PROSPECTIVE TEACHERS' SELF-EFFICACY FOR PREPARING AND IMPLEMENTING WORTHWHILE MATHEMATICAL TASKS

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ABSTRACT

PROSPECTIVE TEACHERS' SELF-EFFICACY FOR PREPARING AND IMPLEMENTING WORTHWHILE MATHEMATICAL TASKS

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The purpose of this study was twofold. First, the aim was to examine prospective elementary mathematics teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks throughout a mathematics teaching methods course. Then, it was sought to investigate factors with impact on prospective teachers' self-efficacy in the context of methods course and explain how each influence operated through hypothesized sources of self-efficacy. Nine junior prospective teachers participated in this qualitative case study, and data were collected basically through semi-structured interviews where participants were interviewed three times throughout the methods course. Findings revealed positive change in most of the participants' efficacy beliefs, especially for preparing tasks. At the end of the methods course, 8 participants were feeling highly efficacious to prepare mathematical tasks effectively, while one of them expressed moderate level of self-efficacy. Regarding their efficacy beliefs for implementing tasks, on the contrary, only 5 participants indicated strong

confidence in their capabilities. The other 4 participants were holding moderate level self-efficacy for implementing tasks after completing methods course. Additionally, it was found that various components of methods course (i.e. lecture hours, group work, feedback on group work, peers' presentations, assigned readings, and examination) had impact on self-efficacy. Each of these elements related to the methods course created effect through one or more of the hypothesized sources of self-efficacy, mostly through vicarious experiences.

Keywords: Elementary mathematics education, prospective teachers, self-efficacy, worthwhile mathematical tasks.

ÖZ

ÖĞRETMEN ADAYLARININ MATEMATİKSEL ETKİNLİKLERİ HAZIRLAMA VE UYGULAMAYA İLİŞKİN ÖZ-YETERLİK ALGILARI

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Bu çalışmanın amacı, matematik öğretim yöntemleri dersi boyunca ilköğretim matematik öğretmeni adaylarının matematiksel etkinlikleri hazırlama ve uygulamaya ilişkin öz-yeterlik algılarını incelerken, bu derse ait hangi bileşenlerin öğretmen adaylarının öz-yeterlikleri üzerinde nasıl etki yarattığını belirlemektir. Nitel durum çalışması olarak tasarlanan bu araştırmaya ilköğretim matematik öğretmenliği programı 3. sınıfta öğrenim gören 9 öğretmen adayı katılmıştır. Çalışmanın temel veri toplama aracı yarı yapılandırılmış görüşmelerdir ve katılımcıların her biriyle ders süresince üçer kez görüşme yapılmıştır. Çalışma sonucunda matematik öğretim yöntemleri dersinin genel olarak öğretmen adaylarının öz-yeterlik algılarına katkı sağladığı, özellikle etkinlik hazırlama konusunda olumlu etki yarattığı görülmüştür. Bu dersi sonunda 8 katılımcı etkinlik hazırlama konusunda yüksek düzeyde yeterli hissederken, 1 katılımcı kendini orta seviyede yeterli olarak değerlendirmiştir. Öte yandan, matematiksel etkinlikleri etkili bir şekilde uygulayabilme açısından

katılımcılardan yalnızca 5'i yüksek düzeyde öz-yeterlik algısına sahip olduklarını belirtmişlerdir. Diğer 4 katılımcı ise etkinlik uygulamaya ilişkin orta düzeyde yeterlik algısı ile dersini tamamlamışlardır. Bulgular ayrıca göstermiştir ki, dersin birçok öğesi (ders anlatımları, grup çalışmaları, grup çalışması hakkında alınan dönütler, arkadaşların sunumları, verilen okumalar ve sınavlar) öğretmen adaylarının yeterlik algıları üzerinde etkiye sahip olmuştur. Bu bileşenlerin her biri öz-yeterlik algısının bir veya birçok kaynağı aracılığıyla, çoğunlukla dolaylı deneyimler yoluyla, etki yaratmıştır.

Anahtar kelimeler: İlköğretim matematik eğitimi, öğretmen adayı, öz-yeterlik algısı, matematiksel etkinlik.

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CHAPTER 1

INTRODUCTION

The call for mathematical competence for success in this changing world led to reform movements in mathematics education (Ministry of National Education [MoNE], 2013; National Council of Teachers of Mathematics [NCTM], 2000). Adopting the motto “every child can learn mathematics,” countries moved from the traditional, content-oriented, algorithm-driven approach to the constructivist, process-oriented, concept-based approach to the teaching and learning of mathematics. This reform movement has given way to the development of student-centered programs where all students are given the opportunity and support they need to understand and do mathematics (e.g. MoNE, 2013).

Consistent with the constructivist reform, the underlying goal of elementary mathematics education was defined as developing students’ mathematical knowledge and skills through problem solving with a focus on conceptual understanding (Brown & Clarke, 2013). The student skills which elementary mathematics education programs aimed at improving are the lifelong skills such as problem solving, reasoning, communication, and making connections (MoNE, 2013; NCTM, 2000). Unlike traditional classrooms where students act as passive receivers of ideas proposed by the teacher and work on routine problems through following memorized rules, and teachers design their instructions emphasizing the development of computational skills, reform-oriented mathematics classrooms are "characterized by greater learner and teacher autonomy directed at conceptional understanding (Brown & Clarke, 2013, p. 456). In these reform classrooms, students are expected to engage in mathematical thinking process by actively taking part in the learning environment where they are challenged to

generate different strategies for solving non-routine, real-life problems, look for patterns, make conjectures, generalize, justify their solutions and communicate their ideas (MoNE, 2013; NCTM, 2000). And "teachers should have children solve problems cooperatively in groups as well as individually, encouraging them to invent, compare, and discuss mathematical techniques as they construct their own, viable mathematical meanings" (Goldin, 2002, p. 200).

Students' solving of problems, or working on mathematical tasks, is the foundation of reform-based mathematics education (MoNE, 2013; NCTM, 2000) and the quality of learning environment in the classroom, and students' understanding in turn, is determined mostly by mathematical tasks that are presented to the students (Stein, Smith, Henningsen, & Silver, 2009). A mathematical task (i.e. a problem or a set of problems) is "a classroom activity, the purpose of which is to focus students' attention on a particular mathematical idea" (Stein, Grover, & Henningsen, 1996, p. 460). When students are given problems which are presented through stories related to real-life situations and solved through using mathematical tools (e.g. manipulatives), they perform higher than their counterparts who are provided tasks emphasizing the use of memorized rules and written symbols (Hiebert & Wearne, 1993). Engaging in tasks which promote high-level mathematical thinking, reasoning, and communication, students develop a deeper understanding of mathematics (Breen & O'Shea, 2010; Jackson et al., 2013). The effects of tasks, therefore, are determined by the level of challenge of tasks.

The level of challenge, or the cognitive demands, of mathematical tasks are "the cognitive processes students are required to use in accomplishing [tasks]" (Doyle, 1988, p. 170). Based on the cognitive demands, mathematical tasks are classified into two main groups, namely, lower-level demanding and higher-level demanding, with two levels in each: memorization and procedures without connections (lower-level demands), procedures with connections and doing mathematics (higher-level demands) (Stein & Smith, 1998). Mathematical tasks with low cognitive demands do not challenge

students' higher-level thinking skills such as problem solving and reasoning, but instead, these tasks engage students in a process where they use previously memorized rules or procedures without conceptualizing mathematical understanding (Stein & Lane, 1996; Stein & Smith, 1998). Higher-level demanding mathematical tasks are referred to as *worthwhile mathematical tasks* "for which students have no memorized rules, nor for which they perceive there is one right solution method; [r]ather, the tasks are viewed as opportunities to explore mathematics and come up with reasonable methods for solution" (Hiebert et al., 1997, p. 8).

Researchers, mathematics educators, and stakeholders have all emphasized the necessity of utilization of mathematical tasks with high cognitive demands. However, it is not the task itself that makes the difference, it is the teacher who selects and implements the task that matters (Doyle, 1983, 1988; Henningsen & Carpenter, 1997; MoNE, 2013; NCTM, 2000; Stein, Grover, & Henningsen, 1996). For example, when a teacher brings a picture to the classroom and asks students to count the numbers of children wearing hats in the picture, it is not likely that students will remember the total number of people or the ratio of girls to boys depicted there because their attention are paid to the number of children with hats, not the ratio of girls to boys (Doyle, 1983). The extent to which students will learn mathematics, therefore, is dependent on how teachers prepare (e.g. choosing the image) and implement (e.g. asking students to count the number of people) mathematical tasks.

Researchers have reported that teachers mostly prefer lower-level demanding tasks in classrooms (Hiebert et al., 2005; Silver et al., 2009), and even when they select worthwhile mathematical tasks, they implement in ways that reduce the complexity of tasks (Otten & Soria, 2014; Stylianides & Stylianides, 2008; Sullivan, Clarke, Clarke, & O'Shea, 2010). Teachers' preparing and implementing of worthwhile mathematical tasks are linked to their knowledge of content and students. Research showed teacher knowledge is related to the quality of their selection and implementation of mathematical tasks (e.g. Sullivan, Clarke, & Clarke, 2009). Yet, having necessary

knowledge does not alone ensure teaching mathematics through tasks effectively, unless teachers feel confident in their capabilities to choose worthwhile mathematical tasks and enact them in their classrooms effectively.

Teachers' confidence in their capabilities are called *teacher self-efficacy*, which has been found to be a powerful influence on teaching practices. Bandura (1997) defined self-efficacy as "beliefs in one's capabilities to organize and execute the course of action required to produce given attainments" (p. 3), and he asserted that perceived self-efficacy is a strong predictor of motivation to achieve and the level of effort that will be exerted when one is faced with challenging situations. In mathematics classrooms, highly efficacious teachers use more conceptually oriented mathematics teaching methods (Kahle, 2008) and set higher goals for their students' and, in turn, students perform better at solving mathematical problems (Allinder, 1995). When compared to teachers who have doubts about their capabilities to teach mathematics effectively, teachers with higher efficacy beliefs positively influence students' expectancies and perceptions of their performances in mathematics (Midgley, Feldlaufer, & Eccles, 1989). Considering the role of mathematical tasks in effective mathematics teaching, it could be asserted that it is necessary for teachers to hold strong self-efficacy beliefs for teaching mathematics through worthwhile mathematical tasks.

1.1 Statement of the Problem

Because self-efficacy beliefs are more open to change during skill development (Bandura, 1997; Tschannen-Moran & Woolfolk Hoy, 2007), it is the responsibility of teacher education programs to support prospective teachers' self-efficacy development so as to guarantee the success of their future teaching. Researchers examined the influence of mathematics teacher education programs with the aim of finding ways to support prospective teachers' development of strong confidence in their capabilities to teach mathematics effectively (e.g. Burton, 2006; Çakıroğlu, 2000; Huinker & Madison, 1997). However, results of research on the effectiveness of teacher education programs are conflicting. Some researchers found that there was a positive

influence of teacher education programs in contributing to the development of prospective teachers' self-efficacy for teaching mathematics (e.g. Koç, 2011), while others reported that mathematics teacher education programs failed to make a positive difference in prospective teachers' efficacy beliefs (e.g. Işıksal & Çakıroğlu, 2006). In order to increase the effectiveness of teacher education programs, therefore, there is a need to identify factors which contribute to prospective teachers' self-efficacy and to understand the ways these factors work as the sources of their efficacy beliefs.

According to Bandura (1997), self-efficacy is developed through four different sources. Mastery experience, also the most powerful source of self-efficacy, is the information gained from personal performances where success boosts self-efficacy and failures undermine it. Vicarious experience refers to the information gained from observing model's performances. Model similarity determines the effect of this source on self-efficacy, the greater the assumed similarity is, the more persuasive the model's success or failures are. Social persuasions are the feedback received from others about personal capabilities and performances. Finally, physiological states such as stress, anxiety, and mood during performances provide information for self-efficacy development.

As Bandura (1997) contended, people weight and interpret the efficacy-relevant information to gauge their efficacy beliefs, and any given influence operate through these four hypothesized sources of self-efficacy. Considering these sources of self-efficacy, the investigation of influences on prospective teachers' efficacy beliefs can help teacher educators to support future teachers' self-efficacy development and to detect which aspects of the teacher preparation programs are unable to enhance prospective teachers' confidence in their capabilities. Still, there is a lack of research to explain the role of teacher training programs and to explore *how* they create any effect on prospective teachers' self-efficacy.

Based on the theorized sources of self-efficacy, there were a few quantitative attempts (e.g Poulou, 2007; O'Neill & Stephenson, 2012) to understand overall effects

of teacher education programs on prospective teachers' efficacy beliefs. Due to methodological limitations, research conducted with quantitative approach do not explain which sources are weighted and interpreted by prospective teachers to judge their capabilities for effective teaching. Even less investigations were undertaken with qualitative approach (e.g. Brand & Wilkins, 2007), which fail to detect the influence of teacher education programs on prospective teachers' self-efficacy for teaching mathematics. A qualitative approach, however, can contribute more to our knowledge of factors related to teacher education program which influence prospective teachers' self-efficacy and how these factors create any perceived effect. This way, teacher educators can also improve their programs.

1.2 Purpose of the Study

In light of remarkable results of research on teacher self-efficacy, it is important to understand how teacher education programs influence prospective teachers' self-efficacy beliefs. Without generating a clear understanding of which components of teacher education programs influence prospective teachers' self-efficacy and how each of these components operate through hypothesized sources of self-efficacy, teacher educators are left with an incomplete map of ways to improve their programs and help prospective teachers develop strong self-efficacy beliefs. Thus, in this case study, prospective teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks were examined in their natural settings without any manipulation so as to provide detailed information about the factors affecting their efficacy beliefs. The research questions guiding this study are as follows:

1. How do prospective elementary mathematics teachers describe their judgments of capabilities to prepare and implement worthwhile mathematical tasks throughout a mathematics teaching methods course?

2. How do prospective elementary mathematics teachers describe the factors influencing their self-efficacy for preparing and implementing worthwhile mathematical tasks throughout a mathematics teaching methods course?

a. Among the main components of the methods course (i.e. lecture hours, group work, peers' presentations, and feedback on group work), which factors were perceived as the most effective influence on prospective elementary mathematics teachers' self-efficacy throughout the semester?

b. How did each factor with an influence on prospective elementary mathematics teachers' self-efficacy operate through the hypothesized sources of self-efficacy?

1.3 Significance of the Study

Understanding the factors that influence prospective elementary mathematics teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks throughout a methods course will first help teacher educators to increase the effectiveness of teacher education programs. This study aims to provide a guide to tap the missing parts of the program to be revised for making required improvements and to strengthen the influence of the program in favor of prospective teachers' confidence in their capabilities to prepare and enact worthwhile mathematical tasks. As a result, teacher educators will be able to support the development of prospective teachers' efficacy beliefs for creating and using tasks. When prospective teachers feel highly efficacious in their capabilities, they can perform better in their mathematics teaching through tasks and successfully select and enact tasks with high levels of cognitive demands during inservice years which can contribute to students' learning as well.

Research which are quantitative in nature (e.g. Poulou, 2007) have a limitation on the understanding of the effects of teacher education programs on prospective teachers' self-efficacy because such research do not explain *how* the change in prospective teachers' efficacy beliefs occur. Few qualitative efforts (e.g. Palmer, 2006), nevertheless, do not provide a clear picture of *how* teacher training programs create effect on prospective teachers' perceived self-efficacy. Thus, there is a need to provide in-depth understanding of the factors affecting prospective elementary mathematics teachers' efficacy beliefs. Especially considering the role of worthwhile

mathematical tasks in mathematics education (NCTM, 2000), a study focused on prospective teachers' perceived efficacy for choosing and implementing such tasks is strongly needed. This study will contribute to the literature by shedding light on prospective teachers self-efficacy through the lens of their insight.

1.4 Definition of Terms

Mathematical tasks: A classroom activity [i.e. a problem or a set of problems], the purpose of which is to focus students' attention on a particular mathematical idea (Stein, Grover, & Henningsen, 1996, p. 460).

Mathematics teaching methods course: A mandatory course designed to help prospective teachers develop required knowledge and skills to teach mathematics at elementary school. Methods course, comprising Methods of Teaching Mathematics I (ELE341) and II (ELE342), is offered in the third year of Elementary Mathematics Education program.

Prospective elementary mathematics teachers: Prospective teachers who are enrolled in the Elementary Mathematics Education program at the Faculty of Education.

Self-efficacy: Beliefs in one's capabilities to organize and execute the course of action required to produce given attainments (Bandura, 1997, p. 3).

Self-efficacy for preparing and implementing worthwhile mathematical tasks: Teachers' confidence in their capabilities to prepare (e.g. select, create) worthwhile mathematical tasks and implement these tasks in their classrooms effectively.

Teacher self-efficacy: Teachers' beliefs in their capabilities to bring about students' learning and achievement (Tschannen-Moran & Woolfolk Hoy, 2001)

Worthwhile mathematical tasks: Mathematical tasks for which students have no memorized rules, nor for which they perceive there is one right solution method; [r]ather, the tasks are viewed as opportunities to explore mathematics and come up with reasonable methods for solution (Hiebert et al., 1997, p. 8).

CHAPTER 2

LITERATURE REVIEW

The main goal of this study is to investigate factors related to a mathematics teaching methods course which create any change in prospective elementary mathematics teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks. In line with this purpose, I focus on how efficacy-relevant information is weighted and interpreted by prospective teachers to gauge their efficacy beliefs, particularly their confidence in their capabilities to prepare and implement mathematical tasks effectively throughout the methods course. To properly situate this study, in this chapter, I present a review of the literature on, first, mathematical tasks and the importance of preparing and implementing worthwhile mathematical tasks. Then, after providing a brief overview of Social Cognitive Theory which serves as the guiding framework for this study, I describe self-efficacy and hypothesized sources of it, and continue with the conceptualization and role of teacher self-efficacy. I also discuss related research on prospective teachers' efficacy beliefs and how sources of their self-efficacy were examined regarding the influence of teacher education programs.

