alignment between what she learned and saw modeled in her second mathematics methods course and her student teaching classroom. She also felt like the mastery-oriented practices and ideas she learned about in those two contexts resonated with her own ideas related to effective mathematics teaching, which had been shaped by some of her experiences with mathematics as a K-12 student. Due to this sense of alignment and coherence, Diane felt she had multiple opportunities to see mastery-oriented practices modeled and multiple opportunities to use and

develop those practices in her own teaching. These findings are consistent with other studies that have shown the importance of compatibility or coherence between the instructional practices promoted in methods courses and student teaching placements for the development of beginning teachers' instructional practices (Borko et al., 2000; Cavanagh & Prescott, 2007; Nolen et al., 2011; Prescott & Cavanagh, 2008).

When Diane began her full-time teaching at Cooper Elementary, she did not encounter the same sense of alignment because most of her colleagues were not teaching in ways that were consistent with her vision of effective mathematics teaching and there were school and district expectations about using certain performance-oriented strategies. Although Diane did not agree with how her colleagues taught mathematics or the strong focus on test scores at the school, she seemed to be able to deal with the misalignment and teach in ways that were primarily consistent with a mastery orientation and the vision of effective mathematics teaching she had developed and enacted during student teaching.

First of all, Diane felt very confident that the mastery-oriented strategies she developed during student teaching and continued to refine during her full-time teaching were beneficial for her students' learning and engagement in mathematics. The strong sense of alignment she experienced during her year of student teaching allowed her to see mastery-oriented strategies modeled in multiple learning contexts and practice them on a daily basis in her own instruction. When Diane began teaching at Cooper Elementary, she already had a year of experience using mastery-oriented instructional practices in mathematics. Based on her teaching experiences and what she had learned in the multiple learning-to-teach contexts she participated in during student teaching, Diane felt very strongly that those mastery-oriented practices were best for her students' learning. Therefore, she felt confident using instructional practices she believed in and

had experience using, even though those practices did not align with what the other teachers in the school were doing.

Another factor that seemed to help Diane deal with the misalignment she experienced in her full-time teaching context was the fact that she had the full support of the vice-principal (Mary) at Cooper Elementary. Through her explicit messages to Diane and other teachers in the building, Mary communicated that she believed Diane's mathematics instruction was exemplary and a model for others to follow. Previous research has shown that administrators can shape beginning teachers' learning and development through their support (Steele, 2001), direct interactions with teachers (Youngs, 2007b), and the way they provide access and construct meaning around policy messages related to instruction (Coburn, 2005). Diane's vice-principal, Mary, seemed to be encouraging her use of mastery-oriented practices in all of these ways. Mary supported Diane through verbal encouragement and access to extra resources (e.g., multiple mathematics curriculum materials) for mathematics instruction. In her direct interactions with Diane, Mary clearly communicated her excitement and approval related to Diane's mathematics instruction. Finally, even though there was a strong focus on test scores at the school, Mary engaged all the teachers in professional development related to incorporating more discussion in mathematics lessons and developing students' understanding of concepts. In her effort to help teachers improve their practice in these areas, Mary had multiple teachers observe Diane's mathematics instruction in person or through the use of videotaped lessons.

Luke's Learning Trajectory

Much like Diane, Luke experienced a strong sense of alignment during student teaching among his second mathematics methods course, his cooperating teacher's practices, and his own vision of effective mathematics teaching. Diane and Luke did have some common learning

experiences in that they were classmates in both of their mathematics methods courses and they both worked with cooperating teachers who had graduated from the same teacher preparation program that they attended. Although their learning trajectories were somewhat similar during teacher preparation, those trajectories differed quite a bit during their first year of full-time teaching.

In his first year, Luke found himself using mastery-oriented practices less often and veering away from the vision of effective mathematics teaching he developed and refined during student teaching. It appeared that his instruction that year was influenced by specific characteristics of the school context including the mathematics curriculum and what he perceived as the principal's expectations about mathematics instruction. This is very similar to the experience of a secondary mathematics teacher (Mr. Hanson) featured in a study by Peressini et al. (2004). In that study, Mr. Hanson was observed to be teaching mathematics his first year in ways that were very different from his instruction during student teaching and disconnected from his vision of effective mathematics teaching because of "time constraints, the emphasis on covering district standards in preparation for district and state tests, the expectations brought to his class by students and the norms for mathematical tasks and discourse that were fostered by other teachers and administrators" (Peressini et al., 2004, p. 88).

Although Diane and Luke both experienced a sense of misalignment between aspects of their visions of effective mathematics teaching and their school contexts, Diane seemed better able to deal with this misalignment. One important difference between their teaching contexts in that first year was Diane felt support from her vice-principal, while Luke did not feel support from his principal. Diane received continual praise for her mathematics instruction, but Luke remembered receiving only negative feedback on what he felt were seemingly insignificant

things he was doing wrong. Whereas Diane's vice-principal provided her with a wide variety of curriculum resources and encouraged her to use them in the way she thought was best, Luke felt his principal expected him to use the mathematics workbook page-by-page in the same way all the other 2nd-grade teachers used it with their students. Although Luke's experience with his principal was almost the opposite of Diane's experience with her vice-principal, these findings provide additional evidence in support of research showing that administrators can shape beginning teachers' practice in important ways (Coburn, 2005; Steele, 2001; Youngs, 2007b).

Luke's learning trajectory changed quite a bit in his second year of teaching when he moved from teaching 2nd grade to teaching 4th grade. He no longer had a student workbook for mathematics so he did not feel the same expectations about teaching mathematics and using the curriculum in a certain way. He also felt more confident because he had taught 4th grade during student teaching and so he was familiar with the mathematics content and teaching strategies for that grade level. As a result of these changes, Luke felt that he was able to use more mastery-oriented instructional practices, much like he did during student teaching. Instead of standing up in front of the class and going through the workbook page-by-page, as he did in his first year, he incorporated group work, explorations, manipulatives, projects, discussions, and real-world connections as much as possible. As was the case with Mr. Hanson in Peressini et al.'s (2004) study, Luke's mathematics teaching in his second year was more consistent with his student teaching experience and his vision of effective mathematics teaching. These findings are consistent with other research showing that beginning teachers often find it challenging to incorporate practices they learned during teacher preparation in their first year of full-time teaching (Cady et al., 2006; Marbach-Ad & McGinnis, 2009; Prescott & Cavanagh, 2008).

Andrea's Learning Trajectory

Andrea's learning trajectory and development of mastery-oriented practices were not based on a strong sense of alignment or coherence as it was with Diane and Luke. In Andrea's case, her learning and development seemed to be strongly influenced by her participation in some communities of practice focused on teaching mathematics that were located outside of the university. Although Andrea found her mathematics content courses and her first mathematics methods course to be productive learning experiences, she did not feel that her second mathematics methods course was helpful for developing her practice related to teaching mathematics. Instead, what she found to be extremely helpful during student teaching was the work she engaged in with her two cooperating teachers (and other teachers). This work involved, among other things, planning lessons, adapting the Everyday Mathematics curriculum for a workshop approach, evaluating student work, and co-teaching lessons. Andrea's experience seemed to be different than the traditional student teacher-cooperating teacher relationship due in part to a yearlong professional development workshop she attended with both of her cooperating teachers. Through this professional development experience, Andrea and her cooperating teachers worked together as a team to learn, practice, and reflect on various teaching strategies in mathematics.