2.1 Worthwhile Mathematical Tasks

In mathematics education, the shift from traditional, teacher-centered approach to the constructivist, student-centered approach brought teaching *through* problem solving to the focus (MoNE, 2013; NCTM, 2000). This change in mathematics education requires active student involvement in the process of learning mathematics through solving challenging problems, explain reasonings behind their solutions, making connections among concepts, and communicating their thinking (MoNE, 2013; NCTM, 2000). Because this reform-oriented mathematics education is centered around students'

solving of problems, mathematical tasks are essential parts of mathematics teaching and learning processes.

A *mathematical task* (i.e. a problem or a set of problems) is "a classroom activity, the purpose of which is to focus students' attention on a particular mathematical idea" (Stein, Grover, & Henningsen, 1996, p. 460). Mathematical tasks which teachers enact in their classrooms "influence learners by directing their attention to particular aspects of content and by specifying ways of processing information" (Doyle, 1983, p. 161). Mathematical tasks provide students the opportunity to learn, and tasks in which students are engaged structure students' understandings of what mathematics is and what doing mathematics means (Henningsen & Stein, 1997). Mathematical tasks that are connected to the real-world experiences of students can promote making sense of mathematical concepts as in reform classrooms, while tasks prepared by traditional teachers are purely mathematical and do not contribute to students' problem solving skills, rather focus on their computational proficiency (NCTM, 2000). Therefore, mathematical tasks have a key role in setting limits for students' understanding of mathematical ideas.

The level of student understanding and use of mathematics is determined by the cognitive demands of mathematical tasks which refer to "the cognitive processes students are required to use in accomplishing [tasks]" (Doyle, 1988, p. 170). Cognitive demands are thinking processes in which students engage when working on tasks, and based on cognitive demands, mathematical tasks are identified mainly in two groups: tasks with lower-level demands and tasks with higher-level demands (Stein & Smith, 1998). As presented in Table 1, these two major categories of tasks include two levels in each. One type of lower-level tasks is *memorization* in which tasks are solved by using previously memorized rules or facts. In this kind of tasks, connection to concepts and meaning is not necessary. *Procedures without connection* is the second type of tasks with low cognitive demands. Different from memorization tasks, these kind of tasks require using procedures to solve tasks, but these already-demonstrated algorithms are employed

without making connections to the underlying mathematical ideas. That is, no attention is paid to how and why the algorithm works. Tasks which are solved with the use of broader algorithms are *procedures with connection*, a kind of task with higher-level cognitive demands. The necessary procedures used for solving these tasks promote higher level thinking. Building connections among mathematical ideas is required at this level. Another type of higher-level tasks is *doing mathematics* in which, without following procedures, tasks are solved through employing complex mathematical thinking and reasoning processes (Stein & Lane, 1996; Stein & Smith, 1998).

Table 1

Cognitive demands of mathematical tasks (Stein & Smith, 1998)

Level of Cognitive Demand	Type of Cognitive Demand	Example
Lower-Level Demands	Memorization	What are the decimal and percent equivalents for the fractions 1/2 and 1/4?
	Procedures without connection	Convert the fraction 3/8 to a decimal and a percent.
	Procedures with connection	Using a 10x10 grid, identify the decimal and percent equivalents of 3/5.
Higher-Level Demands	Doing mathematics	Shade 6 small squares in a 4x10 rectangle. Using the rectangle, explain how to determine each of the following: a) the percent of area that is shaded, b) the decimal part of area that is shaded, and c) the fractional part of are that is shaded.

To achieve the goal of helping students become *doers of mathematics*, who generate solutions to problems, test their strategies, and justify their solutions through mathematical reasoning, teachers are responsible for providing mathematical tasks with high cognitive demands (i.e. worthwhile mathematical tasks) (MoNE, 2013; NCTM, 2000). *Worthwhile mathematical tasks* are "tasks that are truly problematic for students rather than simply a disguised way to have them practice an already-demonstrated algorithm" (Stein, Grover, & Henningsen, 1996, p. 456). Such tasks with high cognitive demands have more than one way of solution; begin where students are and build on students' prior knowledge; and are suitable for multiple representations (Henningsen & Stein, 1997; Lesh, Post, & Behr, 1987; Mitchell, Charalambous, & Hill, 2014; Stein & Lane, 1996). While activities designed with a lower-level demanding approach which basically don't go further than reproducing learned facts and rules or applying previously rehearsed procedures, worthwhile tasks engage students in thinking processes in which they are challenged to construct conceptual understanding of mathematics.

Researchers have reported that promoting higher levels of mathematical thinking, reasoning, and communication through providing worthwhile mathematical tasks, teachers can help students develop a deeper level understanding of mathematics (Breen & O'Shea, 2010; Jackson et al., 2013). Students who are taught by teachers using worthwhile mathematical tasks perform higher than students who are taught mathematics more traditionally (Hiebert & Wearne, 1993; Stein & Lane, 1996). The level of cognitive demands of mathematical tasks is also associated with the extent to which students translate between different representations of mathematical concepts (Lesh, Post, & Behr, 1987). Therefore, to support the development of higher-order mathematical skills (e.g. problem solving and reasoning) in their reform-oriented classrooms, teachers should design their lessons using worthwhile mathematical tasks.

2.1.1 Mathematical Tasks Framework

As a part of a educational reform project named QUASAR[1], Stein, Grover, and Henningsen (1996) developed the Mathematics Tasks Framework, to explain the relationship between the instruction of mathematics through tasks and student learning. The framework highlights the importance of the quality of tasks teachers prepare and implement in their mathematics teaching, which determine how students will make sense of mathematics, as well as the level of their understanding of mathematical ideas (Doyle, 1988; Henningsen & Stein, 1997; Hiebert & Wearne, 1993). In this framework, Stein and her colleagues proposed a number of task-related variables which they found as determinants of student learning and factors that influence the connection between task variables.

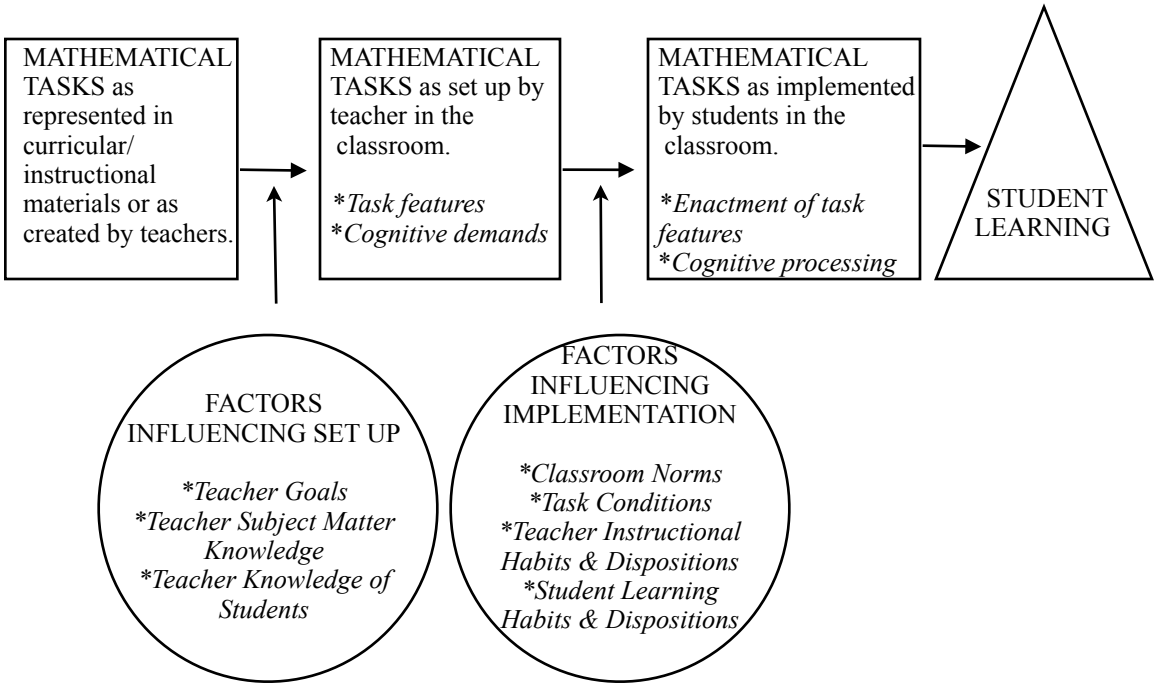

Figure 1. The Mathematical Tasks Framework (Stein, Grover, & Henningsen, 1996)

[1] QUASAR: Quantitative Understanding: Amplifying Student Achievement and Reasoning (Stein, Grover, & Henningsen, 1996).

According to the Mathematical Tasks Framework, a mathematical task goes through three phases which are presented in rectangles in Figure 1 (Stein, Grover, and Henningsen, 1996; Stein et al., 2009). The task appears, first, as a curricular material or as created by teacher, and either way, this phase is where teachers choose the tasks to enact in their classrooms. Throughout this research, this phase is referred to as *preparing tasks*. Second, tasks appear as announced and implemented by the teacher. Even though this phase is called "task set up" in the framework, throughout this research it is referred to as *implementing tasks* because this step is based on teachers' enactments of tasks in the classroom. And third, tasks appear as performed by students.

Studies based on this framework have showed that, at each three stages, the features of tasks can be different (Henningsen & Stein, 1997; Stein, Grover, & Henningsen, 1996; Stigler & Hiebert, 2004). That is, the cognitive demands of tasks can change when passing through these stages. As suggested by researchers, teachers may fail to prepare (e.g. they can't choose right tasks appropriate for students) or implement (e.g. they get too much involved in students' work while trying to help them) tasks effectively, and as a result, they can cause the cognitive demands of tasks to decline (Henningsen & Stein, 1997; Otten & Soria, 2014). For example, after conducting interviews with inservice elementary school teachers in Turkey, Bal (2008) found that teachers frequently expressed difficulty in preparing mathematical tasks to enact in their classrooms. Similarly, analysis of mathematical tasks prepared by teachers seeking positions in the United States showed that only 1 out of 3 tasks required higher-level demands (Silver et al., 2009). It was also reported that only half of the teachers could prepare highly-demanding mathematical tasks (Silver et al., 2009). A recent study with prospective mathematics teachers in Turkey also showed more than half of the prospective teachers could prepare mathematical tasks mostly with high cognitive demands, while others were not even able to create any activity (Ozgen & Alkan, 2014). These studies suggest that teachers are not always able to bring worthwhile mathematical tasks into their classrooms.

Studies have also revealed that, even teachers prepare worthwhile mathematical tasks, they might not successfully enact these high quality tasks in classrooms. That is, providing students highly cognitive tasks does not per se guarantee that these tasks will work well to increase students' learning and understanding of mathematics, unless teachers maintain the quality while implementing such worthwhile tasks. Observing three mathematics teachers' implementations of the same high-level task with their students, for instance, Sullivan and his colleagues concluded that only one teacher could maintain the cognitive demand of the task (Sullivan, Clarke, Clarke, & O'Shea, 2010). The other two teachers tried to make the task less complicated for students by either rejecting students' suggestions for solutions or presenting more procedural ways to solve the task, which, in fact, limited students' mathematical thinking. As a result, when students' performances were compared, highest rate of achievement was reported in classroom where worthwhile task was enacted by the teacher effectively (Sullivan, Clarke, Clarke, & O'Shea, 2010). Then, it is important for teachers to not only prepare but also implement worthwhile tasks effectively by sustaining tasks' high level of cognitive demands.

The elements presented in circles in the framework (Figure 1) suggest factors that are responsible for changes in task features between phases. Stein and her colleagues demonstrated the teacher as the first, and major, source of factors that affect student learning through tasks (Stein, Grover, & Henningsen, 1996). They explained the teacher effect in terms of teachers' goals, teachers' knowledge of subject matter, and teachers' knowledge of students. Factors which influence how students' perform on the tasks presented to them include teachers' instruction as well, in addition to contextual (e.g. classroom norms) and student-related reasons (e.g. students' learning habits). The key for success in reform-oriented mathematics education is, then, how teachers prepare (through choosing or creating) and implement mathematical tasks in classroom.

Focusing on teacher factor as suggested in the Mathematical Tasks Framework (Stein, Grover, & Henningsen, 1996), researchers have found that teachers'

knowledge is significantly correlated with effective implementation of mathematical tasks with higher-level demands (Wilhelm, 2014) and when teachers lacked the necessary knowledge, they believed they could not appropriately design mathematical tasks and effectively use them in their classrooms (Bukova-Guzel & Alkan 2005; Eraslan, 2013). However, it was also evident that teachers' knowledge is not enough for effective use of mathematical tasks in mathematics teaching (Stylianides & Stylianides, 2008). For instance, in an attempt to increase teachers' knowledge through professional development based on the Mathematical Tasks Framework and support their selection and implementation of high quality mathematical tasks, Arbaugh and Brown (2005) concluded that increased knowledge did not always produce growth in the quality of the ways teachers prepare and implement tasks. According to Bandura (1997), having necessary knowledge does not guarantee successful performance, if individuals do not have confidence in their capabilities to perform well. Therefore, it could be asserted that teachers' confidence in their capabilities to prepare and implement worthwhile mathematical tasks effectively (i.e. self-efficacy for preparing and implementing mathematical tasks) is a significant influence on their mathematics teaching through tasks. In the following sections, a review of the literature on self-efficacy, mainly teachers' self-efficacy, with a focus on prospective teachers efficacy beliefs and the role of teacher education programs is provided.

2.2 Self-Efficacy

In 1986, Bandura proposed Social Cognitive Theory to explain human functioning. This theory is based on the idea of *reciprocal determinism* in which personal factors, behavior, and environmental influences interact dynamically as determinants of each other (Figure 2). According to Bandura (1986), personal factors, behavior, and environmental factors affect one another mutually in a process of triadic reciprocality, and this interaction enables people to exercise control over their lives. For example, teachers who are confident in their skills to prepare and implement mathematical tasks effectively (personal factor) can perform well in their teaching

mathematics through tasks (behavior) and help their students learn mathematics better (environmental event), and, as a result, their students' performances may inform teachers about their capabilities and alter their future teaching.

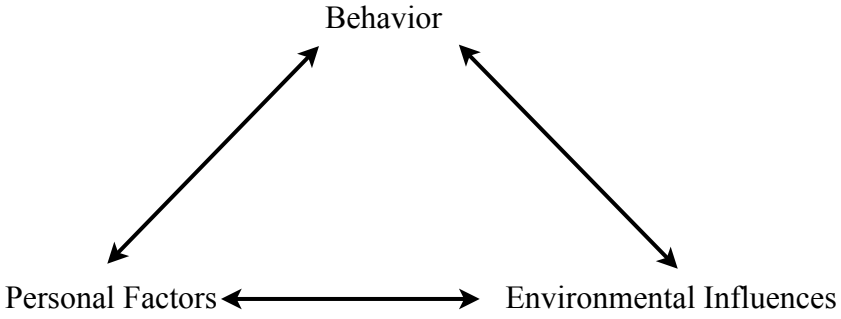

Figure 2. Bandura's model of reciprocal determinism (1986)

Bandura (1997) asserted that, among all personal factors, the most central to human functioning is *self-efficacy*, and he defined self-efficacy as "beliefs in one's capabilities to organize and execute the course of action required to produce given attainments" (p. 3). When people believe they can achieve a specific goal, that is, they feel confident in their capabilities to perform tasks successfully to produce certain outcomes, then they have more incentive to take action, expend more effort, and persevere in the face of difficulties. For this reason, people prefer to engage in activities which they feel competent to and they value, and they rather avoid carrying out activities which they don't value or they don't think they are capable of accomplishing.

Since Bandura introduced the concept in 1977, self-efficacy has received extensive attention in the field of educational research. Ample research on self-efficacy in educational settings demonstrated the importance of students' beliefs about their academic capabilities in predicting their academic performances. Researchers reported that students' self-efficacy beliefs were related to their achievement in various academic disciplines such as mathematics (Hackett & Betz, 1989; Pajares & Miller, 1994, 1995;

Skaalvik & Skaalvik, 2011), reading and writing (e.g. Shell, Colvin, & Bruning, 1995), and science (e.g. Britner & Pajares, 2006). Self-efficacy beliefs are also associated with attitudes (Hackett & Betz, 1989), career choices, achievement goals, and self-concept.

2.2.1 Hypothesized Sources of Self-Efficacy

Self-efficacy beliefs are developed and altered through weighting and interpreting the efficacy-relevant information provided by different sources. Bandura (1977, 1986, 1997) hypothesized that there are four main sources of self-efficacy, namely, mastery experiences, vicarious experiences, social persuasions, and physiological states. People interpret the results of their own performances, or *mastery experiences*, when judging their capabilities, and success boosts self-efficacy, whereas failure undermines it. For example, after preparing worthwhile mathematical activities, if prospective teachers believe that their efforts have been successful, they are more likely to feel confident about their capabilities to prepare mathematical tasks effectively in the future; but, if they believe their efforts failed to create such tasks effectively, their confidence to succeed will be decreased.

Mastery experiences are the most powerful source of self-efficacy because, based on personal experiences, they provide authentic evidence on one's competencies (Bandura, 1997). While performance success raise self-efficacy and failures, especially when repeated, lower it, the same experiences leave self-efficacy unaffected, depending on how people interpret and weight the information. When poor performances (i.e. failures) are seen as faulty strategies rather than results of inability, the belief that future success could be achieved through better strategies will boost self-efficacy. However, easily gained successes cause people to expect quick results and in this case, self-efficacy is diminished when one is faced failures (Bandura, 1997). The perceived difficulty of an activity, therefore, controls the extent to which mastery experiences will affect self-efficacy. "Mastery of difficult tasks," as Bandura stated, "conveys new efficacy information for raising belief in one's capabilities" (p. 82), while success in completing an easy task does not contribute to the development of efficacy beliefs.

Similarly, the amount of effort expended to complete a task provide evidence of capabilities. Individuals interpret laborious effort resulted with failures as lack of capability and their self-efficacy beliefs are undermined, but they ascribe personal attainments with minimal effort in accomplishing tasks others view difficult to high ability.

People not only interpret results of their own performance experiences when gauging their efficacy beliefs, but they also rely on *vicarious experiences* gained through observing models' performances (Bandura, 1997). At times when absolute measures of proficiency are not provided, people compare their own performances with others' and judge their competencies regarding others' successes or failures. For example, when a prospective teacher scores 75 over 100 on a midterm and she knows that her peers mostly earned scores under 70, her self-efficacy will most probably be increased, but if her peers scored over 95, her efficacy appraisal will likely be lowered. The extent to which efficacy appraisals are influenced based on social comparative information is dependent on competence of model chosen for comparison (Bandura, 1997).

Models also provide powerful vicarious experiences, if people are uncertain about their capabilities, especially during skill development when one lacks the adequate experience with the task (Bandura, 1997). In classroom environment, for instance, teachers as proficient models transmit their knowledge and skills and teach their students ways for achieving tasks. Through learning such effective strategies, students' self-efficacy beliefs can increase. Additionally, vicarious informations gained from peers with similar attributes (e.g. age, gender, academic achievement) are referred to as powerful sources of self-efficacy. The more similarity with the model is perceived, the greater effect vicarious experiences have. Other modes of vicarious influence on self-efficacy can be in the form of symbolic modeling as provided by television and other media and self-modeling such as video recording and seeing oneself performing.

Social persuasions, another source of self-efficacy, are verbal persuasions about one's capabilities. Persuaded by teachers, peers, or significant others that they

have the capability to accomplish, students feel more confident in their academic competencies, but when others convey doubts, students' efficacy beliefs are undermined. Social persuasions are most powerful to raise self-efficacy, if they are realistic (Bandura, 1997). Encouraging unrealistic beliefs about one's capabilities likely undermine self-efficacy and discredit the persuader. The credibility of people who provide evaluative feedback is also important. People weight and interpret efficacy relevant feedback they receive from people they trust (e.g. significant others) or from people who they regard as knowledgeable about the tasks at hand (e.g. teachers).

It is also important to frame feedback in a positive and informative way to increase its effects on self-efficacy (Bandura, 1997). Providing ability feedback which highlight capabilities or include messages about improvement in capabilities enhances efficacy beliefs of students. Effort feedback focusing on the effort students expended also boosts self-efficacy, but not as much as ability feedback. Evaluative feedback, even negative, increases perceived efficacy beliefs as well, if it includes helpful guides to better performances. For example, corrective feedback helps students learn from their mistakes. Harsh criticism, on the other hand, undermines self-efficacy.

The last source of self-efficacy as hypothesized by Bandura (1997) is physiological states. People interpret their emotional and physiological states, such as stress, anxiety, and mood they experience while performing a task, as indicators of their capabilities. Positive emotions (e.g. happiness) raise self-efficacy, whereas negative emotional states (e.g. fear) undermine it. Yet, the level of arousal affect how it will be weighted by individuals in judging their capabilities (Bandura, 1997). Even though high physiological arousal is perceived as debilitating, arousal at optimum level facilitates functioning of individuals. In classroom setting, supporting students' physiological well-being and creating an environment where students can experience positive emotional states help teachers contribute to their students' self-efficacy development.

2.2.2 Teacher Self-Efficacy

Teacher self-efficacy is a key factor in the learning and teaching processes in classroom. Although self-efficacy is a concept framed in Bandura's Social Cognitive Theory, early studies on teachers' efficacy beliefs have been grounded in Rotter's conceptualization of individuals' beliefs about the control of reinforcement (i.e. locus of control). Rotter (1966) suggested that even though reward has a crucial role in learning and performance, individuals differ in how they perceive their control over rewards. According to Rotter, when people believe in *internal control* of reward, they perceive success as a result of their actions. People holding beliefs in *external control*, on the contrary, think that success is controlled by other influences such as luck, chance, and fate, but not by their own actions.

Based on Rotter's work, *teachers' sense of efficacy* was examined by RAND researchers (Armor et al., 1976). In this first attempt to measure teachers' efficacy beliefs and their influence on student performances, Armor and his colleagues used two items, both of which they created based on Rotter's (1966) study. The first item was asking teachers whether they believed that "when it comes right down to it, a teacher really can't do much (because) most of a student's motivation and performance depends on his or her home environment," and the second one asked whether teachers thought "if I try really hard, I can get through to even the most difficult or unmotivated students" (p. 23). These two items referred to as beliefs in internal control and external control, respectively (Armor et al., 1976).

After Bandura introduced the concept of self-efficacy in 1977, Ashton and her colleagues re-conceptualized teachers' sense of efficacy, suggesting a two-dimensional model (Ashton, Webb, & Doda, 1982; Ashton & Webb, 1986). They regarded two RAND items as reflecting two different concepts in Bandura's Social Cognitive Theory, self-efficacy and outcome expectancy, where outcome expectancy was defined as "a person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193). According to Ashton and Webb, the *teaching*

efficacy dimension, corresponding to RAND item 1, as well as representing outcome expectancies, "refers to teachers' expectations that teaching can influence student learning," whereas the *personal teaching efficacy* dimension, corresponding to RAND item 2 and claimed to capture self-efficacy concept, was about teachers' "assessment of their own teaching competence" (p. 4).

With the purpose of increasing the reliability of RAND scale through constructing a longer instrument, Ashton and her colleagues developed Webb Efficacy Scale (Ashton, Webb, & Doda, 1982). While trying to maintain Armor et al.'s (1976) narrow conceptualization of teachers' sense of efficacy, these researchers created 7 forced-choice items to reduce the social desirability bias (Ashton, Webb, & Doda, 1982). Still, there were problems with Webb scale (Ashton, Webb, & Doda, 1982). First, authors stated that 10% of participating teachers in each sample showed unwillingness to answer at least one out of 7 items in the scale, probably because of the forced-choice characteristic of the instrument. Second problem was the lack of internal consistency of the scale that items in the scale failed to measure the two dimensions of teachers' efficacy beliefs. Authors suggested that a longer questionnaire could overcome this second issue (Ashton, Webb, & Doda, 1982). Thus, as an attempt to provide a more extensive and reliable instrument for measuring teachers' efficacy beliefs than Webb Scale, Gibson and Dembo (1984) developed a 30-item 6-point Likert scale called Teacher Efficacy Scale. Gibson and Dembo (1984) found that their scale conformed the two dimensions of teachers' sense of efficacy. In their study, Gibson and Dembo defined *personal teaching efficacy* as "belief that one has the skills and abilities to bring about student learning" (p. 573) and the second dimension, *teaching efficacy*, as "teacher's belief about the general relationship between teaching and learning" (p. 574).

Considering the subject-specific nature of self-efficacy beliefs as suggested by Bandura (1997), researchers modified Gibson and Dembo's (1984) scale to measure teachers' efficacy beliefs in different academic areas. Riggs and Enochs (1990) developed Science Teaching Efficacy Belief Instrument (STEBI) modeling after the two

dimensions of Gibson and Dembo's Teacher Efficacy Scale to explore science teachers' efficacy beliefs for teaching science. STEBI consisted of two sub-scales, namely, Personal Science Teaching Efficacy Belief and Science Teaching Outcome Expectancy. And modifying STEBI, Enochs, Smith, and Huinker (2000) developed Mathematics Teaching Efficacy Belief Instrument which was composed of Personal Mathematics Teaching Efficacy and Mathematics Teaching Outcome Expectancy sub-scales.

Even though some researchers (e.g. Cetinkaya & Erbas, 2011; Soodak & Podell, 1996) confirmed the existence of two dimensions of teachers' efficacy beliefs (i.e. personal teaching efficacy beliefs and outcome expectancies), others did not (e.g. Deemer & Minke, 1999). Researchers argued that it was questionable to use teaching efficacy sub-scale to measure teachers' efficacy beliefs. The personal efficacy belief dimension was found to be a more reliable and consistent measure of teacher self-efficacy than teaching efficacy dimension (Coladarci & Fink, 1995; Henson, Kogan, & Vacha-Haase, 2001; Soodak & Podell, 1994). It was contended that teaching efficacy sub-scale was corresponding to teachers' general beliefs about the power of teaching, that is, the Locus of Control Theory (Rotter, 1966) rather than Bandura's definition of outcome expectancy (Guskey & Passaro, 1994; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998).

Bandura (1997) also noted that self-efficacy beliefs were confused with locus of control. Bandura emphasized that according to the Locus of Control Theory "behavior is influenced by generalized expectancies that outcomes are determined either by one's actions or by external forces beyond one's actions or by external forces beyond one's control" (p. 19) and so perceived self-efficacy "cannot, by any stretch of the imagination, be considered the same as beliefs about whether actions affect outcomes (*locus of control*)" (p. 20, emphasis in original). Even though Bandura (1997) stated that self-efficacy and outcome expectancy both have impact on behavior, he concluded that self-efficacy is a better predictor of human functioning. Thus, a clearer conceptualization

of teacher self-efficacy would be grounded in Bandura's Social Cognitive Theory, which also provided the framework for this study.

Pointing out the distinction between self-efficacy and outcome expectancy, Bandura (1977) asserted that "individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform necessary activities, such information does not influence their behavior" (p. 193). And in the Teacher Self-Efficacy Scale he developed in 1990, Bandura excluded the outcome expectancy dimension, focusing solely on teachers' self-efficacy beliefs (Bandura, 2006). Yet, this scale did not draw much attention from researchers. A widely accepted measure of teacher self-efficacy, Teachers' Sense of Efficacy Scale was developed by Tschannen-Moran and Woolfolk Hoy in 2001, based on Bandura's Teacher Efficacy Scale. The Teachers' Sense of Efficacy Scale was composed of three sub-scales: Efficacy for instructional strategies, efficacy for classroom management, and efficacy for student engagement. With its dimensions related to different aspects of teaching, this scale highlights the task specific nature of self-efficacy beliefs.

Research on teachers' efficacy beliefs provided evidence of the power of these beliefs on both teacher behavior and student outcomes. From teachers' aspect, self-efficacy has been found to be an effective factor on teacher behaviors. Teachers with high self-efficacy have more positive attitudes toward implementing innovative instructional methods (Ghaith & Yaghi 1997), they appreciate the importance of such new instructional methods more and regard such methods less difficult to implement than teachers with low efficacy beliefs (Guskey, 1988). Associated with teachers' beliefs about the necessity of reform movements, teachers' self-efficacy is a significant factor too (Czerniak & Lumpe, 1996). Teachers are more likely to use inquiry-based and student-centered teaching methods, utilize appropriate materials and resources, when they are highly confident in their capabilities, but teachers with low efficacy beliefs are more likely to prefer traditional teaching methods, such as direct-teaching (Haney, Lumpe, Czerniak, & Egan, 2002; Riggs & Enochs, 1990). Teachers who have strong

beliefs in their capabilities are more skilled at creating constructivist learning environments (Koç, 2013). And as a result of its influence on teaching practices, self-efficacy of teachers also have power to produce effect on student outcomes. From students' aspect, teacher self-efficacy is a predictive of students' achievement. Higher teacher efficacy produce higher student achievement (Allinder, 1995; Ashton & Webb, 1986; Caprara, Barbaranelli, Steca, & Malone, 2006).

Self-efficacy beliefs also influence teachers' expectations from their students. Highly efficacious teachers make less negative predictions of students' academic and social success than less efficacious teachers (Tournaki & Podell, 2005). Moreover, teachers with high levels of self-efficacy construct their predictions about student achievement regardless of students' characteristics. That is, when teachers are confident in their capabilities to teach, they believe even inattentive students can be successful both academically and socially (Tournaki & Podell, 2005). Similarly, teachers with stronger confidence in their capabilities take more responsibility and suggest more teacher-based solutions (e.g. use of instructional strategies) to problems of difficult-to-teach students, whereas teachers with low efficacy beliefs make non-teacher-based suggestions (i.e. solutions outside of the classroom) for addressing the needs of students with difficulties (Soodak & Podell, 1994).

Teachers holding strong sense of efficacy also show more commitment to teaching (Coladarci, 1992). Additionally, among other personal (e.g. experience) and contextual (e.g. school climate) factors, self-efficacy is a more powerful predictor of teachers' feelings of attachment to the profession (Coladarci, 1992). Teachers' self-efficacy is also strongly correlated with their job satisfaction and burnout. Research showed that the more teachers believe in their capabilities to teach effectively, the more job satisfaction they have (Caprara, Barbaranelli, Steca, & Malone, 2006; Gür, Çakıroğlu, & Çapa, 2012; Klassen & Chiu, 2010; Skaalvik & Skaalvik, 2014), the more in the profession they stay (Friedman, 2003), and the less burnout they experience (Bouwers & Tomic, 2000; Bümen, 2010; Friedman, 2003; Skaalvik & Skaalvik, 2007).

In mathematics classroom, teacher self-efficacy is also related to their mathematics teaching. Teachers with high self-efficacy for teaching mathematics tend to use more conceptually oriented mathematics teaching methods, while teachers who have doubts about their capabilities in effective teaching prefer more procedurally oriented methods (Kahle, 2008). Positive relationship exist between mathematics teachers' self-efficacy and their instructional quality as rated by both teachers themselves and their students (Holzberger, Philipp, & Kunter, 2013). According to teachers' and their students' ratings, mathematics teachers of high self-efficacy were better at classroom management and they provided more learning support to students individually. These teachers also set higher goals for their students' and, in turn, students perform better at solving mathematical problems (Allinder, 1995). Teacher beliefs for teaching mathematics effectively are positively correlated with students' expectancies and perceptions of their mathematics performances, and negatively correlated with students' perceptions of task difficulty in mathematics (Midgley, Feldlaufer, & Eccles, 1989).

2.2.3 Role of Teacher Education Programs

According to Bandura (1997), self-efficacy is more malleable during skill development. Researchers also reported that teacher self-efficacy beliefs are more open to change during pre-service years (Tschannen-Moran & Woolfolk Hoy, 2007). Thus, self-efficacy of prospective teachers received attention from researchers. One area of research has been focused on correlates of prospective teachers' efficacy beliefs, and prospective teachers' self-efficacy for teaching has been found to be correlated with their attitudes toward teaching (Çaycı, 2011; Tekkaya, Çakıroğlu, & Özkan, 2002), conceptual understanding (Tekkaya, Çakıroğlu, & Özkan, 2004), and classroom management beliefs (Gencer & Çakıroğlu, 2007). Studies on mathematics teacher education have showed that prospective teachers' self-efficacy for teaching mathematics is correlated negatively with their mathematics anxiety (Gresham, 2008; Işıksal, 2010; Swars, Daane, & Giesen, 2006). Prospective teachers' efficacy beliefs for teaching mathematics are related to their mathematics performances and self-efficacy for mathematics as well (Bates, Kim, &

Latham, 2011; Briley, 2012). Prospective teachers with high self-efficacy for teaching mathematics valued the use of manipulatives in mathematics teaching more than prospective teachers with low level of self-efficacy (Swars, 2005). These studies have emphasized the role of perceived self-efficacy during teacher training years.

Considering the importance of prospective teachers' efficacy beliefs in the teacher education program, as well as the significance of teacher self-efficacy in both teaching practices and student-related outcomes, it is the responsibility of teacher education programs to ensure that prospective teachers feel strongly efficacious upon completing their training. Therefore, another area of research was centered on the effectiveness of teacher training programs on self-efficacy beliefs of prospective teachers. Researchers examined the influence of teacher education programs with the aim of finding ways to support prospective teachers' development of strong confidence in their capabilities for teaching effectively.

With a longitudinal approach to exploring the influence of teacher education program, Bümen and Ercan Özaydın (2012) investigated the change in Turkish prospective primary school teachers' self-efficacy throughout the program. They implemented Tschannen-Moran and Woolfolk Hoy's (2001) Teachers' Sense of Efficacy Scale as adapted to Turkish by Çapa, Çakıroğlu, and Sarıkaya (2005, as cited in Bümen & Ercan Özaydın, 2012) at the end of each year since the participating prospective teachers enrolled in the four-year program. And they found that prospective teachers' overall self-efficacy beliefs for teaching significantly increased throughout the program. A detailed analysis regarding the sub-scales revealed significant difference between self-efficacy for student engagement of freshmen and sophomores, and between sophomores and seniors. Self-efficacy for classroom management only differed for sophomore and junior prospective teachers. Prospective teachers' efficacy beliefs for instructional skills were also different for freshmen and sophomores, as well as sophomores and juniors. These results revealed that there was no significant difference between junior and senior prospective teachers' self-efficacy for any sub-scales. Thus, it could be concluded that

student teaching which was offered in the last year of the program did not make significant difference in self-efficacy judgments of prospective teachers, while teaching methods courses (e.g. teaching mathematics and teaching science) in junior year were more effective in producing significant difference.

Concentrated on mathematics education, Swars, Hart, Smith, Smith, and Tolar (2007) explored the influence of two-year teacher education program in the United States on prospective elementary teachers' efficacy beliefs for teaching mathematics. First three semesters of the program included field placements at Kindergarten (Pre-K and K), Grades 1-3, and Grades 4-5 respectively. Field placements were followed by one semester of student teaching. Two methods courses were also offered as a part of the program, during the second and third semesters. Data collection began with methods courses and ended with student teaching, and Mathematics Teaching Efficacy Beliefs Instrument (Enochs, Smith, & Huinker, 2000) was administrated at the end of each semester. Swars and her colleagues observed significant increase in prospective teachers' personal efficacy beliefs for teaching mathematics throughout the program. Prospective teachers' outcome expectancies about teaching mathematics also showed significant improvement during both methods courses, but remained the same during student teaching (Swars, Hart, Smith, Smith, & Tolar, 2007). Thus, it could be concluded that methods course with classroom observation can effectively contribute to prospective teachers' personal efficacy beliefs and outcome expectancies, and fieldwork might be powerful to create positive impact on personal efficacy beliefs of prospective teachers too, even not on outcome expectancies.