According to Wenger (1998, 2000, 2011), communities of practice can vary in size but they all share three important characteristics: (a) joint enterprise (i.e., the domain), (b) mutual engagement (i.e., the community), and (c) shared repertoire (i.e., the practice). Andrea and her cooperating teachers were engaged in a community of practice in which they focused on the joint enterprise of improving their mathematics instruction and meeting the learning needs of all their students. According to Andrea's interpretation of her experience with this community of

practice, there seemed to be mutual engagement because Andrea and the other teachers worked as a team and learned from each other and their work together on using the strategies they learned about in their professional development sessions. Andrea was not just on the periphery observing the other teachers, but instead she was actively involved in their community of practice. Finally, in their work together, Andrea and the other teachers developed a shared repertoire for teaching mathematics that included lesson plans, discussion techniques, questioning skills, formative assessment strategies, grouping strategies, and a general structure for using a mathematics workshop approach. Andrea incorporated aspects of this shared repertoire into her mathematics instruction, which she later used in her full-time teaching and her work with Kelsey in a different community of practice.

When Andrea and Kelsey began their first year of full-time teaching at Draper Upper Elementary, they decided early on to develop a partnership and work together to plan their instruction. They had been classmates in their first mathematics methods course so they had previous experience working together and they had some shared knowledge about teaching mathematics from that particular class. Andrea and Kelsey met every week to work together on planning lessons, developing assessments, creating handouts and slideshows, evaluating student work, etc. In those meetings, they also discussed their practice and ways to improve their students' learning in mathematics. This partnership developed into a community of practice focused on teaching mathematics. Every gathering of teachers talking about their experiences or sharing materials is not necessarily a community of practice, but in this case, all three characteristics of Wenger's (1998, 2000, 2011) definition were present: (a) joint enterprise, (b) mutual engagement, and (c) shared repertoire. Andrea and Kelsey were very committed to the joint enterprise of developing their mathematics instruction and improving student learning.

Both teachers were mutually engaged in that they both participated actively, shared ideas, and learned from each other and their work together. As they worked together, they developed a shared repertoire around teaching mathematics using mastery-oriented practices such as challenging problem-solving tasks and groupwork.

Andrea often shared ideas and resources that had previously been developed as part of the shared repertoire for the community of practice she participated in during student teaching. From a situated learning perspective, these shared ideas and resources could be considered "boundary objects" as Andrea brought them from one community of practice into another community of practice (Nolen et al., 2011). Andrea and Kelsey would then work together to negotiate how to adapt these ideas and resources so they would fit the needs of their students and the context at Draper Upper Elementary. Through their negotiation, they incorporated the newly adapted resources and practices into the shared repertoire of their two-person community of practice. Even though Andrea was often the one sharing her knowledge and experiences, she still felt that she learned a great deal and was able to develop her practice further because of the work she did with Kelsey as they adapted and modified lessons, activities, and ways to use a mathematics workshop approach. If Andrea had not been working with Kelsey on a regular basis, she may not have had the same opportunities to learn and further develop her practice.

Kelsey's Learning Trajectory

Kelsey had a very different learning trajectory than all the other case study teachers because she spent most of her time during teacher preparation focused on the goal of becoming a kindergarten teacher. Her teaching major was specifically focused on young children and all of her field experiences were with young children. In her mathematics content and methods courses, she paid careful attention to anything that pertained to mathematics concepts and

pedagogy for teaching kindergarten. She even did her year of student teaching in a kindergarten classroom.

Kelsey's learning trajectory went through an abrupt shift when she was hired to teach 5th grade for her first year of full-time teaching at Draper Upper Elementary. Since she had focused her learning and development on teaching mathematics in kindergarten, Kelsey did not feel confident planning and teaching mathematics lessons for upper elementary students. Unfortunately, there did not seem to be much support at Draper Upper Elementary for helping teachers examine or develop their mathematics instruction. Teachers were not allowed to team and there did not seem to be much collaboration between teachers around mathematics. The school administrators had focused all school-wide reform efforts on reading instruction, so there seemed to be no available resources for mathematics (e.g., manipulatives). Kelsey was never observed teaching mathematics so she never received feedback from her administrators on her mathematics teaching. Although Kelsey had never used the Everyday Mathematics curriculum required by the school, there was no professional development or guidance provided on how to use or adapt the curriculum. Therefore, Kelsey (and Andrea) seemed to be missing all of the components of a supportive learning culture for early-career teachers identified by Lovett and Cameron (2011): professional talk about what to teach, observations and feedback on actual teaching, and organizational features such as resource allocation.

Although Kelsey's mathematics methods courses had focused on strategies for teaching a wide range of concepts and grade levels, she admitted that she had not focused her learning on the ideas related to upper elementary because she had been so intent on becoming a kindergarten teacher. As a result, Kelsey had a lot to learn about teaching 5th-grade mathematics and there did not seem to be a lot of support mechanisms in place at Draper Upper Elementary to help her

develop in this area. This seems to further emphasize the importance of the community of practice that Andrea and Kelsey developed together around mathematics instruction. Since there was not a supportive learning culture at the school, these two teachers had to create their own. Luckily, they had worked together before in their first mathematics methods course and they shared similar aspects of a vision of effective mathematics teaching. In the beginning, Andrea may have provided most of the ideas and suggestions due to her experiences teaching mathematics in upper elementary and the shared repertoire she had developed with her cooperating teachers during student teaching. As the year progressed and Kelsey learned more and became more confident with planning and teaching 5th-grade mathematics, she contributed more of her own ideas and suggestions.

As a result of their self-created community of practice, Kelsey and Andrea both seemed to learn a great deal from working together to develop their practice and identities as mathematics teachers. If only one of the teachers had been hired to teach at Draper Upper Elementary, it would likely have been a very different learning and teaching experience. Although it is possible Andrea or Kelsey could have worked with another teacher at the school, it seemed important that these two teachers had the shared background of being classmates in their first mathematics methods course. In that setting, Andrea and Kelsey worked together on ideas related to teaching and learning mathematics. I was the course instructor and often observed these two teachers working together in small groups during class. They also had shared knowledge in that they had been exposed to the same readings, discussions, activities and instructional practices related to teaching mathematics. These shared experiences and shared knowledge were things they could build on in their work together. Therefore, this seemed to provide a much different opportunity for collaboration than working with a teacher who you

have never worked with before and who may have very different ideas about effective mathematics instruction.