Longitudinal studies of prospective teachers' self-efficacy, however, are limited in number, probably due to the certain difficulties caused by the nature of the research design (e.g. participant dropout, time restrictions, higher costs). As an alternative approach, cross-sectional studies were conducted to examine whether teacher training was effective to prepare efficacious teachers. For example, using Turkish version of Tschannen-Moran and Woolfolk Hoy's (2001) Teachers' Sense of Efficacy

Scale which was adapted by Baloğlu and Karadağ (2008, as cited in İpek & Camadan, 2012), İpek and Camadan (2012) compared teaching self-efficacy of freshman and senior prospective primary school teachers in Turkey. They found that senior prospective teachers had significantly stronger beliefs in their capabilities to teach. Findings on sub-scales were not reported, though, so it cannot be claimed that prospective teachers in the last year of of training program scored higher in all three aspects of teaching self-efficacy beliefs (i.e. student engagement, classroom management, instructional skills). Moreover, because no data were gathered from sophomores and juniors, it is not possible to talk about the contribution of final year of the program on prospective teachers' efficacy beliefs, like these researchers did. İpek and Camadan concluded that teaching experiences might have helped prospective teachers "realize their self-efficacies towards the profession at fourth grade" (p.1212), which could be regarded as an over-interpretation of findings because it is not clear whether data collection occurred before or after seniors completed practicum courses, it could be that junior prospective teachers, for instance, were feeling more confident until they engaged in student teaching as senior prospective teachers.

With a similar yet detailed approach, Çaycı (2011) compared teaching self-efficacy beliefs of Turkish prospective elementary school teachers from each of the four years of the teacher education program. He administrated Gibson and Dembo's (1984) Teacher Efficacy Scale, which was revised by Guskey and Passaro (1994) and adapted to Turkish by Diken (2004, as cited in Çaycı, 2011), to elementary teacher candidates and reported that juniors and seniors were holding stronger self-efficacy than freshmen and sophomores. Findings showed no significant difference between junior and senior prospective teachers' self-efficacy for teaching. Based on the results of Çaycı's study, it could be asserted that teaching methods and practicum courses which are generally offered in the last two years of four-year teacher education programs (Işıksal & Çakıroğlu, 2006; Koç, 2011) might have the power to create positive effect, but final

year courses (e.g. student teaching) might not necessarily add up to the contribution of third year courses (e.g. methods courses).

Işıksal and Çakıroğlu (2006) have also examined the differences in efficacy beliefs of Turkish prospective teachers with a cross-sectional approach to the investigation of teacher training program, in terms of mathematics education. They adapted Enochs, Smith, and Huinker's (2000) Mathematics Teaching Efficacy Belief Instrument to Turkish and administered the scale to prospective elementary mathematics teachers from different grade levels in the elementary mathematics education programs at two different universities. Unlike Çaycı's (2011) study, results of Işıksal and Çakıroğlu's research revealed that prospective teachers' efficacy beliefs differed with regard to neither their universities nor their grade levels. As authors suggested, similar efficacy beliefs of teacher candidates studying at different universities could be considered as a sign that teacher education programs had similar approaches to teacher education (Işıksal & Çakıroğlu, 2006). Still, regardless of the finding showing that juniors and seniors had higher efficacy beliefs, not reaching to significant difference in self-efficacy of prospective teachers at different stages might be seen as a deficiency of courses directly related to mathematics teaching (e.g. methods course and fieldwork).

Similar to Işıksal and Çakıroğlu's (2006) study, using Mathematics Teaching Efficacy Belief Instrument (Enochs, Smith, & Huinker, 2000), Koç (2011) investigated self-efficacy of prospective teachers at elementary and secondary teacher education programs in the United States. He compared efficacy beliefs of junior and senior prospective teachers, but different from Işıksal and Çakıroğlu, prospective teachers' overall efficacy beliefs were not tested in Koç's study; he rather focused on each sub-scale separately, and found that both elementary and secondary junior prospective teachers had significantly higher personal mathematics teaching self-efficacy than senior prospective teachers. This finding showed that prospective teachers' efficacy beliefs for teaching mathematics lowered through the transition from junior to senior level, which might have been a result of negative impact of fieldwork (Koç, 2011). The researcher

reported no significant difference in prospective teachers' outcome expectancies about mathematics teaching.

A similar attempt to reveal the differences in self-efficacy beliefs of junior and senior prospective teachers was Gencer and Çakıroğlu's (2007) study with prospective science teachers in Turkey. They implemented Science Teaching Efficacy Beliefs Instrument (Enochs & Riggs, 1990, as cited in Gencer & Çakıroğlu, 2007) as adapted to Turkish by Tekkaya et al. (2004, as cited in Gencer & Çakıroğlu, 2007) to junior and senior prospective teachers at 9 universities. With a larger sample than other studies discussed earlier, Gencer and Çakıroğlu increased the generalizability of their findings, yet they reported no significant difference between junior and senior prospective teachers' efficacy beliefs for teaching science on neither of sub-scales. Because seniors participated in this study have already completed practicum courses (Gencer & Çakıroğlu, 2007), it could be concluded that teaching practices provided by teacher education programs do not produce significant influence on prospective teachers' self-efficacy beliefs. This finding is also consistent with results of other studies (e.g. Bümen & Ercan Özaydın, 2012; Çaycı, 2011; Işıksal & Çakıroğlu, 2006).

Researchers also conducted studies concentrated on certain courses offered in teacher education programs, especially the ones linking content knowledge to pedagogical knowledge (e.g. methods course), with the aim of determining the effectiveness of classes which are highly relevant to teaching profession. To examine the effects of such specific courses on prospective teachers' efficacy beliefs, researchers have mostly employed experimental designs. An early effort of research in this area was conducted by Huinker and Madison (1997). In their study on the effects of methods course, Huinker and Madison used Mathematics Teaching Efficacy Beliefs Instrument (Huinker & Enochs, 1995, as cited in Huinker & Madison, 1997) in a one-group pretest-posttest design with prospective elementary teachers in the United States. Prospective teachers met weekly for three hours for this mathematics teaching methods class, and fieldwork was a part of methods course, too. Huinker and Madison found positive

changes in prospective teachers' personal efficacy beliefs and outcome expectancies for teaching mathematics.

Employing the same experimental design with Huinker and Madison (1997), Çakıroğlu (2000) investigated the influence of a reform-oriented mathematics teaching methods course on mathematics teaching efficacy beliefs of prospective elementary teachers in the United States. This methods course included both lectures which were held once a week and fieldwork where prospective teachers taught mathematics and science to small groups of elementary school students. Çakıroğlu modified Science Teacher Efficacy Beliefs Instrument (Enochs & Riggs, 1990, as cited in Çakıroğlu, 2000) to assess prospective teachers' efficacy beliefs for mathematics teaching and developed Beliefs About Teaching Reform-Oriented Mathematics questionnaire. Then he administrated these scales to prospective teachers before and after the methods course. Results showed that the methods course had positive impact on prospective teachers personal efficacy beliefs for teaching mathematics (Çakıroğlu, 2000). This positive change in participants' efficacy beliefs was supported by qualitative data collected through open-ended posttest questions and interviews. As qualitative findings revealed, prospective teachers mentioned that fieldwork and various examples of reform-oriented teaching provided by instructors during methods course helped them feel more confident in their capabilities to teach reform-oriented mathematics (Çakıroğlu, 2000). Yet, the qualitative part of this study did not describe in detail the effect of elements of methods course under investigation, rather it provided a general conclusion that when opportunities of student teaching and examples for reform-oriented teaching methods are given to prospective teachers, an increase in their efficacy beliefs can be observed. Additionally, no significant effect of methods course on prospective teachers' outcome expectancies was reported.

In 2006, Burton designed a study in which the effects of a traditional and experimental methods course were compared. Both traditional and experimental methods courses were composed of meetings which took place once a week, prospective

teachers' planning and implementing mathematics lessons, and fieldwork. Additionally, a 20 minutes of intervention of teaching 5th and 6th grade mathematical content was included in the experimental course. Mathematics Teaching Efficacy Beliefs Instrument (Enochs, Smith, & Huinker, 2000) and content knowledge scale were administered to prospective elementary teachers in each methods class at the beginning and at the end of the semester. Burton found positive influence of both methods courses on prospective teachers' personal efficacy beliefs for teaching mathematics and content knowledge, with greater improvement in experimental group than traditional group. Prospective teachers' outcome expectancies, on the contrary, showed no significant change in neither of method courses. Regarding the correlation between personal efficacy beliefs and content knowledge of prospective teachers, no significant relationship was observed, but findings revealed that the level of change in efficacy beliefs was related to the level of change in content knowledge (Burton, 2006). That is, prospective teachers who had higher levels of change in personal efficacy beliefs for teaching mathematics experienced higher increase in content knowledge of 5th and 6th grades mathematics. In general, it could be concluded that an emphasis on content knowledge in methods course have the power to make a positive contribution to the development of prospective teachers' self-efficacy.

Recently, Albayrak and Aydın Ural (2011) have studied effects of mathematics teaching methods course on junior prospective elementary mathematics teachers' self-efficacy beliefs for teaching mathematics. Meetings of this methods course were held weekly and directed by the course instructor. During these lecture hours every week, direct instruction, manipulative use, problem solving, and classroom discussions took place (Albayrak & Aydın Ural, 2011). Studying with prospective teachers in Turkey, Albayrak and Aydın Ural administrated Mathematics Teaching Efficacy Belief Instrument (Enochs, Smith, & Huinker, 2000) as adapted to Turkish by Işıksal and Çakıroğlu (2006). Both personal efficacy beliefs and outcome expectancies of prospective teachers increased significantly after enrolling in the methods course.

Utley, Moseley, and Bryant (2005) compared the influences of one semester of mathematics teaching methods course and student teaching on prospective teachers' mathematics teaching self-efficacy. The Mathematics Teaching Efficacy Beliefs Instrument (Huinker & Enochs, 1995, as cited in Utley, Moseley, & Bryant, 2005) was implemented to prospective teachers three times throughout the 9-month period: Prior to methods course, at the end of methods course, and at the end of student teaching. According to research results, Utley and her colleagues reported that prospective teachers' self-efficacy (both personal efficacy beliefs and outcome expectancies) positively changed during methods course, but not during fieldwork. They also concluded that there was not a significant effect of overall coursework on prospective elementary teachers' personal efficacy beliefs, but significant influence on outcome expectancies was observed (Utley, Moseley, & Bryant, 2005). Thus, the program was successful at improving prospective teachers' beliefs about the power of mathematics teaching regardless of external factors (i.e. outcome expectancies), not at supporting their confidence in their capabilities to teach effectively (i.e. personal efficacy beliefs).

In addition to exploring the impact of teacher education programs on prospective teachers' efficacy beliefs, researchers have recently started to explore the predictive power of hypothesized sources of self-efficacy. This area of research on prospective teachers' self-efficacy beliefs included investigations of efficacy beliefs' sources as provided by teacher education programs. In 2007, Poulou developed the Teaching Efficacy Sources Inventory to investigate sources of prospective teachers' efficacy beliefs for teaching in general. This inventory, however, failed to detect all four sources of self-efficacy as hypothesized by Bandura (1997). Factor analysis revealed that items were loaded in three categories, namely, vicarious experiences (e.g. comparisons of own teaching with colleagues), physiological states (e.g. feelings of stress during teaching experiences), and the third category in which mastery experiences (e.g. teaching experience in primary schools) and social persuasion (e.g. feedback from colleagues) were combined in one category. Because items were worded considering

teaching practices, obviously this questionnaire was developed for prospective teachers with field experiences, but not for prospective teachers at earlier stages in their programs. Poulou, therefore, implemented the Teaching Efficacy Sources Inventory to senior prospective teachers enrolled in primary education program at two universities in Greece right after their 6-week field experience. Results showed that, among these three source categories, the highly rated source was the combined mastery experiences/social persuasions. As Bandura (1997) suggested and related research supported (e.g. Usher & Pajares, 2009), mastery experience is the most powerful source of self-efficacy. Poulou's research also seems to confirm the predictive power of mastery experiences, but because mastery experiences were combined with social persuasions in the inventory used, it is not clear whether mastery experiences or social persuasion was perceived as the strongest source of prospective teachers' self-efficacy. Poulou also implemented the Teacher Sense of Efficacy Scale (Tschannen-Moran & Hoy, 2001) to examine the sources of self-efficacy, and results revealed that only a conjunction of mastery experiences and social persuasions significantly predicted prospective teachers' efficacy beliefs (Poulou, 2007). Again, it is not clear which source, either mastery experiences or social persuasions, was perceived as an effective predictor of prospective teachers' efficacy beliefs because these sources were treated as a combined factor of this scale.

In 2011, Oh conducted a similar research using Teaching Efficacy Sources Inventory (Poulou, 2007) and Teacher Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001). Prospective teachers who completed a literacy methods course at a university in the United States participated in Oh's study. A part of this methods course included student teaching at elementary schools, so Poulou's inventory was appropriate to examine sources of these prospective teachers' efficacy beliefs. Findings showed that mastery experiences/social persuasion and physiological states significantly predicted prospective teachers' efficacy beliefs for classroom management, while none of the sources were found to be significant predictors of self-efficacy for student engagement and instructional strategies (Oh, 2011).

Later, O'Neill and Stephenson (2012) implemented Poulou's (2007) scale to senior prospective primary school teachers at 15 four-year undergraduate primary teaching programs in Australia. Using, again, Teacher Sense of Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001), these researchers found physiological states source was a significant predictor of prospective teachers' self-efficacy, but not mastery experiences/social persuasions or vicarious experiences (O'Neill & Stephenson, 2012). Even though mastery experiences as defined in the inventory was not perceived as an effective source for prospective teachers' efficacy beliefs, further analysis of descriptive data revealed that prospective teachers with tutoring experiences had significantly higher self-efficacy and the number of teaching experiences other than field experiences was positively correlated with their efficacy beliefs. This finding could be interpreted as the deficiency of teaching practices provided by teacher education program.

In addition to these quantitative studies, researchers also employed qualitative methods to explore sources of prospective teachers' efficacy beliefs. For example, Palmer (2006) investigated self-efficacy of Australian prospective primary education teachers who were enrolled in a science teaching methods course. This science methods course was composed of "lectures, in which students were relatively passive members of a large audience" (p. 343) and workshops in which prospective teachers observed the instructor who modeled teaching of science concepts and engaged in hands-on activities provided by the instructor. Administrating informal surveys throughout the methods course, Palmer found that prospective teachers mainly relied on their cognitive pedagogical mastery (i.e. mastery experiences in learning to teach science) when judging their capabilities to teach science. Vicarious experiences (self-modeling and simulated modeling) and cognitive content mastery (i.e. mastery experiences in learning science content) were other two most powerful sources respectively, while enactive mastery experiences were not mentioned by any of the participants which might be a result of limited opportunities for their performances as provided by the instructor.

Interestingly, Palmer suggested two kinds of mastery experience source, namely, cognitive pedagogical mastery and cognitive content mastery, both of which he differentiated from enactive mastery, or Bandura's (1997) definition of mastery experiences. When participants indicated they "had learnt or been shown how to do science lessons, activities, explanations, demonstrations or procedures for teaching science" (p. 346), Palmer used the code cognitive content mastery. Apparently, this shows that what Bandura (1997) would have probably called vicarious experiences were regarded as a kind of mastery experience by Palmer because being shown how to teach by a competent model (the instructor in this case) provides vicarious learning opportunity. Similarly, responses of prospective teachers were coded as cognitive content mastery when "they implied improved understanding of science concepts or improved ability to answer children's questions about science" (p. 346) which did not explain *how* such understandings occurred. For example, if participants' observation of instructor's modeling caused increase in their knowledge of the content, then this would be a result of their vicarious experiences, not their cognitive content mastery experiences; and if the improvement of understandings of science content was a result of personal effort, then it would be the mastery experiences source which contributed to participants' judgements of their capabilities. Therefore, these two sources as suggested by Palmer might be treated factors that influenced prospective teachers' self-efficacy without specifying which sources these factors operated through.

With a similar methodological approach, Brand and Wilkins (2007) explored the influence of a combined science and mathematics methods course on self-efficacy beliefs of prospective elementary teachers. The methods course was taught by these researchers and offered as a part of Master's degree Elementary Teacher Education Program in the United States, prior to practicum course. Because this methods course was a combination of teaching mathematics and science, Brand and Wilkins focused on prospective teachers' beliefs about their capabilities in teaching both science and mathematics. These researchers analyzed the data using the four hypothesized sources

(Bandura, 1997) and concluded that methods course created impact operating through all four sources of self-efficacy, mostly through mastery experiences. According to Brand and Wilkins (2007), engaging in inquiry-based activities throughout the methods course created positive effect on participants' efficacy beliefs by operating through mastery experience source. Findings also revealed that their peers provided vicarious experiences for prospective teachers which they used when judging their own capabilities. Yet, prospective teachers did not talk about the influence of course instructors' modeling in terms of vicarious learning, which could have been an expected source of information for self-efficacy of participants, as Bandura (1997) hypothesized. Social persuasions provided by researchers as the instructors of this methods course contributed to prospective teachers' efficacy beliefs as well. However, the excerpts related to social persuasions source rather reflected mastery and vicarious experiences and physiological states sources. For example, participants stated that "the way you managed our classroom has helped me to see that giving students control in their own learning helps with the process of learning" and "the way you modeled the investigative approach really helped me feel better about teaching" (Brand & Wilkins, 2007, p. 311), and both of these excerpts from participants' written reflections clearly indicate vicarious experiences the methods course provided to them, not social persuasions. Regarding physiological states source, Brand and Wilkins found decrease in prospective teachers' stress and anxiety which they expressed to have before entering the methods course, and the researchers concluded that "stress reduction" as a form of physiological states was another source on participants' self-efficacy. The researchers concluded that stress reduction (i.e. physiological states) was perceived as the second most powerful source of prospective teachers' self-efficacy and social persuasions was the least effective source which their experiences in methods course operated through.