Views of Success in Mathematics

Previous research has shown that it is possible for teachers to change students' views about intelligence and success in mathematics from a fixed mind-set to a growth mind-set, and this change can result in increased student motivation and achievement (Conference Board of the Mathematical Sciences, 2012; Dweck, 2010; National Mathematics Advisory Panel, 2008). The results from the success in mathematics word list activity, although limited in scope, seemed to provide evidence that some of the upper elementary students who participated in the study may have subscribed to elements of both a fixed mind-set and a growth mind-set. The majority of teachers in the study seemed to be focused on a growth mind-set and they communicated this view to their students in varying degrees. Although survey results showed that students perceived their teachers to be focused on emphasizing and recognizing effort in mathematics (i.e., growth mind-set), it seemed possible that students' mind-sets were also likely influenced by factors other than the classroom teacher such as messages from previous teachers, family members, school-wide goals, media, and peers.

Implications for Teacher Education

In this study, I focused on early-career, upper elementary teachers who had graduated from the same teacher preparation programs where they were exposed to similar mastery-oriented teaching practices in mathematics. Although my results showed that all the teachers in the study reported and were perceived to be using mastery-oriented instructional practices in their teaching of mathematics, these results cannot be generalized to all early-career, upper elementary teachers or even all early-career, upper elementary teachers who graduated from the

same teacher preparation program. My sample was limited in size with only 10 teachers and this is a small percentage of the number of teachers that graduate from the teacher preparation program each year.

In my case studies, I provided information about the different learning trajectories that some teachers experienced and the factors that seemed to influence their learning and use of mastery- and/or performance-oriented strategies in mathematics. Since I only focused on four teachers, these results cannot be generalized to all early-career, upper elementary teachers but the results do provide evidence of possible factors that teacher educators should consider as they think about ways to help beginning teachers learn about and use mastery-oriented strategies in mathematics.

The case studies on Diane and Luke, along with previous research on the mathematics instruction of beginning teachers (Borko et al., 2000; Cavanagh & Prescott, 2007; Nolen et al., 2011; Prescott & Cavanagh, 2008), highlight the importance of coherence and alignment between the instructional practices emphasized in the methods courses and the instructional practices emphasized in student teaching placements. If we want teachers to use mastery-oriented instructional practices in mathematics, then it would be most beneficial if they could see those practices being modeled in the different learning contexts they experience and participate in as student teachers, including their mathematics methods and content courses. In an ideal world, teacher preparation programs would only partner with cooperating teachers who have been carefully screened and observed to make sure they are using mastery-oriented practices (and other strategies emphasized in the methods courses). Although this kind of partnership would be the ideal, it is usually not feasible due to the time, effort, and human resources required. Focusing only on teachers who are using mastery-oriented practices on a regular basis

also discounts experienced teachers who may not always use mastery-oriented practices but may be open to learning new strategies along with their student teachers. Therefore, teacher education programs should look for other ways to build more coherence between methods courses and student teaching placements. One way to build coherence could be to recruit cooperating teachers who are recent alums of the teacher preparation program (as was the case with Diane and Luke) and are therefore familiar with the practices and ideas emphasized in the methods courses. Another way to build coherence might be to offer professional development for the cooperating teachers so they are exposed to the same instructional practices and are prepared to support the research-based methods that the prospective teachers learn about in the teacher preparation program.

The cases of Andrea and Kelsey highlight how communities of practice outside of the university teacher preparation program can provide powerful learning opportunities for beginning teachers. Andrea learned a great deal by participating in a yearlong professional development workshop with her cooperating teachers. As mathematics teacher educators, we could focus on designing specific learning opportunities for student teachers to attend with their cooperating teachers. In some cases, these types of learning opportunities are already in place but we could try to be more explicit about designing such opportunities or encouraging cooperating teachers to invite their student teachers along to any professional development opportunities that are offered.

Andrea and Kelsey's positive learning experience with their own community of practice suggests the benefits of encouraging beginning teachers to maintain strong connections with classmates from their methods courses so they have colleagues they can talk to on a regular basis who have a similar background and knowledge of mathematics instruction. Andrea and Kelsey

were lucky enough to end up at the same school for their full-time teaching, but there could be other ways teacher educators could help teachers maintain these connections as a resource for developing their practice. For example, in a study by Goos and Bennison (2008), beginning secondary mathematics teachers who developed a community of practice through their work together in methods courses were able to maintain their community of practice and help each other develop their instruction as first-year teachers through the use of an online bulletin board originally created by teacher educators at the university.

The findings in this study related to students' views about success and failure in mathematics are limited due to the nature of the activity the students completed. Since the students were choosing words from a pre-determined list, it is possible that their choices were influenced by the words they understood and the words they did not fully understand. It is also possible that different students attached different meanings to the same word. Although the data was limited in scope, the results do seem to suggest that even when teachers believe in or emphasize elements of a growth mind-set, their students may exhibit aspects of both a growth and fixed mind-set. Since it is more beneficial for students to have a growth mind-set in mathematics (Dweck, 2010; Middleton & Jansen, 2011), then teachers may need to be more diligent and explicit in teaching a growth mind-set to their students. It seems possible that many teachers are not aware of the differences between a growth and fixed mind-set, let alone how to teach that to their students, so this is something teacher educators should focus on in methods courses and professional development offerings.

As a teacher educator who has been focused on issues related to success and failure in mathematics, I saw this focus on mind-sets as something I could use right away in my own work focused on mathematics instruction. After doing further research related to mind-sets, I

developed a plan to incorporate some of the research and related activities into my own teaching of elementary mathematics methods courses during Fall Semester 2013. This is an area that I want to continue to develop and improve on in my own teaching, and hopefully pursue further research to see how a focus on mind-sets may influence beginning teachers and their mathematics instruction.

Implications for Future Research

Although Diane and Luke seemed to have similar mastery-oriented views and used similar mastery-oriented practices, there were also some important differences in how they facilitated discussions during the lessons I observed. Diane would often ask open-ended questions or use open-ended tasks where students could use a variety of approaches. In whole-class discussions, students in Diane's classroom would often respond to and build off each other's ideas as they constructed knowledge and understanding of the concepts. Luke's discussions were more teacher-guided and, in the case of one of the lessons, focused on following a specific procedure. Although students in Luke's classroom had multiple opportunities to participate and share their thoughts during whole-class discussions, they were almost always responding to the teacher's questions and not to each other's ideas.

It is important to note that I only observed two lessons so it is possible that what I saw is not truly characteristic of the teachers' mathematics discussions. It is also possible that aspects of the different school contexts (e.g., teacher evaluation criteria, time allotted for mathematics, pacing schedule) accounted for some of the differences. That being said, I was interested to see that these differences in discussion techniques and different types of knowledge (e.g., procedural vs. conceptual) have not been addressed in previous research using achievement goal theory. Although Luke's discussion strategies and techniques were not performance-oriented, they did

seem to be more teacher-guided and emphasized more procedural than conceptual knowledge at times. Further research is needed to explore how mastery- and performance-oriented instruction could be further characterized by how discussions are structured and/or a focus on procedural vs. conceptual understanding.