In a recent effort, Aydın and Boz (2010) investigated sources of efficacy beliefs of prospective elementary science teachers from all grade levels at three different universities in Turkey. Findings of semi-structured interviews showed that mastery

experiences were perceived as the most powerful source of prospective teachers' self-efficacy. Still, these experiences only included actual teaching practices either provided by the program (i.e. practicum course) or tutoring experiences. The second strongest predictor of self-efficacy was vicarious experiences which were provided through observing instructors in the program, mentor teachers at fieldwork, and even teachers from the past (e.g. high school science teacher). Regarding social persuasions, only one participant mentioned the impact of feedback provided by peers. Findings revealed that prospective teachers did not talk about physiological states source. The weakness of this study is that it could not make the connection between teacher education program and prospective teachers' efficacy beliefs, probably due to the variety of participants' grade levels. For example, a freshman might talk about the influence of high school teacher as a vicarious experience source, but a senior prospective teacher can feel stronger impact of mentor teacher's modeling. Methodological limitations might have also been an obstacle to uncovering self-efficacy sources which teacher education program provided. Interview questions, or even information about the design of these questions, were not reported by researchers, but it might be the case that interview questions did not enable them to detect the efficacy-relevant information provided by the program that prospective teachers interpreted to judge their capabilities.

Another attempt to gain a deeper understanding of the sources of prospective teachers' self-efficacy was the qualitative investigation undertaken by Phelps (2010). From a narrative approach, Phelps interviewed 22 prospective elementary teachers twice during a mathematics teaching methods course. Yet, her main focus was not to explore the effects of methods course on prospective teachers' efficacy beliefs, nor the components of methods course which served, or could have served, as sources of self-efficacy. Rather, Phelps was more interested in prospective teachers' past experiences as students of mathematics. Findings revealed that prospective teachers interpreted their mastery experiences, vicarious experiences, and verbal persuasions when gauging their efficacy beliefs for teaching mathematics, but not physiological states. Phelps also found

that mastery experiences were the most powerful source of prospective teachers' efficacy beliefs, where successful past performances, understanding, and efforts in mathematics contributed to their self-efficacy development, while negative performances and lack of understanding lowered their efficacy beliefs. The amount of effort prospective teachers exerted to achieve was interpreted as efficacy-relevant information as well. Participants in Phelps' study had a view that achievement in mathematics was a natural result of fixed ability, so success gained with less effort was perceived as a sign of competence, whereas failures after higher levels of effort expended caused doubts in prospective teachers' confidence in their capabilities. The second strongest source of self-efficacy, as Phelps (2010) reported, was vicarious experiences of prospective teachers. Participants referred to their parents' achievement in mathematics which served as successful models and social comparisons with their peers when judging their own capabilities in mathematics. The verbal persuasions provided by parents and teachers, not specifically their teachers in the teacher training program, worked as sources of prospective teachers' efficacy beliefs. Findings also revealed that prospective teachers' perceptions of the fit between their beliefs about mathematics and mathematics taught in the teacher training program, as well as their career goals affected participating prospective teachers' mathematics self-efficacy.

2.2.4. Summary

In the reform-oriented mathematics classrooms in which teaching and learning activities are designed to promote students' mathematical understanding through problem solving, mathematical tasks are crucial elements in the development of higher-order mathematical skills. Reform movements, therefore, calls for teachers' effective use of mathematical tasks with high cognitive demands (i.e. worthwhile mathematical tasks) (MoNE, 2013; NCTM, 2000). As researchers have suggested, mathematics teachers' knowledge is a strong yet insufficient determinant in their selection and implementations of worthwhile tasks (e.g. Stylianides & Stylianides, 2008). Considering the significant power of self-efficacy on teaching performances, it

could be suggested that teachers' beliefs in their capabilities to prepare and implement worthwhile mathematical tasks play a key role in mathematics teaching through tasks.

Because self-efficacy is more open to change during skill development (Bandura, 1997), teacher education programs are responsible for supporting the development of prospective teachers' efficacy beliefs. Previous research, however, showed that teacher education programs are not always successful at creating positive effect on prospective teachers' self-efficacy for teaching mathematics in a positive way. In order to increase the effectiveness of teacher education programs, therefore, it is important to identify factors which contribute to prospective teachers' self-efficacy and to understand the ways these factors work as the sources of their efficacy beliefs. Yet, these quantitative and experimental in nature studies cannot provide teacher educators with the necessary knowledge of ways to develop their programs. Examining factors which have the power to influence prospective teachers' self-efficacy beliefs, therefore, is needed. Still, there has been little effort to explore how teacher education programs contribute to the development of prospective teachers' self-efficacy.

Although previous qualitative studies provided clues about the influence of methods course, there is need for a clearer guide for teacher educators to increase the effectiveness of teacher education programs. An investigation of which elements of methods course affect prospective teachers' efficacy beliefs and how each of these elements create perceived influence may provide such a guideline for the design and revision of methods course to support development of prospective teachers' self-efficacy.

CHAPTER 3

METHODOLOGY

The aim of this study was to explore prospective elementary mathematics teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks in the context of a mathematics teaching methods course. While tracing the effects of this course on selected prospective teachers' self-efficacy throughout a methods course, I investigated the factors related to this course that were responsible for any changes. This chapter describes the method of this study in detail. After the background of the research approach is introduced, participants, data collection, and data analysis procedures are explained. The chapter ends with the trustworthiness issues.

3.1 Background

Starting with the question of how prospective teachers describe their self-efficacy for preparing and implementing mathematical tasks and the influence of a mathematics teaching methods course on their self-efficacy, in this study qualitative research approach was preferred over quantitative approach. Unlike the quantitative research approach, qualitative approach does not test prior theories or any stated hypotheses. Instead, qualitative research is concerned with how the meaning is constructed by individuals (Creswell, 2013). The meanings that were produced by prospective teachers were what I was specifically interested in this research so as to picture their insights from the experiences they gained throughout a methods course. In qualitative research, the researcher is interested in "how people interpret their experiences, how they construct their worlds, what meaning they attribute to their experiences" (Merriam, 2009, p.14). This research approach also provides a holistic description of the issue under study (Creswell, 2013). In this regard, to better understand

the self-efficacy of prospective teachers in the context of a methods course, qualitative approach is employed.

I elected case study as the appropriate qualitative research design for this study among other research strategies in qualitative approach. Case study is the exploration of a bounded system in detail (Creswell, 2013), where the case is "a phenomenon of some sort occurring in a bounded context" (Miles & Huberman, 1994, p. 25). Because the unit of analysis (i.e. the case) in this study is the prospective elementary mathematics teachers, more specifically their self-efficacy for preparing and implementing worthwhile mathematical tasks, I decided to use case study design.

Case study is a research design where the phenomenon described and analyzed is bounded per se (Merriam, 2009) in its real-life context which is highly pertinent to the phenomenon (Yin, 2014). The in-depth examination of descriptions provided by prospective teachers about their efficacy beliefs and about the effects of a methods course on their self-efficacy based on their own experiences within the context of a methods course was the goal of this case study research. The context of this study, a mathematics teaching methods course offered by the Elementary Mathematics Teacher Education program, defined the boundaries of the case.

In this study I was not interested in exploring the case because of its particularity, like in intrinsic case studies; instead, I was interested in this case because of its representativeness of other cases, like in instrumental case studies. And to gain a better understanding of prospective teachers' self-efficacy and their perceptions of the influence of methods course on their self-efficacy beliefs, more than one case was included into this study. That is, more than one prospective teacher participated in this "multiple-case study" (Yin, 2014). Detailed information about the participants and the context of this study is provided in the following section.

3.2 Context of the Study

Since my priority was to establish familiarity with the participants through joining the weekly meetings of methods course, the criterion for sampling process in this

research was based on participant accessibility. Thus, methods course offered by Elementary Mathematics Education program at Middle East Technical University (METU), a large public university in Ankara, Turkey, was chosen as the context of the study. METU is one of the most competitive universities in Turkey, and it is a state university where the medium of instruction is English. Students without a valid English Proficiency Exam Result (i.e. TOEFL, IELTS, or METU English Proficiency Exam) are required to attend English Preparatory Class at the Department of Basic English for one year, before entering their program. Elementary Mathematics Education program is part the Department of Elementary Education in the Faculty of Education at METU.

Elementary Mathematics Education program is a four-year undergraduate degree program where the aim is "to develop teachers with a sound understanding of how children learn mathematics; confident in using technology; capable in problem-solving; attentive to human rights, democracy, and ethics" (METU, 2014). The first two years of the program includes mathematics content courses provided by the Department of Mathematics (MATH) and general educational sciences courses offered by the Department of Educational Sciences (EDS). Prospective teachers are also enrolled in Turkish, English, history, basic physics, and statistics courses at related departments. In the following two years, the program offers mathematics teaching courses which are provided by the Department of Elementary Education (ELE). The graduates of Elementary Mathematics Education program are qualified to work as elementary mathematics teachers at middle grades (6-8[2]) in public schools and at both middle and elementary grades (4-8) in private schools (METU, 2014).

The undergraduate curriculum for the program is represented in Appendix A. Among the courses that prospective teachers enroll throughout this program, courses in

[2] By the time of the data collection for this study, only elementary education was compulsory in Turkey. And Grades 1-5 were considered as primary school years, whereas Grades 6-8 were middle school years. In 2012, with a change in the mandatory education system in Turkey, the Ministry of National Education made secondary education compulsory as well. Thus, starting from 2012-2013 academic year, mandatory education consists of 4 years of elementary school (Grades 1-4), 4 years of middle school (Grades 5-8), and 4 years of high school education (Grades 9-12).

which they are mostly engaged in mathematics teaching and learning processes are methods course (i.e. Methods of Teaching Mathematics I-II) and practicum courses (i.e. School Experience and Practice Teaching in Elementary Education). These two courses aim to provide the environment of learning and practicing teaching mathematics for prospective teachers.

Methods course, comprising Methods of Teaching Mathematics I (ELE341) and II (ELE342), is offered in the third year of the program, 14 weeks each semester[3]. This course is designed to help prospective teachers develop required knowledge and skills to teach mathematics at elementary schools. The objectives of methods course include applying teaching methods to teach elementary level mathematics topics outlined in the NCTM Principles and Standards and defined in Turkish Elementary School Mathematics Curriculum (Number, Algebra, Geometry, Measurement, Probability and Statistics) which prospective teachers are expected to be familiar with, understand misconceptions on mathematical concepts in these topics, and integrate technology into mathematics teaching. Preparing self-confident and motivated teachers with positive attitudes toward teaching mathematics also features within the major objectives of methods course (see Appendix B for syllabus). The prerequisite course for methods course is the Instructional Principles and Methods (ELE221) course provided by the Department of Elementary Education.

During the data collection process of this study, which covered 2011-2012 academic year, ELE341 was offered in the fall semester. This course was an introduction to mathematics education, preparing and using both mathematical tasks and manipulatives, NCTM principles and standards, and the Mathematics Education Program used in Turkey. ELE342, offered in the spring semester, was mainly concerned with mathematics education for Grades 6-8. Van de Walle, Karp & Bay-Williams's (2010) book, *Elementary and Middle School Mathematics*, was the main reference book

[3] In the spring semester of 2012, prospective teachers participated in another research study which took part in the last two weeks of the regular 14-week period. Thus, ELE342 in spring 2012 lasted for 12 weeks. All subjects in the syllabus were covered by then.

(i.e. textbook) used throughout the methods course. Prospective teachers were also suggested a methods of teaching mathematics book of a Turkish professor in mathematics education, which would help them deepen their knowledge and understanding about tasks regarding Turkish mathematics curriculum and classroom context. Additional sources on mathematics teaching were provided as well (see Appendix B for syllabus). Every week, a chapter from the main textbook was covered in classroom meetings which were held on every Tuesday in fall semester and on every Monday in spring semester. Before these weekly classroom meetings, prospective teachers were supposed to read the assigned chapter.

Weekly discussions were directed by the instructor, Dr. T., who was an associate professor of elementary mathematics education and had been teaching this methods course for 6 years by the time of this study. In the context of methods course, Dr. T. had a guidance role in classroom discussions during lectures. Her lectures were intended to assisting prospective teachers identify and analyze the reasons behind students' misconceptions and errors in mathematics, and recognize connections among mathematical ideas. A typical lecture meeting started Dr. T.'s questions focused on that week's subject as introduced in the related chapter in the textbook. She used to pose her questions with an aim at revealing prospective teachers' understanding from the textbook, as well as their own misconceptions about the subject. Then, prospective teachers were encouraged to demonstrate the use of task samples provided in the textbook and further explain how they would apply these tasks in their future classrooms, through adapting or modifying those tasks. Dr. T. was contributing prospective teachers' learning by providing examples either from the literature or from her own experiences. There were several unannounced quizzes on the assigned readings prior to the class meetings for lectures as well.

After lecture hours, prospective teachers, in groups of 5-6, worked together to prepare mathematical tasks related to the topic of that week. They were free to choose the grade level and objectives that their tasks would cover. Since the Elementary

Mathematics Curriculum in Turkey requires mathematics teaching through tasks, methods course, in line with the curriculum, mainly aimed to help prospective teachers learn preparing and implementing worthwhile mathematical tasks effectively. Thus, in addition to her lecturing, the instructor also showed videos of effective implementation of such tasks by teachers from different countries, provided examples of tasks created by prospective teachers from previous methods classes. Prospective teachers referred to these experiences, classroom discussions, the reference book together with other related books in the library, and sample tasks and videos on the internet, when they were preparing tasks. Each group presented their work in lab hours which were held on every Thursday in fall semester and on every Wednesday in spring semester. Lab meetings were held in the mathematics lab of the Department of Elementary Education. This lab was equipped with various hands-on and technological mathematical manipulatives (e.g. linking cubes, counters, fraction bars, calculators), office products (e.g. scissors, tapes, rulers), a video projector, an overhead projector, a whiteboard and a projection screen positioned over it, and a computer. Studying in separate sections at lab hours created the environment to work on and analyze each group's tasks.

In lab hours, prospective teachers presented their work by using mathematical manipulatives and tools. This was a simulation of their tasks, so other groups were supposed to implement these tasks as they were elementary students. After each presentation, tasks and performances of prospective teachers were evaluated, and feedback on their work were provided by their counterparts, as well as the instructor. Prospective teachers revised and edited their tasks, based on the feedback they received, then they shared these tasks online with whole class so as to prepare a portfolio at the end of each semester.

Assessment was ongoing through the methods course where prospective teachers continuously evaluated through their participation in classroom discussions, group activities, quizzes, a midterm, and a final exam. The portfolios they prepared were also a part of the assessment. Additionally, group projects were used as an assessment

method at the end of each semester. The fall semester project was about misconceptions on topics in mathematics. Prospective teachers were supposed to find common misconceptions on specific content areas (Numbers and Operations, Algebra, Geometry, Measurement, Probability and Statistics). In the spring semester, prospective teachers worked on examining mathematics problems, writing realistic mathematics problems, and evaluating the quality of those problems again in specific content areas.

Even though prospective teachers enrolled in both ELE341 and ELE342, I was concentrated more on ELE342. I collected the data during ELE342 for two reasons. First, ELE341 was a great opportunity for me to build trust with prospective teachers, and the potential participants as well, by meeting them at class hours. Second, in ELE342, prospective teachers were only focused on mathematical content in the curriculum they were going to teach because they covered the perspectives on mathematics education and the core ideas in teaching and learning of mathematics in ELE341. Thus, I chose to study the perceived effects of ELE342 (referred to as "methods course" for the rest of this dissertation) on prospective teachers' self-efficacy.

3.3 Participants

There were 40 junior prospective elementary mathematics teachers, 33 women and 7 men, who were taking both ELE341 (in fall semester) and ELE342 (in spring semester) at METU in 2011-2012 academic year. Before methods course started in spring, I arranged an appointment with the instructor to discuss which of the prospective teachers to invite to the study. I made a list of 20 names of possible participants on it, and among the names of my list were prospective teachers who were attending classes regularly. I also focused on prospective teachers who I believed I built trust with, so that they would not hesitate to talk and be more open to me during the interviews. This decision emanated from my belief that those prospective teachers would be more open to communicate their thoughts and feelings about methods course, and would be more willing to answer my questions, providing detailed information. Then, I went through these names together with Dr. T.; I worked with her to reduce the number

of participants to a manageable amount, considering the names who would provide the most data for my study, and we agreed on 10 names, 9 women and 1 man. I had to elect one out of the 7 male prospective teachers because two of them were enrolled in practicum course together with methods course, which could cause bias, and 4 of them entered the program earlier than the rest of the class and they were either returning to complete their degrees or repeating the methods course, so these 6 names were excluded.

The spring of 2012, when ELE342 (i.e. methods course) took place, started on February 16 and the first day of methods class was on February 20. At the end of this first meeting, I briefly explained the purpose of my study to the 10 prospective teachers I invited to participate in my study and talked about the data collection method (i.e. the interviews). I asked them to write down their e-mail addresses to take part in this study, and 9 of them, 8 women and 1 man, accepted to join the study throughout the methods course. Pseudonyms were used to ensure anonymity, and I selected a pseudonym for each participant. I preferred to choose names in English to match with the language of this dissertation.

All 9 junior prospective elementary mathematics teachers participated in this study were graduates of Anatolian teacher training high schools[4]. Anatolian teacher training high schools prepare students for teacher education programs at universities. In addition to core high school curriculum courses, students are offered theory, history, and methods of education courses. However, not all of the participants had the affinity for teaching, nor particularly teaching mathematics even though they graduated from this same type of high school. Other than teaching, participants had the intention to study, for instance, medicine or architecture. After taking the University Placement Examination (ÖSS), which is held once a year nationally, these participants had to reconsider their options and decided to study elementary mathematics education for different reasons that I explain next.

[4] A type of high school in Turkey, which were changed into high schools of science, high schools of social sciences, or Anatolian high schools by the Ministry of Education with a recent regulation in June 2014.

Kate

Kate aspired to be an architect, a profession she found related to mathematics which was her favorite subject. However, coming from "a family in which every 2 members out of 3 were teachers" (Kate, I1), Kate always considered the option of being a teacher. In her second attempt at ÖSS to achieve her goal to be an architect, she failed again, and ended up in the Elementary Mathematics Education program instead. This was her first choice following Architecture program on her university application form. The main reason why she added elementary mathematics teaching to her list was the university, METU, itself. Studying at METU was another dream for her. And since being a teacher was something she was familiar with, she applied for the Elementary Mathematics Education Program at METU. Previously in the program she was enrolled in Problem Solving course, and in spring 2012 she was taking Hands-On Activities in Mathematics Education.