Another potential area for future research would be to extend the length to see how teachers' views and instructional practices change or remain the same over a longer period of time. Since I collected data for this study, the 10 teacher participants have experienced many changes in their teaching contexts. Diane is teaching in a different school in Tennessee while Luke moved and is now teaching elementary school in Michigan. Andrea and Kelsey are still teaching at the same school but Andrea's position changed and she is now working as a special education teacher and spends two days a week co-teaching mathematics with Kelsey. Theresa moved to a different grade level while Jennifer left teaching altogether. Paul and Rachel both moved out of Utah and are currently looking for teaching jobs and pursuing a graduate degree in education. Erin was displaced from her job so she is also currently looking for a full-time teaching job and working on a graduate degree. Finally, Samantha is currently teaching the same grade level in the same school. Since most teachers experience these kinds of changes in their teaching contexts and careers, following a group of teachers for a longer period of time could help explore how learning trajectories and uses of mastery-oriented practices change and develop.

APPENDICES

APPENDIX A: Teacher Survey

This survey is part of a Michigan State University research study on early-career upper elementary teachers of mathematics. As part of this study, we are surveying teachers who are in their 1st, 2nd or 3rd year of teaching mathematics to upper elementary students (grades 4-6).

We want you to know that:

1. We are asking you these questions to better understand early-career teachers' instructional practices in mathematics, how teachers communicate their views about math to their students, and the various factors that may influence teachers' instructional practice in math.
2. Your name, the name of your school, the name of your district, and your responses to the questions in this survey will be kept strictly confidential among members of the research team at Michigan State University.
3. You may skip any questions you do not wish to answer; however we hope that you will answer as many questions as you can.

---

1. I give special privileges to students who do the best work in mathematics.

1 **2** **3** **4** **5**

STRONGLY DISAGREE SOMEWHAT AGREE STRONGLY AGREE

---

2. Natural ability is more important than effort for success in mathematics.

1 **2** **3** **4** **5**

STRONGLY DISAGREE SOMEWHAT AGREE STRONGLY AGREE

---

3. If I try really hard, I can get through to even the most difficult student in mathematics.

1 **2** **3** **4** **5**

STRONGLY DISAGREE SOMEWHAT AGREE STRONGLY AGREE

---

4. In this school: The importance of trying hard is really stressed to students.

1 **2** **3** **4** **5**

STRONGLY DISAGREE SOMEWHAT AGREE STRONGLY AGREE

5. I make a special effort to recognize students' individual progress in mathematics, even if they are below grade level.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

6. In this school: It's easy to tell which students get the highest grades and which students get the lowest grades.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

7. In this school: Students are told that making mistakes is OK as long as they are learning and improving.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

8. Any student can be successful in mathematics if they work hard.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

9. Factors beyond my control have a greater influence on my students' achievement in mathematics than I do.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

10. I consider how much students have improved in mathematics when I give them report card grades.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

11. I display the work of the highest achieving students in mathematics as an example.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

12. In this school: Students who get good grades are pointed out as an example to others.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

13. Some students will always struggle with mathematics no matter how hard they work.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

14. During mathematics class, I often provide several different activities so that students can choose among them.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

15. In this school: Students hear a lot about the importance of getting high test scores.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

16. I am good at helping all the students in my classes make significant improvement in mathematics.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

17. In this school: A lot of the work students do is boring and repetitious.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

18. I encourage students to compete with each other in mathematics.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

19. In this school: Students are frequently told that learning should be fun.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

20. Students will be successful in mathematics if they try to understand the concepts instead of just focusing on getting correct answers.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

21. I help students understand how their performance in mathematics compares to others.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

22. Some students are not going to make a lot of progress in mathematics this year, no matter what I do.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

23. In this school: Grades and test scores are not talked about a lot.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

24. Making mistakes in mathematics is an important part of the learning process.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

25. In this school: The emphasis is on really understanding schoolwork, not just memorizing it.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

26. I point out those students who do well in mathematics as a model for the other students.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

27. In this school: A real effort is made to recognize students for effort and improvement.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

28. In this school: Students are encouraged to compete with each other academically.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

29. It is important for students to be able to solve mathematics problems quickly and accurately.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

30. There is little I can do to ensure that all my students make significant progress in mathematics this year.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

31. I am certain that I am making a difference in the lives of my students with regards to mathematics.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

32. In this school: Students hear a lot about the importance of making the honor roll or being recognized at honor assemblies.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

33. I give a wide range of assignments in mathematics, matched to students' needs and skill level.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

34. Students will be successful in mathematics if they focus on trying to do better than other students in the class.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

35. In this school: A real effort is made to show students how the work they do in school is related to their lives outside of school.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

---

36. I can deal with almost any learning problem in mathematics.

1	**2**	**3**	**4**	**5**
STRONGLY DISAGREE		SOMEWHAT AGREE		STRONGLY AGREE

APPENDIX B: Student Survey #1

This survey is part of a Michigan State University research study on early-career upper elementary teachers of mathematics. As part of this study, we are surveying students of teachers who are in their 1st, 2nd or 3rd year of teaching mathematics to upper elementary students (grades 4-6).

We want you to know that:

1. We are asking you these questions to better understand early-career teachers' instructional practices in mathematics, how teachers communicate their views about math to their students, and the various factors that may influence teachers' instructional practice in math.
2. Your name, the name of your teacher, the name of your school, the name of your district, and your responses to the questions in this survey will be kept strictly confidential among members of the research team at Michigan State University.
3. You may skip any questions you do not wish to answer; however we hope that you will answer as many questions as you can.

The first question is an example.

I like strawberry ice cream.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

Here are some questions about you as a student in this class. Please circle the number that best describes what you think.

1. It's important to me that I don't look stupid in mathematics class.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

2. It's important to me that other students in my mathematics class think I am good at my classwork.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

3. It's important to me that I learn a lot of new concepts in math this year.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

4. One of my goals in mathematics class is to learn as much as I can.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

5. One of my goals is to show others that I'm good at my classwork in math.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

6. One of my goals is to master a lot of new math skills this year.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

7. One of my goals is to keep others from thinking I'm not smart in mathematics class.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

8. It's important to me that I thoroughly understand my mathematics classwork.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

9. One of my goals is to show others that mathematics classwork is easy for me.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

10. One of my goals is to look smart in comparison to the other students in my mathematics class.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

11. It's important to me that my teacher doesn't think that I know less than others in mathematics class.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

12. It's important to me that I improve my math skills this year.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

13. One of my goals in mathematics class is to avoid looking like I have trouble doing the work.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

14. It's important to me that I look smart compared to others in my mathematics class.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

The following questions are about your teacher and the work you do in class. Remember to say how you really feel. No one at school or home will see your answers.