When we were talking about her teaching experiences, Kate said that she had never experienced tutoring. She had volunteered once as a leader where they played mathematical games with 5th and 6th grade students. During this visit to an elementary school, communication with students was an obstacle for her. "People around me are mainly my peers, they are people who speak my language. This wasn't exactly the case with those students. I mean, I couldn't actually decide *how* to call them, I struggled a lot," she stated (Kate, I1). In addition to her first real classroom experience, early in the fall semester of her junior year she also visited her mother's classroom, who was an elementary school teacher, and had "the chance to analyze [her] mother's teaching practices as a prospective teacher engaged in the profession rather than an ordinary observer" (Kate, I1). This perception of her, the way she analyzed her mother's teaching, was a result of ELE341, she further explained. For example, when Kate had seen her mother was asking students to give examples from daily life, related to the subject, she thought this warm-up phase of a mathematics lesson was just a method to gather students' attention to the subject. But after this course, she was able to realize that

activating prior learnings through warm-ups was a way to help students build on their previous knowledge and construct their learning, like her mother was actually doing.

Cindy

Studying medicine was Cindy's goal, she had never planned to be a teacher. However, in her years at teacher training high school, she began to consider teaching as a profession to pursue in. Then, because she couldn't get into a medical school, her interest in mathematics led her to study elementary mathematics education. Throughout the Elementary Mathematics Education program at METU, she enrolled in Teaching of Geometry Concepts as an elective course. She also registered for Problem Solving and Hands-On Activities in Mathematics Education courses in the spring semester of 2012.

Cindy didn't have teaching experience, but she helped her acquaintances' children at 6th, 7th, and 9th grades with their homework and exams a few times. She also had an elder sister, an elementary school teacher with whom Cindy shared and discussed her experiences, her knowledge. Their communication, however, didn't always produce positive outcomes. Cindy, for instance, perceived manipulatives and technological tools as important components of mathematics teaching, whereas her sister told her that in Eastern Turkey, where she worked, it was not always possible to teach through manipulatives because such tools were not available, and even if they were provided with such tools, her sister wouldn't prefer to use manipulatives because students were lacking the required knowledge and experience to work with hands-on tools. Thus, Cindy was concerned about her future teaching practices.

Angel

Being an elementary school (Grades 1-5) teacher was Angel's childhood dream, and this was why she applied to teacher training high school. Among other programs at the Faculty of Education, there were two main reasons for her choice of mathematics education. First, she wanted to study at METU. She attended a school trip to the campus at 10th grade and was determined to study there. And the second reason was her love for mathematics. Therefore Cindy applied for and was accepted to her very

first choice on her university application list, Elementary Mathematics Education program at METU. Throughout the program, she enrolled in Teaching of Geometry Concepts and Problem Solving courses. She was not taking any of the elective courses on mathematics education at the time of this study.

About her teaching practices, Angel told me that she used to tutor her cousins in her hometown, as a sophomore. There she was using direct teaching method, the only method she knew and she had been experiencing all through her student life, and she was feeling confident that she could teach. But when she entered ELE341, she realized that she knew too little about teaching mathematics. Then she got confused and began to question her capabilities to teach. Yet, this motivated her to improve herself through studying and learning more about teaching mathematics with understanding. During the winter break, between ELE341 and ELE342, she was at home with her family, tutoring one of her cousins again, and this time she was feeling better about her performance, even better than she was expecting.

Judy

Judy didn't have a specific career goal before applying to university. The subject she always enjoyed studying was mathematics, but considering the working conditions as a woman, she believed that engineering was not an option. Among the mathematics related programs, Judy found teaching "more suitable" for her than medical school. Thus, she entered Elementary Mathematics Education Program at METU. Judy defined herself as a person who can adapt to things easily, so she quickly adapted to the program and started to enjoy preparing for her future job. Different from other participants, she didn't enroll in any of the elective courses throughout the program. Her teaching practice was also limited. She was tutoring one of her acquaintances' children at 8th grade in her English Preparatory year at the university. Later, due to the overload of the mathematics content courses, Judy had to quit tutoring.

Lisa

Lisa started teacher training high school without any aspiration of teaching, like the most of the participants. Her goal was to enter a school of medicine in Ankara, but she also applied for mathematics education programs to increase her chances of going to college. In the end, she wasn't accepted to a medical school, and Lisa entered Elementary Mathematics Education program. Because she was still not sure if she wanted to be a teacher, after completing the first year in the program, she froze her registration and took another chance at ÖSS. But again, she couldn't get enough score for medical schools in Ankara. Lisa expressed that she would rather work as a high school mathematics teacher indeed, since she liked secondary school level mathematics better. The limited job opportunities and the longer time of prospective education in secondary mathematics program (i.e. 5 years) persuaded her to register to the Elementary Mathematics Education, though. In the program, the elective course she took was Teaching of Geometry Concepts.

Lisa had been tutoring high school students and graduates for two years by the time of this study. In fall 2012, Lisa also worked at Mathematicians Association (MATDER) where she was teaching high school mathematics again. She was enjoying teaching at MATDER because the students there were "very eager to learn." In the spring of the same semester, when she was participating in this study, Lisa was still tutoring high schoolers.

Kevin

Kevin was one of the participants interested in pursuing a career in teaching. His aspiration was to be an elementary school teacher, and his admiration for the mathematics teacher he had at high school motivated Kevin to prioritize studying mathematics education. Then, however, he "somehow" changed his mind and decided to study medicine. Even though he was expecting to accomplish this goal, "things changed after entering ÖSS." Family related issues during his preparation for the ÖSS affected his performance at the exam negatively, and he wasn't accepted to medical school.

Kevin, finally, went back to his initial decision and started his prospective education. He took Teaching of Geometry Concepts, Mathematical Modeling for Teachers, and Problem Solving courses throughout the Elementary Mathematics Education program at METU. In the spring of 2012, he was enrolled in Hands-On Activities in Mathematics Education.

Kevin's teaching experiences started in the spring semester of his freshman year, when he began tutoring at a private cram school. For one semester there he had been helping high school students one-on-one with their homework and exams, rather than teaching mathematics in a class. After that, at the beginning of his junior year, he started to work at a cram school again. Still, he wasn't expecting these tutoring experiences help him at the methods class, or vice versa, since he didn't implement activities there, nor had a real classroom involvement.

Amy

Amy had been planning to study medicine. Yet, in her high school years at teacher training high school, she used to enjoy the courses about education too. Thus, she developed an interest in both mathematics education and medicine, with a priority to the latter. Her university application started with different Medical School programs, to which she was not accepted, and continued with programs of education. Her favorite class, mathematics, determined Amy's choice among teaching programs, and she was accepted to the Elementary Mathematics Education program at METU, the one on top of her list of application. In the program, she enrolled in Teaching of Geometry Concepts and Problem Solving courses.

Amy's teaching experience was in tutoring at a private cram school. She had been tutoring 8th grade and high school students, as well as high school graduates to help with ÖSS preparation for one semester, the spring of 2011, in her second year as a prospective teacher. At cram school, she was mainly concentrated on exam preparation, but there were times she taught high school mathematics to groups of 4-5 students. After that, in fall 2011, she started one-on-one tutoring high school level mathematics, and in

spring semester of 2011-2012 academic year, she was still tutoring high school students. Notwithstanding her experiences, she didn't believe that tutoring would help her with methods course. Instead, she expected methods course to improve her tutoring. One reason for this was the curricular difference; because majority of her students were high schoolers, she wasn't familiar with elementary mathematics curriculum. Another reason was the recent changes in elementary mathematics curriculum, which occurred long time after she graduated from high school. Once, one of her students asked Amy to teach Fractals, a subject she had never learned before, and she could not help that student. "If I worked there after taking methods [course], I could teach it. I learned what it was, at methods [course]," she stated (Amy, I1).

Rachel

An aspiring literature teacher, at ÖSS, Rachel scored higher at mathematics than literature, and in the application period, she let her family members to make the decision for her. Parents' or other family members' involvement in the decision making process, she explained, was something usual in the small town she was from. In the end, she entered the Elementary Mathematics Education program at METU, her last choice on the list, which was added by her elder sister. Previously in her prospective education, Rachel enrolled in Teaching of Geometry Concepts, and at the time of this study she was taking Hands-On Activities in Mathematics Education.

Rachel had been tutoring since she was a freshman at the university. She had students at 6th, 7th, and 8th grades. She also volunteered in an organization at METU, called İLKYAR. This is an organization where people donate money, books, clothes, and manipulatives for schools with low socioeconomic status. Students from various departments at METU volunteer to sort and pack donated materials, then deliver them to those schools, and lead a range of activities in different subjects from mathematics to music. Rachel visited a couple of schools through this organization. Together with another volunteer, she implemented mathematical tasks with 2nd to 8th graders.

Becca

Becca didn't inspired to be a teacher; instead, she was planning to apply to a medical school. However, things didn't go as she planned at the ÖSS, and she wasn't willing to walk through the same path of exam preparation for another year. Considering her interest in mathematics and the higher possibilities of finding a job, Becca decided to be a mathematics teacher, and she entered the Elementary Mathematics Education program at METU. Until her junior year in the program, she didn't take any of the elective courses, but she was enrolled in Hands-On Activities in Mathematics Education course in spring 2012.

Becca started tutoring in her first year at the university, during English Preparatory year. Her first students were children of an acquaintance of hers. This experience made her feel that she could teach, so she continued tutoring with teaching other students she met through an association at the university. In the spring semester this study was conducted, Becca was still tutoring a good number of students. The grade levels of students she tutored varied from 4th grade to 12th grade.

Summary of the participants' backgrounds.

All graduates of teacher training high schools, participants were mostly intending to study at medical schools before taking the University Entrance Examination (ÖSS). This mandatory exam was an influence on their university applications. Participants' interest in studying mathematics related programs also had a role in their choices.

After registering to the Elementary Mathematics Education program at METU, participants enrolled in different elective courses, in addition to must courses listed in the undergraduate curriculum (Appendix A). Elective courses that prospective teachers could register were not limited with the courses offered in the Faculty of Education, so participants chose to attend, for example, Violin, German, and History of Theater classes. Yet, I only included the courses related to mathematics education that

participants enrolled in, considering the possible impact of those courses on participants' performances.

Table 2

Elective courses participants enrolled in throughout the program

Participant	Hands-On Activities in Mathematics Education	Teaching of Geometry Concepts	Problem Solving in Mathematics	Mathematical Modeling for Teachers
Kate	+		+	
Cindy	+		+	
Angel		+	+	
Judy				
Lisa		+		
Kevin	+	+	+	+
Amy				
Rachel	+	+		
Becca	+			

Note. All the elective courses that participants enrolled in during spring 2012 are given in bold.

Table 2 summarizes the elective courses participants attended throughout the program, namely, Teaching of Geometry Concepts, Mathematical Modeling for Teachers, Hands-On Activities in Mathematics Education, and Problem Solving in Mathematics. Kevin was the only participant to take all of these courses on mathematics education. On the contrary, Judy did not enroll in any mathematics related elective course, but rather took Arabic, Education and Awareness of Sustainability (offered by the Department of Elementary Education), and Introduction to History of Science

(offered by the Department of Philosophy). In spring 2012, there were 5 participants enrolled in Hands-On Activities in Mathematics Education course. While participants were taking methods course in the spring semester of 2011-2012 academic year, other must courses they registered were Instructional Technology and Material Development, Community Service, and Classroom Management.

In terms of teaching experiences, participants had different backgrounds. Kate and Cindy did not teach any student before, except for the times Cindy helped a few children with their homework. Angel was a little more experiences, she had the opportunity to tutor her cousins from time to time, especially in her visits to home during semester breaks. Judy, on the other hand, had a longer tutoring experience than these three participants, which occurred in her English Preparatory year at university, but she didn't continue with that because of the courseload. Rest of the participants had experiences in tutoring either privately (e.g. Rachel) or at cram schools (e.g. Kevin). Regarding experiences with preparing and using mathematical tasks, participants uttered that in their previous years as students, they had never been taught mathematics through tasks. At university level, even though some participants (e.g. Angel) recalled working on projects where they prepared assessment tasks for mathematics lessons previously, they did not perceive these experiences as real enactments of tasks because they started to learn basics of teaching mathematics through tasks at methods class. Therefore, methods course, in general, was where participants were involved in the process of teaching and learning of mathematics through tasks for the first time.

3.4 Data Collection

Data for this study were collected basically through semi-structured interviews. These interviews were mainly guided by a list of open-ended questions prepared for prospective teachers to provide in-depth information about their self-efficacy for preparing and implementing worthwhile mathematical tasks, and about the influence of the methods course on their efficacy beliefs. The interview protocol consisted of three parts: (a) background questions, (b) questions to provide information

about participants' self-efficacy for preparing and implementing mathematical tasks, and (c) questions focused on the perceived effects of methods course on their self-efficacy (see Appendix C for the interview protocol).

The background questions were designed to elicit information about participants' education history, starting with questions about the type of high school they graduated and factors led them to study elementary mathematics education. Questions about their previous experiences on mathematics teaching and the elective courses they registered throughout the program were also included in the interview protocol. Since the mastery experiences are the most powerful source of self-efficacy (Bandura, 1997), I tried to provide as much detailed information about their past experiences as I could that could be related to their self-efficacy for preparing and implementing mathematical tasks.

In the next part of the interview protocol, questions were concentrated on participants' self-efficacy. First, every participant was asked to describe her/his level of efficacy belief: *"How confident do you feel about your capabilities to prepare and implement worthwhile mathematical tasks effectively? What are your concerns?"* Then, to provide insight about factors that they perceived as effects on their self-efficacy, questions for the last part of the interview were developed. In terms of the components of methods course that prospective teachers spent the most time with (i.e. lecture hours, group work, peers' presentations, and feedback on group work), a question was posed on the influence these components created. I focused on these parts of methods course to make sure every participant expressed their views that I could draw a picture of participants' perception of methods course's effect on their self-efficacy through some major components of the course, in case they did not talk about any other factors related to the course. Thus, regarding the second research question, to gain in-depth information about participants' perceptions of any effect each component had, I asked them to describe *how* each of these factors was responsible for such impact, through their efficacy-relevant experiences.

Additionally, participants were asked to describe any other factor with an effect on their self-efficacy, for a disclosure of different ways methods course created influence on participants' judgements of their capabilities to effectively prepare and implement tasks. Another question for enabling me to make a clear distinction between methods course and other courses that participants enrolled in was *"Did any of the courses you are taking this semester influence your judgments? Please explain how."* I also wanted to know on which component of methods course participants put more emphasis when judging their capabilities throughout the semester. This question was designed with the purpose of acquiring an understanding of how participants weighed the information from methods course as they were making judgments about their capabilities.

After preparing the interview protocol, two associate professors in mathematics education and a professor in science education, as experts in self-efficacy research, reviewed the protocol to determine the face validity of the interview questions. They were asked to decide whether the interview questions were matching the research questions and the purpose of the study, and whether the questions were leading or biased. Questions, then, were revised in the light of these feedback and the interviews were ready to be piloted.

Pilot study was conducted one semester before the main study, in the fall of 2011. Three prospective teachers were invited to participate in the pilot study that I thought who could provide the most feedback, based on the suggestions of Dr. T., and 2 of them accepted to be interviewed. The interviewees were senior prospective teachers from the Elementary Mathematics Education program at METU. They were 1 female and 1 male prospective teachers who enrolled in methods course, taught by Dr. T. as well, in the previous academic year. At the end of each interview in the pilot study, interviewees talked about which questions were not clear to them, and there were a few suggestions to modify and reword those interview questions. Their information led the construction of the final version of the interview protocols.

Each participant in the main study was interviewed at the beginning, in the middle, and at the end of the methods course, that is, three times in the second semester of 2011-2012 academic year. Same interview protocol was used for every interview session, so the only interview protocol was modified grammar-wise for each time point. For example, the interview question asking about the effect of lecture hours, one of the pre-defined factors, on participants' self-efficacy beliefs was stated as *"How are lecture hours going to influence your judgment of your capabilities?"* in the initial interview, the same question was defined as *"How do the lecture hours influence your judgment of your capabilities?"* in the mid-semester interview, and as *"How did the lecture hours influence your judgment of your capabilities?"* in the last interview. This way, I was able to keep track of the impact of methods course all the way throughout the semester, as well as the change, if any, in participants' descriptions and ideas. All of the interviews were digitally recorded, and then, I transcribed the interviews verbatim. I explain the data analysis procedure in greater in the next section.

A secondary method of data collection tool used was direct observation. I entered ELE341 first time in the mid-semester of fall 2011. The allowance of time at the start of ELE341 was for enabling prospective teachers to become comfortable in the classroom, establish effective relationships with other prospective teachers, and have quality study interaction with the instructor. On a Wednesday in the mid-semester, I joined the lab hour's meeting. I introduced myself to the class, and then I talked briefly about the purpose of my study. I told prospective teachers that in the fall semester I would be attending their class meetings to get to know each other so that in the spring semester they would decide whether they wanted to contribute to my study by participating in it or not. Even though I was able to make visits to class meetings of ELE341 regularly for 6 weeks, in spring semester, due to time restrictions, I could join 3 lab hours and 2 lecture hours in total.

My stance in classroom was an *observer as a participant* (Merriam, 2009), where I was interacting with prospective teachers without actually participating in

classroom activities. In ELE341, I gathered information about the classroom culture, how lectures were held, and the group work procedures in lab meetings. I was observing prospective teachers' engagement in discussions and activities, as well as the relationships established in the class. I was joining a different group every week to learn more about the group members, the way they communicated and worked as a group. In ELE342, I was more concentrated on prospective teachers who were participating in my study. The main purpose of my visits to the lecture and lab meetings during the spring of 2012 was to complement interviews and strengthen my interpretation of the data. Thus, my observations were not structured and I was not using any observation protocol. Rather, I was taking notes about participants and things they mentioned previously in the interviews. For example, when participants talked about the influence of feedback the instructor provided, in the following lab meeting, I paid more attention to those kind of feedback from Dr. T. and tried to relate to participants' perceptions. I was writing down the observation data at the end of the classroom observations to prevent participants' feeling uncomfortable.