15. My teacher thinks mistakes in math are okay as long as we are learning.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

16. My teacher points out those students who get good grades in math as an example to all of us.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

17. My teacher tells us that it is important that we don't look stupid in mathematics class.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

18. My teacher wants us to understand our math work, not just memorize it.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

19. My teacher says that showing others that we are not bad at mathematics classwork should be our goal.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

20. My teacher really wants us to enjoy learning new things in math.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

21. My teacher lets us know which students get the highest scores on a math test.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

22. My teacher tells us it's important to join in discussions and answer questions in mathematics class so it doesn't look like we can't do the work.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

23. My teacher recognizes us for trying hard in math.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

24. My teacher tells us how we compare to other students in math.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

25. My teacher gives us time to really explore and understand new ideas in math.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

---

26. My teacher tells us it's important to answer questions in mathematics class, so it doesn't look like we can't do the work.

1	**2**	**3**	**4**	**5**
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

APPENDIX C: Student Survey #2

Table 16

Success in Mathematics Word List Activity for Students

arrogant	**gifted**	**open-minded**
brave	**humble**	**organized**
brilliant	**imaginative**	**passionate**
careful	**independent**	**patient**
confident	**interested**	**persistent**
creative	**introverted**	**resourceful**
curious	**lighthearted**	**social**
diligent	**motivated**	**teachable**
focused	**obedient**	**verbal**

APPENDIX D: Observation Protocol

Based on *Observing Patterns of Adaptive Learning: A Protocol for Classroom Observations* (Patrick et al., 1997)

Directions to Researcher:
As part of the first observation, draw a map of the physical setting including students' seating arrangements, placements of resources and furniture, and the content of posters, displays, and messages on the board. On subsequent observations, note any changes.

Write a running description of all the activities that occur within the mathematics class, focusing on the teacher and his or her interactions with the students. Record the flow of events continuously and make a note of the time every 5-10 minutes.

In particular, describe the following:

Task:
- The content of the mathematical task
- The participation structure(s) required or suggested by the teacher
- The expected product
- Anything the teacher says about the reason for doing the task, its value, or the difficulty
- Routines, rules, and procedures for doing the task
- Materials and resources used, and how the materials are distributed

Authority:
- What the class rules are (get a hard copy)
- Who determines the rules
- What implicit rules are assumed or referred to
- What the implications are for non-compliance to norms or rules
- Whether there is a discipline system in place
- How consistently sanctions are imposed or rules are followed through on

Autonomy:
Any instances in which students have choice (and note the degree of choice) over:
- The order in which students complete their tasks
- The content of the task
- The form of the product
- With whom the students work
- When they have completed the task
- How their work is evaluated

Recognition:

- Whether the teacher's praise and criticism is public or private
- What the teacher's praise and criticism is contingent on (e.g., conduct, participation, achievement)
- What the praise or criticism is attributed to (e.g., effort, ability, luck)
- Any concrete forms of recognition beyond praise (e.g., candy, stickers)
- Any non-verbal recognition

Grouping:

- The number of groups
- The size of groups
- The basis of group formation (e.g., ability, cooperation, competitive teams)
- If the groups are formal or informal arrangements
- The extent to which groups are stable or flexible
- Whether students have different roles in the group, and if so, how the roles are allocated and what they involve
- The characteristics of the group (e.g., gender, ethnicity, special needs students)

Evaluation:

- Whether evaluation occurs within the class or elsewhere (e.g., teacher grading away from class)
- What the criteria for evaluation are
- Whether students evaluate their own work
- Whether or not students evaluate one another's work
- If any attributional statements are made for success or failure
- Any statements that are made about the implications of success or failure
- How students' previous successes or difficulties are referred to

Time:

- If there is a set time schedule. If so, get a copy
- The extent to which time schedules are adhered to, and under what circumstances they are or are not
- Any comments made by the teacher or students about time restrictions

Social:

- Anything the teacher says about students interacting with one another during activities, what is allowed and what is reprimanded
- Anything the teacher says about social responsibility (e.g., following rules, being helpful, sharing, actions that are for the good of the group)
- Anything the teacher says about interpersonal relationships or conflict

Help-Seeking:

- What students do when they are unsure of what is required of them
- The manner in which students seek help from the teacher (e.g., publicly or privately)

- If students seek help from one another
- What the teacher says about getting help
- What resources are available for students to refer to independently

Messages:
Record any general comments that teachers make that indicate their beliefs and assumptions about student behavior, work expectations, the goal structure of the classroom, and relationships, but that are not made during a specific academic activity.

APPENDIX E: Teacher Interview 1 Protocol

1. CURRICULUM
    a. Can you tell me about your mathematics curriculum?
    b. How did or have you learned about the curriculum?

2. PLANNING:
    a. How do you decide what you are going to teach in mathematics each day? What factors influence that decision?
    b. Do you do any planning with your colleagues?

3. TIME
    a. How much time do you spend teaching mathematics each day? Each week?
    b. How do you decide how much time to spend on a particular lesson or activity? What factors influence those decisions about time?

4. GROUP WORK
    a. How often do you use group work in mathematics?
    b. How do you create and use groups in mathematics?

5. ASSESSMENT AND EVAULATION
    a. How do you assess and evaluate your students in mathematics?
    b. How is information about mathematics shared with parents/families?

6. EXPECTATIONS:
    a. What expectations, if any, are in place about mathematics instruction and student learning in mathematics?

7. SUPPORT:
    a. Who do you go to when you have a question about mathematics or you want some help with planning or getting ideas for mathematics instruction?

8. ADMINISTRATORS
    a. How much communication do you have with your administrator about mathematics?

9. INTERNSHIP YEAR:
    a. How would you describe your mathematics instruction during your internship year? How does that compare with how you teach now?
    b. How would you describe your mentor teacher's mathematics instruction?
    c. How did the images of mathematics teaching you saw in your internship year compare with the images talked about at the university?

10. BEGINNING OF FULL-TIME TEACHING:
    a. How would you describe your mathematics instruction when you began your first full-time teaching job? How has your mathematics instruction changed since you started?
    b. How does your mathematics instruction compare to the vision or ideal you had for yourself? Are you teaching the way you want to be teaching math? If not, why?
    c. Thinking back to those images of mathematics teaching that were talked about during your teacher preparation, how close is your teaching to those images?

11. COLLEAGUES
    a. How would you compare your mathematics instruction to the instruction of other teachers at your school?
    b. What factors influence their instruction?

APPENDIX F: Teacher Interview 2 Protocol

1. Choose five words from the list that you think best describe someone who is good at math. *(Task adapted from Leatham & Hill, 2010)*

Table 17

Success in Mathematics Word List Activity for Teachers

arrogant	gifted	open-minded
brave	humble	organized
brilliant	imaginative	passionate
careful	independent	patient
confident	interested	persistent
creative	introverted	resourceful
curious	lighthearted	social
diligent	motivated	teachable
focused	obedient	verbal

2. Are there any words that you immediately disregarded?

3. Are there any words that you think should be added to the list to describe someone who is good at math?

4. Which of the five words you chose describe you with regards to mathematics? Do you consider yourself successful at math? Why or why not?

5. If you did this activity with your students, do you think they would pick the same five words? What other words (either on the list or their own words) might they use to describe someone who is good at mathematics?

6. If you did this activity with the other teachers at your school, do you think they would pick the same five words? What other words (either on the list or their own words) might they use to describe someone who is good at mathematics?