3.5 Data Analysis

I transcribed and interpreted the data following the guidelines set forth by Creswell (2014). First, I prepared and organized the data for analysis. I used a computer program for transcribing the interviews, and read through all the transcriptions to gain a general sense of the information. Throughout this process, I was taking notes of ideas for coding and interpreting the data. Then, I started coding one of the initial interviews using MAXQDA software program. Continuously comparing the information collected from the participants, I coded the rest of interviews from the first round of data collection. I developed a list of codes according to the theoretical framework of this study and the research questions (e.g. self-efficacy for preparing tasks, transmission of knowledge and skills, feedback from the instructor) and added new codes emerged from the data (e.g. questioning method, expectations, working as a group). I continued to code the second and the third round of interviews, respectively.

The first research question was about prospective elementary mathematics teachers' self-efficacy for preparing and implementing mathematical tasks throughout the methods course. Data related to participants' efficacy judgments for preparing and implementing tasks were coded. First, *self-efficacy for preparing tasks* and *self-efficacy for implementing tasks* were the two categories used in this part of analysis because participants regarded their efficacy beliefs for preparing and using tasks separately. Since no scale was used to measure participants' level of self-efficacy, participants were asked to describe how confident they were feeling for preparing and implementing tasks effectively and to explain why they believed so. Interviews were analyzed to determine participants' self-efficacy levels at each time point (i.e. at the beginning, during, and at the end of the methods course). Answers like "I feel (very) confident" were coded as high self-efficacy, whereas medium self-efficacy level was used for coding when participants expressed some kind of doubt about their capabilities. Because participants did not talk about lack of confidence, such as "I don't feel confident" or "I don't think I can prepare/implement tasks," their self-efficacy levels were not coded as low.

Then, considering the second research question, data were coded separately for each sub-question. First, participants' answers to the question *"What will be/is/was the most effective component of methods course to make you feel confident in your capabilities to prepare and implement worthwhile mathematical tasks?"* were first coded as *the most effective component*, which was composed of one or more of the major elements of methods course, namely, lecture hours, group work, peers' presentations, and feedback. Then, responses regarding participants' descriptions of how each of these factors and any other component of methods course created effect on their self-efficacy beliefs were analyzed. In total, 6 factors were found to have an impact on participants' efficacy judgments: *Lecture hours, group work, peers' presentations, feedback on group work, assigned readings,* and *examination*. Because participants perceived different aspects of the effect of each factor, various aspects of these factors were used as codes, and these factors constituted themes. For example, *group work* was viewed as an effect

where *working as a group*, *group work to prepare tasks*, and *group work to implement tasks* had different impact on efficacy judgments.

Table 3

Interpretation of the data in light of hypothesized sources of self-efficacy

Source of Self-Efficacy	Examples from data
Mastery experience	Preparing mathematical tasks Implementing tasks in the lab with peers Creating ideas to implement tasks with future students Putting effort to meet the instructor's expectations Performances in exams on teaching mathematics through tasks
Vicarious experience	Learning to prepare and implement tasks effectively though instructor's lecturing Learning from peers when they share their ideas in classroom discussions Learning from group members while working as a group Observing peers' performances as models Observing feedback their peers were provided Learning to prepare and implement tasks effectively through reading the textbook and other resources
Social persuasion	Corrective feedback provided by the instructor during lectures to overcome own misconceptions Corrective feedback provided by the instructor during lectures to support learning from the textbook Feedback provided by group members during group work Feedback provided by the instructor and peers during lab hours
Physiological state	Enthusiasm to participate in classroom discussions on teaching mathematics through tasks Feelings of comfort, joy, or stress as a result of interaction with the instructor Feelings of joy or boredom with preparing and implementing tasks Feelings of joy with working as a group Feelings of joy or boredom with working on peers' tasks Negative emotional state as a result of feedback received Stress caused by unannounced quizzes

Subcategories, then, were created regarding the data related to the efficacy-relevant information which participants referred to when judging their capabilities, using Bandura's (1997) hypothesized sources of self-efficacy (Table 3). That is, *mastery experiences* (when participants talked about the efficacy-relevant information gained through their own performances, like in group work), *vicarious experiences* (when vicarious learning occurred, like through observing peers' presentations or transmission of knowledge from the instructor), *social persuasions* (when participants mentioned the effects of feedback, like the feedback they received from the instructor on group work), and *physiological states* (when emotions and mood of participants were perceived as sources of self-efficacy, like having fun during group work) were the categories used for coding the sources of participants' self-efficacy beliefs.

A colleague with a PhD degree in elementary mathematics education participated in the data coding to ensure the credibility of codes. She was a former mathematics teacher, whose research interest was in teacher education. I asked her to verify my codes and analyze an interview by coding it according to the code list (Appendix D). At first, we reached a 81% coder agreement, which met the 80% criterion for good reliability (Miles & Huberman, 1994). Yet, when we discussed the difference between our codings, we decided to repeat the cross-checking process. I provided her a clearer description of each code and we both coded another interview, reaching a 92% coder agreement.

Once coding accuracy was ensured, I analyzed the final codes to generate descriptions and themes. For every theme and description, I created a matrix to display the data. I listed participant names in the left-hand side column in each matrix, and the top-row of the matrix included codes, and the cells were filled with excerpts tagged with those codes. Through these matrices, I was able to easily make comparisons and contrasts among cases, based on the descriptions and themes. Descriptions are "detailed rendering of information about people, places, or events in a setting" (Creswell, 2014, p.

199) and themes are major findings of this study that "display multiple perspectives from individuals" (p. 200).

Findings regarding the first research question (i.e. participants' self-efficacy for preparing and implementing mathematical tasks throughout methods course), as well as the background information of participants were regarded as the descriptions emerged from the interviews. The themes revealed from codes included the detailed explanation of the perceived effects of methods course on participants' judgment of their capabilities (i.e. the second research question), in terms of the hypothesized sources of self-efficacy (Bandura, 1997). Participants' self-efficacy for (a) preparing and (b) implementing worthwhile mathematical tasks are two descriptions emerged from the data, and are depicted first to answer the initial research question. Factors which created influence on participants' efficacy beliefs constituted the themes, namely, lecture hours, group work, peers' presentations, feedback on group work, assigned readings, and examination.

3.6 Quality of Research

The quality of qualitative research is determined by the trustworthiness of research results, and deals with credibility, consistency, transferability, and confirmability concerns which substitutes for internal validity, external validity, reliability, and objectivity in quantitative research (Merriam, 2009). Credibility is the congruence of research findings of a qualitative study with the reality, and the researcher seeks to answer the question "Are the findings *credible* given the data presented?" (Merriam, 2009, p. 213, italics in original). In this study I aimed to maintain credibility (i.e. internal validity) in different ways.

First, I used multiple data sources (i.e. a variety of participants) and multiple methods of data collection which are classroom observations, interviews, and notes taken during both observations and interviews. The data I gathered through various methods and participants enabled me to triangulate my findings. Then, I compared and cross-checked the interviews with different participants at different time points throughout the semester which offered support for the internal consistency of each case

as a means of data triangulation. I also conducted member check with participants in the second and third rounds of interviews through referring to the previous interview(s); I asked them to provide detailed information that was left blurry for me or whether they wished to modify their answers. Member check helped me to ensure that the conclusions I drew from the interviews accurately reflected participants' views.

Finally, observations and field notes complemented the interviews to support the credibility of my findings. Recall that I attended ELE341 and ELE342 to observe the participants and the instructor. In the fall semester, prolonged involvement was an opportunity for me to learn about the culture of the class and build trust with prospective teachers. Throughout the spring semester, when I was attending the methods course and collecting my data, engagement in the context helped me to test if there were any misleading information introduced by the participants in the interviews. Familiarity with the context and the participants allowed me to make more sense of the data as well.

Consistency, substitute of reliability in quantitative approach, is another of issue regarding the quality of a qualitative research, and deals with the question "whether the results are consistent with the data collected" (Merriam, 2009, p. 221). I attempted to ensure the consistency across my findings in several ways. First, I asked two associate professors in mathematics education and two professors, one in mathematics and the other in science education, all of whom were familiar with this line of research, to review my data collection and analysis procedures. We arranged a meeting before and after data collection to discuss the disagreements, and I modified the coding scheme as needed. Then, I invited a different colleague to code two interviews using the coding scheme (see the previous section) and a 92% intercoder agreement was reached in the end.

Additionally, I applied different strategies to increase *transferability* (i.e. external validity). Traditionally, external validity is a matter of generalizability of research results in quantitative approach. Although the sample size is usually too small to generalize findings of a qualitative research, "[t]he general lies in the particular; that

is, what we learn in a particular situation we can transfer or generalize to similar situations subsequently encountered" (Merriam, 2009, p. 225). Thus, qualitative researchers aim to ensure transferability through providing enough detail about the study so as to enhance the possibility of transferring the findings to other contexts. With an attempt to increase transferability of this study, I first described the context and cases under my investigation in detail that the similarity between other settings can be assessed by readers to transfer the findings. I also conducted a thorough process of data collection and analysis, which I explained through providing rich and thick reporting of the procedures, supported by excerpts from the interviews. Researchers in similar settings may find such detailed description useful to design their own studies. The use of rich and thick description strategy worked as a means of support for credibility as well.

Second, I studied multiple cases to maximize the possibility of transferability of findings to other contexts by teacher educators and by researchers. Teacher educators of prospective teachers with similar characteristics to the participants of this study can apply the study findings to their courses to design or revise so they can boost prospective teachers' efficacy beliefs for preparing and implementing worthwhile mathematical tasks. Researchers, too, can use these findings from multiple cases to compare with or further explore in other contexts.

3.7 Ethics

Ethical issues that should be taken into account in qualitative studies include the protection of participants from harm, ensuring privacy, confidentiality, and the anonymity of research (Miles & Huberman, 1994). There weren't any harmful situation for the prospective teachers in this study since they were observed and interviewed in their classrooms, their natural setting without any manipulation. Privacy was achieved through the protection of data and control over others' access to the information gathered from the interviews. Confidentiality is "agreement with a person or organization about what will be done (and may be done) with their data" (Miles & Huberman, 1994, p. 293). In this study, participants were informed about the study and the interview process.

They were told that the interview did not contain any questions that could cause discomfort. They were also reminded that if they felt any discomfort, they could quit any time they wanted. The anonymity of the study was ensured with using pseudonyms and lack of identifiers, so that which participant provided which data was not obvious.

3.8 Researcher Bias

In this study, I had a long-term involvement in the context to prevent researcher bias. In the fall of 2011, I started the communication with participants by attending weekly meetings of ELE341. My involvement in the class allowed me to built trust in the first step, and it helped participants get used to communicate with me. Continuing my engagement through ELE342, I, then, was able to check inaccuracy in the information participants provided because I was familiar enough with both participants and the context. Moreover, in any interview session that required further explanation for me to achieve a clear understanding from participants' statements, I asked participants to provide more detail. Finally, the inclusion of more than one researcher in the data analysis process was the other method I used to handle researcher bias. This enabled me to minimize the effects of bias caused by myself and reflect the reality as it exists.

CHAPTER 4

FINDINGS

The purpose of this study was to explore possible changes in prospective teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks as a result of enrolling in a mathematics teaching methods course, and to investigate the factors related to methods course that produced any effect on self-efficacy of prospective teachers. Recall that the following research questions were formed with respect to the aims of this study.

Research Questions

1. How do prospective elementary mathematics teachers describe their judgments of capabilities to prepare and implement worthwhile mathematical tasks throughout a mathematics teaching methods course?

2. How do prospective elementary mathematics teachers describe the factors influencing their self-efficacy for preparing and implementing worthwhile mathematical tasks throughout a mathematics teaching methods course?

   a. Among the main components of the methods course (i.e. lecture hours, group work, peers' presentations, and feedback on group work), which factors were perceived as the most effective influence on prospective elementary mathematics teachers' self-efficacy throughout the semester?

   b. How did each factor with an influence on prospective elementary mathematics teachers' self-efficacy operate through the hypothesized sources of self-efficacy?

In this chapter, I present findings of this study to answer these research questions. I begin by providing evidence of how participants described their judgments of capabilities to prepare and implement worthwhile mathematical tasks. Then, I continue with a thorough description of how participants weighted and interpreted efficacy-relevant information when gauging their self-efficacy beliefs, and I explain in detail the 6 factors related to the methods course (i.e. lecture hours, group work, peers' presentations, feedback on group work, assigned readings, and examination) that influenced their self-efficacy throughout the semester. After providing a brief report on the factors that were found most effective by each participant, I present factors that were responsible for the changes in efficacy beliefs of participants and the way that each factor produced these changes, considering Bandura's (1997) hypothesized sources of self-efficacy.

4.1 Self-Efficacy for Preparing and Implementing Mathematical Tasks

In this section, I first present participants' judgments of their capabilities to *prepare* worthwhile mathematical tasks, based on the descriptions they provided throughout the semester. I continue with explaining how participants gauged their own capabilities to *implement* mathematical tasks effectively. The similarities and differences in how participants with different levels of self-efficacy describe their efficacy beliefs both for preparing and implementing tasks throughout the methods course are also examined and presented in the next two parts of this section. Findings in each part are reported following the order of interviews. That is, I start each part with how participants described their efficacy beliefs at the beginning of the semester and proceed with the descriptions they provided during and after completing the methods course. Example quotes and excerpts are provided to support findings.

4.1.1 Prospective Teachers' Self-Efficacy for Preparing Worthwhile Mathematical Tasks

After completing ELE341 in the fall of 2011, participants entered methods class in spring 2012 with either a moderate (Kate, Cindy, Lisa, Kevin, and Amy) or high

(Angel, Judy, Rachel, and Becca) level of confidence in their ability to prepare worthwhile mathematical tasks. Participants who expressed strong self-efficacy during the initial interviews were confident that they could prepare such activities effectively because they believed that they gained required knowledge and skills in the previous semester, at ELE341 class. For example, Becca was feeling efficacious that she could prepare mathematical tasks with high cognitive demands, for she "knew what a good activity sheet looks like," she could "criticize [her] own work [of tasks]" and "tell if an activity sheet [she] prepare is decent or not" (Becca, Interview 1 [I1]). She further explained:

> The design of the activity sheet, let's say, like it should include pictures, the instructor tells us to provide an example first, things like that… Like you have to prepare [tasks] in a way that when you give it to students who missed the class, their parents should be able to implement the task with them… Because I will prepare [tasks] taking into consideration all of these [features], I can prepare something good. (Becca, I1)

Additionally, as they mastered their skills throughout the previous semester. Participants believed they could prepare tasks easily. For example, Angel said "At the beginning we, as a group, used to spend much time on pondering whether [a task] should be prepared in this or that way, how we should write [the problem], and so on so forth. Then, through the end of the semester, we gained practice" (Angel, I1). She also noted that "[our tasks] got better; even we thought it was low quality, the instructor said '[Your task] is good,' and we were like 'Oh, so we improved!'" (Angel, I1).

On the other hand, for participants with lower efficacy beliefs (i.e. Cindy, Lisa, Kevin, and Amy), curricular knowledge was their main concern. Because the focus of ELE341 was on K-5 curriculum, participants had doubts about their competencies to prepare tasks for Grades 6-8. Lisa, for instance, expressed less confidence in her capabilities to prepare tasks at middle grades, but stronger confidence at Grades 4-5, based on her experiences in ELE341. Similarly, Amy added "I have trouble with the [middle school] curriculum, like which subject is [taught] at which grade" (Amy, I1).

And considering the subjects they needed to learn to create activities at middle school level, Cindy and Kevin interpreted this lack of curricular knowledge as a sign of incompetence at the beginning of the semester. Yet, all of these four participants with moderate level of efficacy were expecting to overcome their worries about curriculum through the methods course. The findings of following interviews, the second and third rounds of interviews, showed that methods course helped those participants to improve their knowledge and skills to prepare highly demanding mathematical tasks effectively for middle grade students and boosted their self efficacy, except for one participant, Lisa.

In our second interview, Lisa pointed out that methods course caused worries about her future practices of preparing mathematical activities. She expressed anxiety about preparing tasks that could be implemented with *every* student, even with high or low achievers. And because she found her experiences in methods class "imaginary," Lisa did not believe that methods course contributed to her skills and knowledge.

> Because [tasks] I prepare here are at a more imaginary level, I don't think of multiple aspects [of preparing tasks] much. Let me talk about myself, I mean, for example, you consider the grade level, you think whether it is difficult or easy and so on, but, for example, you don't think like "Okay, I write this problem, but is this problem going to teach something to the student?" When a task is not prepared with these considerations, I think something is missing. But if you enter a real classroom and get to know the students, know when they can make mistakes, you prepare something appropriate [to them]. (Lisa, I2)

However, Lisa was the only one to regard tasks they designed as "imaginary" or as activities that could not be implemented in every classroom. Indicating a stronger self-efficacy than she had at the beginning of the semester, Amy, for example, said that she was more confident "because this semester we prepare tasks which could be fully used in [our future] classroom. If we go to any classroom and implement them, I mean, these tasks are at an applicable level" (Amy, I2). While mastering their capabilities to prepare worthwhile tasks in methods class, one common view among participants about tasks they prepared throughout the semester was that they believed, in their future

teaching, they would use the activities they collected (i.e. portfolios). Moreover, Cindy noted that they, not only her group but also other groups in methods class, prepared tasks for every subject that they even had various activities to use in their future practices.

In terms of the expectancy to feel proficient in curricular knowledge, Lisa stated dissatisfaction at the end of the methods course. But she admitted that her curricular knowledge, about which she was concerned since the beginning of the semester, did not improve because she "didn't expend a specific effort" (Lisa, I3). During the semester Lisa lost her enthusiasm in methods course, in contrast to the previous semester when she used to enjoy participating in class, and she started to show reluctancy to prepare and implement tasks.