7. If you did activity with your administrator, do you think he or she would pick the same five words? What other words (either on the list or his or her own words) might he or she use to describe someone who is good at mathematics?

8. If I had asked you to do this activity when you were the same age as your students, what words do you think you would have used to describe someone who is good at math? When you were a student at MSU? When you first started teaching?

APPENDIX G: Teacher Interview 3 Protocol

[Adapted from Drake, 2006 – Based on McAdams (1993)]

Introductory Comments:
This is an interview about the story of your life experiences with math. Teachers' lives vary tremendously, and they make sense of their own math experiences in a variety of ways. My goal is to begin the process of making sense of how beginning teachers interpret their own math experiences and how those experiences influence their mathematics instruction.

Critical Events:
I would like you to concentrate on a few key events that may stand out in your math story. I am going to ask you about several specific events. For each event, describe in as much detail as you can what happened, where you were, who was involved, what you did, and what you were thinking and feeling in the event. Also, try to express what impact this key event has had in the story of your life experiences with math and what this event says about who you are or were as a person and as a teacher.

Event #1: Peak Experience:
A peak experience would be a high point in your story about math in your life – perhaps a high point. It would be a moment or episode in the story in which you experienced extremely positive emotions; like joy, excitement, great happiness, uplifting, or even deep inner peace after some math experience. Tell me exactly what happened, where it happened, who was involved, what you did, what you were thinking and feeling, what impact this experience may have had upon you, and what this experience says about who you were or who you are now as a teacher.

Event #2: Nadir Experience:
A "nadir" is a low point. A nadir experience, therefore, is the opposite of a peak experience. It is a low point in your experiences with math. Thinking back over your life, try to remember a specific experience in which you felt extremely negative emotions about math. You should consider this experience to represent one of the "low points" in your math story. What happened? When? Who was involved? What did you do? What were you thinking and feeling? What impact has the event had on you? What does the event say about who you are or who you were as a teacher?

Event #3: Turning Point:
In looking back on one's life, it is often possible to identify certain key "turning points" – episodes through which a person undergoes substantial change. I am especially interested in a turning point in your understanding or teaching of mathematics. Please identify a particular episode in your life story that you now see as a turning point. If you feel that your math story contains no turning points, then describe a particular episode in your life that comes closer than any other to qualifying as a turning point.

Single Greatest Challenge:
Looking back over your life and interactions with math, please describe the single greatest challenge that you have faced. How have you faced, handled, or dealt with this challenge? Have other people assisted you in dealing with this challenge? How has this challenge had an impact on your experiences with math?

Influences on Life Story: Positive
Looking back over your life story, please identify the single person, group of persons, or organization/institution that has or have had the greatest positive influence on your perspective of math. Please describe this person, group, or organization and the way in which he, she, it or they have had a positive impact on your story.

Influences on Life Story: Negative
Looking back over your life story, please identify the single person, group of persons, or organization/institution that has or have had the greatest negative influence on your perspective of math. Please describe this person, group, or organization and the way in which he, she, it or they have had a negative impact on your story.

Alternative Future: Positive
Now that you have told me a little bit about your past, I would like you to consider the future. First, please describe a positive future. That is, please describe what you would like to happen in the future with regards to your interactions with math, including what goals and dreams you might accomplish or realize in the future.

Alternative Future: Negative
Now, please describe a negative future. That is, please describe a highly undesirable future for yourself with regards to your interactions with math, one that you fear could happen to you but that you hope does not happen.

REFERENCES

REFERENCES

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261-271. doi:10.1037/0022-0663.84.3.261

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology, 80*(3), 260-267. doi:10.1037/0022-0663.80.3.260

Anderman, E. M., Eccles, J. S., Yoon, K. S., Roeser, R., Wigfield, A., & Blumenfeld, P. (2001). Learning to value mathematics and reading: Relations to mastery and performance-oriented instructional practices. *Contemporary Educational Psychology, 26,* 76-95. doi:10.1006/ceps.1999.1043

Bickmore, S., Smagorinsky, P., & O'Donnell-Allen, C. (2005). Tensions between traditions: The role of contexts in learning to teach. *English Education, 38*(1), 23-52.

Borko, H., Peressini, D., Romagnano, L., Knuth, E., Willis-Yorker, C., Wooley, C., Hovermill, J., & Masarik, K. (2000). Teacher education does matter: A situative view of learning to teach secondary mathematics. *Educational Psychologist, 35*(3), 193-206. doi: 10.1207/S15326985EP3503_5

Britzman, D. P. (1986). Cultural myths in the making of a teacher: Biography and social structure in teacher education. *Harvard Educational Review, 56*(4), 442-456. Retrieved from http://exproxy.msu.edu.proxy2.cl.msu.edu/login?url=http://search.proquest.com.proxy2.cl.msu.edu/docview/212323683?accountid+12598

Britzman, D. (2003). Practice makes practice: A critical study of learning to teach. Albany, NY: State University of New York Press.

Brophy, J. (2005). Goal theorists should move on from performance goals. *Educational Psychologist, 40*(3), 167-176. doi:10.1207/s15326985ep4003_3

Brophy, J. (2010). *Motivating Students to Learn* (3rd ed.). New York, NY: Routledge.

Brown, C. A., & Borko, H. (1992). Becoming a mathematics teacher. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 209-239). New York: Macmillan.

Cavanagh, M., & Prescott, A. (2007). Professional experience in learning to teach secondary mathematics: Incorporating pre-service teachers into a community of practice. *Mathematics: Essential research, essential practice, 1,* 182-191.

Cady, J., Meier, S. L., & Lubinski, C. A. (2006). Developing mathematics teachers: The transition from preservice to experienced teacher. *The Journal of Educational Research, 99*(5), 295-305. doi:10.3200/JOER.99.5.295-306

Chapin, S. H., O'Connor, C., & Anderson, N. C. (2009). *Classroom Discussions: Using Math Talk to Help Students Learn, Grades K-6.* Math Solutions.

Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology, 93*(1), 43-54. doi:10.1037/0022-0663.93.1.43

Coburn, C. (2001). Collective sensemaking about reading: How teachers mediate reading policy in their professional communities. *Educational Evaluation and Policy Analysis, 23*(2), 145-170.

Coburn, C. (2005). Shaping teacher sensemaking: School leaders and the enactment of reading policy. *Educational Policy, 19*(3), 476-509. doi: 10.1177/0895904805276143

Conference Board of the Mathematical Sciences. (2001). *The mathematical education of teachers.* Providence, RI and Washington DC: American Mathematical Society and Mathematical Association of America.

Conference Board of the Mathematical Sciences. (2012). *The mathematical education of teachers II.* Providence, RI and Washington DC: American Mathematical Society and Mathematical Association of America.

Covington, M. V. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology, 51,* 171-200. Retrieved from http://ezproxy.msu.edu.proxy1.cl.msu.edu/login?url=http://search.proquest.com.proxy1.cl.msu.edu/docview/205798227?accountid=12598

Deyhle, D. L., Hess, G. A., & LeCompte, M. D. (1992). Approaching ethical issues for qualitative researchers in education. In M. LeCompte, W. Millroy, & J. Preissle (Eds.), *Handbook of qualitative research in education* (pp. 598-641). San Diego: Academic Press.

Drake, C. (2006). Turning points: Using teachers' mathematics life stories to understand the implementation of mathematics education reform. *Journal of Mathematics Teacher Education, 9*(6), 579-608. doi:10.1007/s10857-006-9021-9

Dresel, M., Martschinke, S., & Kopp, B. (2009). *Elementary school teachers' feedback practices, perceived classroom goal structures, and students' personal achievement goals.* Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.

Dweck, C. S. (1996). Implicit theories as organizers of goals and behaviors. In P. M. Gollwitzer & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behavior* (pp. 69-90). New York: Guilford Press.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychology Review, 95*(2), 256-273. doi:10.1037/0033-295X.95.2.256

Dweck, C. S. (2006). *Mindset: The new psychology of success.* New York: Ballantine Books.

Dweck, C. S. (2010). Mind-sets and equitable education. *Principal Leadership, 10*(5), 26-29. Retrieved from http://www.principals.org/tabid/2043/default.aspx

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record, 103*(6), 1013-1055. doi:10.1111/0161-4681.00141

Glesne, C. (2006). *Becoming qualitative researchers: An introduction* (3rd ed.). Boston: Pearson.

Gordon, S. C., Dembo, M. H., & Hocevar, D. (2007). Do teachers' own learning behaviors influence their classroom goal orientation and control ideology? *Teaching and Teacher Education, 23*(1), 36-46.

Goos, M. & Bennison, A. (2008). Surveying the technology landscape: Teachers' use of technology in secondary mathematics classrooms. *Mathematics Education Research Journal, 20*(3), 102-130.

Greenberg, J., & Walsh, K. (2008). No Common Denominator: The Preparation of Elementary Teachers in Mathematics by America's Education Schools (pp. 1-102); National Council on Teacher Quality. Retrieved from http://www.nctq.org/p/publications/docs/nctq_ttmath_fullreport_20080626115953.pdf

Greeno, J. G., Collins, A. M., & Resnick, L. B. (1996). Cognition and learning. In D. Berliner, & R. Calfee (Ed.), *Handbook of educational psychology* (pp. 15-46). New York: Macmillan.

Grossman, P., & Thompson, C. (2004). District policy and beginning teachers: A lens on teacher learning. *Educational Evaluation and Policy Analysis, 26*(4), 281-301. doi:10.3102/01623737026004281

Harackiewicz, J. M., Barron, K. E., Pintrich, P. R., Elliot, A. J., & Thrash, T. M. (2002). Revision of achievement goal theory: Necessary and illuminating. *Journal of Educational Psychology, 94*(3), 638-645. doi:10.1037/0022-0663.94.3.638

Horn, I. S., Nolen, S. B., Ward, C., & Campbell, S. S. (2008). Developing practices in multiple worlds: The role of identity in learning to teach. *Teacher Education Quarterly, 35*(3), 61-72. Retrieved from http://www.jstor.org/stable/23478981

Kaplan, A., & Maehr, M. L. (2007). The contributions and prospects of goal orientation theory. *Educational Psychology Review, 19,* 141-184. doi:10.1007/s10648-006-9012-5

Kumar, R., Gheen, M. H., & Kaplan, A. (2002). Goal structures in the learning environment and students' disaffection from learning and schooling. In C. Midgley (Ed.), *Goals, goal structures, and patterns of adaptive learning* (pp. 143-173). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge University Press.

Lau, S., & Nie, Y. (2008). Interplay between personal goals and classroom goal structures in predicting student outcomes: A multilevel analysis of person-context interactions. *Journal of Educational Psychology, 100*(1), 15-29. doi:10.1037/0022-0663.100.1.15

Leatham, K. R., & Hill, D. S. (2010). Exploring our complex math identities. *Mathematics Teaching in the Middle School, 16*(4), 224-231.

Leonardi, A., & Gialamas, V. (2002). Implicit theories, goal orientations, and perceived competence: Impact on students' achievement behavior. *Psychology in the Schools, 39*(3), 279-291. doi:10.1002/pits.10035

Linnenbrink, E. A., & Pintrich, P. R. (2002). Motivation as an enabler for academic success. *School Psychology Review, 31*(3), 313-327. Retrieved from http://web.ebscohost.com.proxy1.cl.msu.edu/ehost/pdfviewer/pdfviewer?sid=1978a534-18e9-4066-bb38-81a2970e7fab%40sessionmgr115&vid=4&hid=124

Lortie, D. C. (1975). *Schoolteacher: A sociological study.* Chicago: University of Chicago Press.

Lovett, S. & Cameron, M. (2011). Schools as professional learning communities for early-career teachers: How do early career teachers rate them? *Teacher Development, 15*(1), 87-104. Doi: 10.1080/13664530.2011.555226

Maehr, M. L., & Midgley, C. (1991). Enhancing student motivation: A schoolwide approach. *Educational Psychologist, 26*(3-4), 388-427. doi:10.1080/00461520.1991.9653140

Marbach-Ad, G., & McGinnis, J. R. (2009). Beginning mathematics teachers' beliefs of subject matter and instructional actions documented over time. *School Science and Mathematics, 109*(6), 338-354. doi:10.1111/j.1949-8594.2009.tb18103.x

McAdams, D. P. (1993). The stories we live by: Personal myths and the making of self. New York: The Guilford Press.

McDonnough, J. & Matkins, J. (2010). The role of field experience in elementary preservice teachers' self-efficacy and ability to connect research to practice. *School Science and Mathematics, 110*(1), 13-23.

Meece, J. L., Anderman, E., & Anderman, L. (2006). Classroom goal structure, student motivation, and academic achievement. *Annual Review of Psychology, 57,* 487-503. doi:10.1146/annurev.psych.56.091103.070258

Meece, J. L., Herman, P., & McCombs, B. (2003). Relations of learner-centered teaching practices to adolescents' achievement goals. *International Journal of Educational Research, 39,* 457-475. doi:10.1016/j.ijer.2004.06.009

Middleton, J. A., & Jansen, A. (2011). Motivation matters and interest counts: Fostering engagement in mathematics. Reston, VA: National Council of Teachers of Mathematics.

Middleton, J. A., & Spanias, P. A. (1999). Motivation for achievement in mathematics: Findings, generalizations, and criticisms of the research. *Journal for Research in Mathematics Education, 30*(1), 65-88. Retrieved from http://www.jstor.org/stable/749630

Middleton, M., Kaplan, A., & Midgley, C. (2004). The change in middle school students' achievement goals in mathematics over time. *Social Psychology of Education, 7*, 289-311. doi:10.1023/B:SPOE.0000037484.86850.fa

Midgley, C. (2002). *Goals, goal structures, and patterns of adaptive learning.* Mahwah, NJ: Erlbaum.

Midgley, C., Anderman, E., & Hicks, L. (1995). Differences between elementary and middle school teachers and students: A goal theory approach. *The Journal of Early Adolescence, 15*(1), 90-113. doi:10.1177/0272431695015001006

Midgley, C., Kaplan, A., & Middleton, M. (2001). Performance-approach goals: Good for what, for whom, under what circumstances, and at what cost? *Journal of Educational Psychology, 93*(1), 77-86. doi:10.1037/0022-0663.93.1.77

Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E., Anderman, L., Freeman, K., Gheen, M., Kaplan, A., Kumar, R., Middleton, M., Nelson, J., Roeser, R., & Urdan, T. (2000). *Manual for the Patterns of Adaptive Learning Scales.* Ann Arbor, MI: The University of Michigan. Retrieved from http://www.umich.edu/~pals/manuals.html

National Mathematics Advisory Panel. (2008). Foundations for Success: The Final Report of the National Mathematics Advisory Panel (pp. 90): U.S. Department of Education. Retrieved from http://www2.ed.gov/about/bdscomm/list/mathpanel/index.html

Nicholls, J. G., Cobb, P., Wood, T., Yackel, E., & Patashnick, M. (1990). Assessing students' theories of success in mathematics: Individual and classroom differences. *Journal for*

Research in Mathematics Education, 21(2), 109-0122. Retrieved from http://www.jstor.org/stable/749138

Nolen, S. B., Horn, I. S., Ward, C. J., & Childers, S. A. (2011). Novice teacher learning and motivation across contexts: Assessment tools as boundary objects. *Cognition and Instruction, 29*(1), 88-122. doi: 10.1080/07370008.2010.533221

Patrick, H., Anderman, L. H., Ryan, A. M., Edelin, K. C., & Midgley, C. (2001). Teachers' communications of goal orientations in four fifth-grade classrooms. *The Elementary School Journal, 102*(1), 35-58. Retrieved from http://www.jstor.org/stable/1002168

Patrick, H., & Ryan, A. (2008). What do students think about when evaluating their classrooms' mastery goal structure? An examination of young adolescents' explanations. *Journal of Experimental Education, 77*(2), 99-124. doi:10.3200/JEXE.77.2.99-124

Patrick, H., Ryan, A., Anderman, L., Middleton, M., Linnenbrink, L., Hruda, L. Z., Edelin, K. C., Kaplan, A., & Midgley, C. (1997). *Observing Patterns of Adaptive Learning: A Protocol for Classroom Observations.* Ann Arbor, MI: University of Michigan. Retrieved from http://www.umich.edu/~pals/finalopal.pdf

Peressini, D., Borko, H., Romagnano, L., Knuth, E., & Willis, C. (2004). A conceptual framework for learning to teach secondary mathematics: A situative perspective. *Educational Studies in Mathematics, 56*(1), 67-96. Retrieved from http://www.jstor.org/stable/4150264

Perry, C. A. (2011). Motivation and attitude of preservice elementary teachers toward mathematics. *School Science and Mathematics, 111*(1), 2-10. doi:10.1111/j.1949-8594.2010.00054.x

Phelps, C. M. (2010). Factors that prospective elementary teachers perceive as affecting their motivational profiles in mathematics. *Educational Studies in Mathematics, 75,* 293-309. doi:10.1007/s10649-010-9257-2

Pintrich, P. R. (2000). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology, 92*(3), 544-555. doi:10.1037/0022-0663.92.3.544

Pogodzinski, B., Youngs, P., Frank, K. A., & Belman, D. (2012). Administrative climate and novices' intent to remain in teaching. *The Elementary School Journal, 113*(2), 252-275. Retrieved from http://www.jstor.org/stable/10.1086/667725

Prescott, A., & Cavanagh, M. (2008). A situated perspective on learning to teach secondary mathematics. In M. Goos, R. Brown, & K. Makar (Eds.), *Proceedings of the 31st Annual Conference of the Mathematics Education Research Group of Australasia. Sydney: MERGA.*

Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher, 29*(1), 4-15. Retrieved from http://www.jstor.org/stable/1176586

Raymond, A. M. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice. *Journal for Research in Mathematics Education, 28*(5), 550-576. Retrieved from http://www.jstor.org/stable/749691

Roeser, R. W., Marachi, R., &Gehlbach, H. (2002). A goal theory perspective on teachers' professional identities and the contexts of teaching. In C. Midgley (Ed.), *Goals, goal structures, and patterns of adaptive learning* (pp. 205-241). Mahwah, NJ: Lawrence Erlbaum Associations, Inc.

Senko, C., & Harackiewicz, J. M. (2004). *Regulation of achievement goals: The role of competence feedback.* Paper presented at the annual meeting of the American Educational Research Association, San Diego.

Senko, C., Hulleman, C. S., & Harackiewicz, J. M. (2011). Achievement goal theory at the crossroads: Old controversies, current challenges, and new directions. *Educational Psychologist, 46*(1), 26-47. doi:10.1080/00461520.2011.538646

Shim, S. S., Cho, Y., & Cassady, J. (2013). Goal structures: The role of teachers' achievement goals and theories of intelligence. *The Journal of Experimental Education, 81*(1), 84-104.

Shim, S. & Ryan, A. (2005). Changes in self-efficacy, challenge avoidance, and intrinsic value in response to grades: The role of achievement goals. *The Journal of Experimental Education, 73*(4), 333-349. Retrieved from http://www.jstor.org/stable/20157405

Siefert, T. (2004). Understanding student motivation. *Educational Research, 46*(2), 137-149.

Stake, R. (2004). Qualitative case study. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed.). (pp. 443-466). Thousand Oaks, CA: Sage.

Steele, D. F. (2001). The interfacing of preservice and inservice experiences of reform-based teaching: A longitudinal study. *Journal of Mathematics Teacher Education, 4,* 139-172. doi: 10.1023/A:1011436116480

Vogler, J. S., & Bakken, L. (2007). Motivation across domains: Do goals and attributions change with subject matter for grades 4 and 5 students? *Learning Environments Research, 10*(1), 17-33. doi:10.1007/s10984-007-9021-4

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge University Press.

Wenger, E. (2000). Communities of practice and social learning systems. *Organization, 7*(2), 225-246. doi: 10.1177/13505084007202

Wenger, E. (2011). Communities of practice: A brief introduction.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology, 96*(2), 236-250. doi: 10.1037/0022-0663.96.2.236

Yin, R. (2003). Designing case studies. *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: Sage.

Youngs, P. (2007a). District induction policy and new teachers' experiences: An examination of local policy implementation in Connecticut. *Teachers College Record, 109*(4), 797-837. Retrieved from http://www.tcrecord.org.proxy1.cl.msu.edu/library/content.asp?contentid=12872

Youngs, P. (2007b). How elementary principals' beliefs and actions influence new teachers' experiences. *Educational Administration Quarterly, 43*(1), 101-137. doi:10.1177/0013161X06293629