On the contrary, there was a positive change in Kevin's self-efficacy throughout the semester, parallel with the improvement in his proficiency in middle grades mathematics curriculum. The second interview with Kevin showed that he was still carrying concerns about his capabilities to prepare worthwhile tasks for middle grades, since there were subjects they have not yet covered. But after completing methods course, Kevin was confident that he could create worthwhile tasks at middle school level. He stated that he "had been taking this course for a year," emphasizing his enhanced competencies of designing activities effectively through his experiences as a part of methods course:

> I feel efficacious for [preparing tasks about] the subjects [we have studied] so far, we learned what is what [in terms of preparing worthwhile mathematical tasks]. . . . I believe I have knowledge about how to design a task about a subject. (Kevin, I3)

Findings revealed positive changes in Kate's and Cindy's self-efficacy beliefs as well. Kate, who said that "not all tasks I prepare are real good or awesome. . . . I need more practice" (Kate, I1), signaling the lack of self-assuredness in creating activities at the beginning of the semester, also started to feel efficacious that she could prepare worthwhile tasks during methods course. And even though Cindy, defining herself as a "perfectionist," was sad to receive negative feedback on tasks she prepared during the

semester which caused her to doubt about her competence, and she was holding a strong self-efficacy for preparing tasks at the end of the methods course. Comparing her current and past performances, Cindy described how much she improved throughout this class. "I am looking at the [first and last] activities we created, they are poles apart." Moreover, overcoming the self-doubt caused by the lack of curricular knowledge, she believed there was no subject in the curriculum that could be difficult for her to prepare task and she could easily create an activity with high cognitive demands (Cindy, I3).

At the end of the semester, participants who entered methods class with strong efficacy beliefs for preparing tasks expressed more confidence in terms of their capabilities for creating worthwhile mathematical activities. For example, pointing out her mastering skills to create tasks, in our last interview Rachel stated that she was "feeling efficacious indeed because we have prepared so many activities" (Rachel, I3). Judy also mentioned her practices in creating activities and she confidently noted that "either 3 or 5 times, because I prepared tasks myself, I know what it is to prepare tasks, whatever subject I face in the future or no matter how much the curriculum changes, I can prepare a task about that subject" (Judy, I3). And Becca expressed similar confidence in her capabilities, "at this point, I feel really really efficacious because, like I said, we have activities about almost every subject in the curriculum, we prepared all of them" (Becca, I3).

Table 4 summarizes the change in participants' self-efficacy for preparing worthwhile tasks throughout the methods course. At the beginning of the semester (Time 1) there were 5 participants who were holding moderate level of self-efficacy, whereas the remaining 4 participants expressed strong confidence in their capabilities. Findings showed that, at the end of the semester (Time 3), all participants but one were highly efficacious. That one participant, Lisa, had concerns about her curricular knowledge and capabilities to prepare worthwhile tasks appropriate to actual students' levels. In the last interview she admitted that "I have worries like always. [The task I prepare for my

future students] might not be suitable for the class level, [that is, it] might be easy or difficult for students" (Lisa, I3).

Table 4

Participants' self-efficacy for preparing worthwhile mathematical tasks throughout the methods course

Participant	Time 1	Time 2	Time 3
Kate	Moderate	High	High
Cindy	Moderate	Moderate	High
Angel	High	High	High
Judy	High	High	High
Lisa	Moderate	Moderate	Moderate
Kevin	Moderate	Moderate	High
Amy	Moderate	High	High
Rachel	High	High	High
Becca	High	High	High

4.1.2 Prospective Teachers' Self-Efficacy for Implementing Worthwhile Mathematical Tasks

Unlike their self-efficacy for preparing tasks, participants were holding more doubts about their capabilities to implement mathematical tasks effectively when they entered methods class in the spring of 2012. Findings of the initial interviews showed that only three participants (i.e. Cindy, Judy, and Rachel), were feeling highly efficacious for implementing tasks, whereas 6 of them had moderate level of self-efficacy. For example, in our first interview, Judy had so strong belief in her capabilities that she believed she could start teaching immediately, "if they tell me to start on Monday, I can do it," she said (Judy, I1).

Worries about real classroom practices were voiced by Kate and Angel, who had little teaching experiences, but their worries caused doubts about their capabilities and they interpreted these concerns as a sign of incompetency. For example, at the beginning of the semester when I asked Kate how confident she felt about implementing mathematical tasks effectively, she indicated a moderate level of self-efficacy, that is, she believed she could implement tasks, but she was anxious about the problems she can face. This was mainly because of her lack of teaching practice, as she noted. "At this point, there should be some more room for practice because my peers know me, I know they do everything they can to help me implement the task, but this will not be the case in reality for sure," she explained (Kate, I1). Similarly, Angel, who had a strong self-efficacy for preparing tasks at the beginning of the semester, pointed out the deficiency of their experiences in lab hours which caused her doubt her competencies, when talking about her moderate level of self-efficacy for implementing tasks.

> We know how to prepare tasks, but we can't implement [them], I think, because they are all our friends in the class, they all can solve [the tasks we bring], but we don't know how youngsters will react, I think. . . . We now give these [tasks], they [my friends] read, they know [how to solve them], our friends immediately do it, they cut, they paste, but is the kid going to be able to do that? (Angel, I1)

Findings revealed that participants with moderate level of self-efficacy for implementing tasks were mostly concerned about classroom management issues they could be faced with in their future practices, since they did not have actual classroom experiences with implementing such activities, even participants with tutoring backgrounds. Kevin, Amy, and Becca had been tutoring for a while, but they all expressed that they were not teaching mathematics through tasks, that is, they were using traditional methods, so had doubts about their competencies. Amy, for instance, believed her tutoring experiences at a cram school did not make her feel confident in terms of implementing tasks in a classroom environment. She stated that "I can't manage a classroom [effectively]. I experienced tutoring only one-on-one, okay maybe you can

master a subject and teach, but managing a classroom is completely different thing" (Amy, I1). Becca also talked about her fears of classroom management:

> Preparing [tasks] is not the issue, we will of course get tired, there is no easy money but… teaching [the task] in the classroom, like I said, [students] shouldn't think of it as a game, this is a lesson, they shouldn't spoil it. [So], that managing the classroom thing is something I'm a bit scared of. (Becca, I1)

On the contrary, Rachel, another participant with a background in tutoring, was feeling highly efficacious that she could implement tasks effectively because she had a positive view about the influence of teaching mathematics through mathematical tasks which she believed would make classroom management easier.

> We learn multiple representations of every [concept] here in methods [class] such that it catches even our interest, we wonder about our friends' tasks, I mean, "What is it going be like?" Similarly, I believe students will look at tasks we worked on in methods [class] with interest, and so their attention will be drawn, they will be of help with the classroom management, maybe while they work [on their tasks] in their groups concentratedly, I will easily guide them and take care of them through [implementing] tasks maybe because I think it is harder to write the rule or the procedure on the blackboard and to manage the classroom. (Rachel, I1)

Different than her counterparts, Rachel was confident that she could implement tasks effectively, even though she too lacked the experience of teaching mathematics through tasks.

> Now, I tutor through traditional methods, totally like our teachers had taught us. I open [the student's] notebook, see what they did that day, how they solved those problems, and do anything else. And it's not possible for me to use manipulatives while tutoring at home either, but at least I can teach using more innovative methods, I can give the message "There is this other way of doing this [solving problem], you don't have to memorize [rules, for example]," [to the student] at the same time. (Rachel, I1)

A student of traditional teachers, Lisa, on the other hand, believed she couldn't implement tasks effectively because throughout her education until university

she had been learning mathematics with memorizing procedures and rules. Thus, expressing moderate level of self-efficacy at the beginning of the semester, Lisa felt incompetent to use mathematical tasks with students.

> Indeed, since we have been taking Methods I [ELE341], I was like "I know nothing [about teaching mathematics]" because we never learned [mathematics] that way. . . . At school, we were always taught by memorizing trigonometry, memorization of this and that. . . . So, I believe there is more to learn for me, I think. I mean, if I start [teaching] now, I don't think I would be efficacious for [teaching mathematics to] students. (Lisa, I1)

However, about subjects Lisa learned to prepare tasks in ELE341 the previous semester, she believed she could implement activities for primary school students effectively. In the initial interview at the beginning of the semester, Lisa was confident about her capabilities to prepare and implement mathematical tasks about 4 and 5 grade level mathematics. She was also expecting to improve her competencies about preparing tasks at methods class, but not implementing tasks because, like Kate and Angel, Lisa thought only real classroom practices would boost her confidence in using mathematical tasks.

> Let's say, during practicum, we will look at the students and be like "Oh, that is really what it is [about tasks that we were taught in methods class]," or when we implement a task there, we will be able to see the outcomes, but here [in the lab], because we use [tasks] with our friends, they already know [how to work on the tasks], because they solve [the problems in the tasks] without much difficulty, we don't know how real students will react. But if I take practicum [course] now at the same time [with methods course], I think it would be nice, in terms of both tasks and classroom observation, it would be good. (Lisa, I1)

Throughout the methods course, while participants with strong beliefs in their capabilities (i.e. Cindy, Judy, and Rachel) continued to feel efficacious about implementing mathematical tasks effectively, participants with moderate level of self-efficacy either experienced positive changes and uttered self-assuredness at the end of the semester in terms of their competencies to implement tasks (i.e. Angel and Amy) or

described no change in their efficacy beliefs and completed the semester with moderate level of self-efficacy for effective implementation of mathematical activities (i.e. Kate, Lisa, Kevin, and Becca). For example, Cindy, who expressed strong efficacy belief at the beginning of the semester, but pointed out classroom management as a concern about future practices, said in our mid-semester interview that Classroom Management course caused worries about her future teaching, while methods course boosted her self-efficacy to implement mathematical tasks.

> Classroom will be completely different thing. . . . This is about my fear, rather than deficiency, of something extraordinary [I might face]. I mean, I might have a really different student, how am I going to guide that student or how am I going to prevent that student from affecting whole class? I mean, maybe this is the influence of Classroom Management course that we take, the instructor is telling us about very unusual students and it could be an effect of [that course]. I mean, whether I can do [manage a classroom] or not, I am an emotional person in the end, maybe this is why I now think so far, [that I have concerns about classroom management], or else it has nothing to do with methods [course], I mean, it's not like "I took methods course and I don't feel competent." (Cindy, I2)

Still, at the end of the semester, Cindy could get over her worries about classroom management issues, and she was more confident about her capabilities. She noted the role of methods course, together with other courses, in this positive change, though. "Methods course eliminated my initial worries about tasks, about implementing [tasks], but together with the elective courses I took. I mean, however, methods [course] is the primary [course]," she said (Cindy, I3).

Of the participants with moderate self-efficacy, Amy described herself highly efficacious for implementing tasks at the end of the semester. Although she still thought not implementing tasks in actual classrooms was a deficiency of methods course in providing experience, Amy believed that "I now know [how] to connect the task with the subject, not leaving it up in the air, and things like that, I can implement a task in the classroom, I am at that level" (Amy, I3).

Findings revealed a similar positive change in Angel's self-efficacy as well. Through her experiences in methods course, Angel started to feel herself more engaged in teaching mathematics through tasks, and mastering her skills boosted her self-efficacy. Her doubts about real classroom implementations were also weakened at the end of the semester, and like Rachel, she regarded tasks as a facilitation to classroom management.

> Yes, I am much better [in implementing tasks]. For example, rather than direct teaching in front of the blackboard, I can be more effective in teaching through tasks because I now know how to do it, how to prepare task, how to distribute handouts [activity sheet], how to keep [the process] under control, where to start when entering [the classroom]. What if I get confused while teaching, for example? A sign of a bad teacher is that she teaches, teaches, and talks about something else in between, and goes back [to the subject], that's called flip-flop. I am scared to be like that, but there is not such [flip-flop] thing in [implementing] tasks, everything is in an order, I have everything in my hand, everything is organized, in step 1-2-3 it goes, you can't jump to step 2 without completing step 1, I think [implementing tasks] will be more effective [in classroom management]. (Angel, I3)

Although Kevin also stated that "I know how to start the lesson when implementing [tasks] with kids," he didn't feel confident in his competencies to implement tasks effectively (Kevin, I2).

> I can teach [mathematics through tasks] better after a few years of experience, [but] it might not be that effective if I start teaching now. . . . I don't think I'm efficacious enough about implementing [mathematical tasks]. In fact, I know how to start the lesson when implementing tasks with kids. I mean, I know these things in theory, talking a bit about the history of the subject, warming the kids up for the lesson, getting into the tasks step by step, from easy to the difficult, but since I have no experience, [that is] I haven’t implemented tasks in a classroom, I mean, in a real classroom, I have no idea about the effectiveness [of my implementation]. (Kevin, I2)

And at the end of the semester, continuing his worries about classroom management, Kevin was still concerned about his capabilities for effective implementation of mathematical tasks.

> We prepare tasks and present them [in the lab], but it's not exactly like implementing in a [real] classroom. Even if we do implement in the lab, because we work with university students, I don't think it will be the same context like implementing with elementary school students. Indeed, elementary schoolers are more naughty. Plus, we can't know exactly how they are thinking. University students can or can't do [work on a task], but I guess, elementary schoolers can do in a shorter time, Dr. T. was telling us those things. I mean, I can't exactly foresee what is going to happen. . . . I am tutoring, but this is just [helpful] for mastering the subject, or it's more like one-on-one work, I don't know if I will be efficacious about classroom management. About classroom management, I have to be more, I don't know, I have never managed a classroom before, I can't really tell if I can be good [at it] or not. (Kevin, I3)

Becca, who was holding moderate level of self-efficacy for implementing mathematical activities, was carrying the same concern as Kevin at the end of the semester.

> I have never been to a classroom environment. If you ask me about teaching a subject to one person, okay, I feel efficacious about that, I can teach something to one, but having a classroom, let's say there are around 22 people in a class, in front of me, I don't know if I can teach 22 people all together. (Becca, I3)

Kate also talked about similar doubts, and she explained her moderate level of self-efficacy in terms of her lack of experience, interaction as well, with students. In the mid-semester interview Kate uttered that "I don't get along well with children, I didn't get much involved with them, this is my case, I mean, I don't know how to approach them" (Kate, I2). And in our last interview she stated "I wish we had more chance to implement [tasks], but, like I said, I have doubts about putting [things] into practice, [and] this will be eliminated through practicum" (Kate, I3).

One last participant who completed methods course with moderate level of self-efficacy, Lisa admitted that she still didn't know how to teach all middle school mathematics subjects, which she perceived as an incompetency. She also mentioned her lack of teaching practices at a public school in our last interview session.

> Especially time management or how to teach what, I mean, I don't exactly know [how to teach] every subject, and I don't have any experience at public schools. I mean, how I am going to teach a subject about which students know nothing, which methods to use in what type of classroom [or] with students at which level is what I don't know well, I think I'm lacking about these things. (Lisa, I3)

On the contrary, Rachel believed that "a good activity can be implemented well" (Rachel, I3), and parallel with her high self-efficacy for preparing mathematical tasks, she expressed strong belief in her capabilities for implementing tasks too. Judy described herself as highly efficacious for implementing tasks at the end of the semester as well, and she also stated that enrolling in Classroom Management course positively influenced her judgment of capabilities. She confessed that before taking Classroom Management she was worried about implementing tasks in a classroom full of students, but that course helped her overcome such concerns.

> I had a fear about classroom management, like whether the students... umm... would spoil the lesson, I mean, at the beginning of the semester, before taking Classroom Management course. And there were even times when I was like "How am I going to apply [tasks] in such a crowded classroom?" But... umm... after enrolling in that course, I know that I can make students listen to me. (Judy, I2)

Similar to the above excerpt from Judy's interview, other participants had doubts about their competencies of implementing tasks in a real classroom context because they were concerned about classroom management issues. However, while participants with strong efficacy beliefs did not express negative influence of such worries on their judgments of their capabilities, like Cindy, Judy, and Rachel, others' self-efficacy beliefs were affected negatively, and Kate, Kevin, and Becca completed the methods course with efficacy beliefs at moderate level. Table 5 summarizes the change in each participant's self-efficacy for implementing worthwhile tasks throughout the methods course. In the following section, the factors which were perceived as an effect on participants' self-efficacy are explained in detail.

Table 5

Participants' self-efficacy for implementing worthwhile mathematical tasks throughout the methods course

Participant	Time 1	Time 2	Time 3
Kate	Moderate	Moderate	Moderate
Cindy	High	High	High
Angel	Moderate	High	High
Judy	High	High	High
Lisa	Moderate	Moderate	Moderate
Kevin	Moderate	Moderate	Moderate
Amy	Moderate	High	High
Rachel	High	High	High
Becca	Moderate	Moderate	Moderate

4.2 Factors Affecting Self-Efficacy for Preparing and Implementing Mathematical Tasks

In the previous section, I presented the change in each prospective teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks throughout the methods course. The second research question was aimed at examining the factors responsible for these changes in participants' self-efficacy. Based on the interviews with participants, 6 factors related to the methods course (i.e. lecture hours, group work, peers' presentations, feedback on group work, assigned readings, and examination) that influenced their self-efficacy were identified. I begin this section with the factors that were found most effective by each participant at the beginning, in the middle, and at the end of the methods course. I then continue this section examining similarities and differences in how participants described the effects of each 7 factor in detail.

Considering Bandura's hypothesized sources of self-efficacy (mastery experiences, vicarious experiences, verbal persuasion, and physiological states), I explain the ways these factors produced effect on participants' self-efficacy.

4.2.1 The Most Effective Components of Methods Course

The components of methods course which constituted the largest part of the course were lecture hours, group work to prepare and implement tasks, peers' presentations in the lab hours, and feedback provided by both the instructor and peers on group work. Thus, I primarily focused on these components in each of the three interviews with every participant. I asked participants to define which source had, or as in the initial interview they were *expecting* that would have, the greatest effect on their self-efficacy for preparing and implementing mathematical tasks. The factors participants talked about at the initial interviews were the ones they were expecting that would affect their self-efficacy the most, in the light of their experiences from the previous semester, in ELE341. Table 6 shows components of methods course which were defined as the most effective factors on self-efficacy by each participant at different time points.

Findings of the first round of interviews showed that 4 out of 9 participants (Kate, Angel, Lisa, and Kevin) stated that they were expecting group work to be the most effective factor on their self-efficacy, based on their previous experiences from ELE341 (Table 6). Five participants (Cindy, Judy, Amy, and Becca) expected that feedback from the instructor would affect their judgments of their capabilities the most, whereas one participant (Rachel) thought feedback from both the instructor and her peers would be the most effective factor. This one participant, Rachel, also believed that her peers' presentations during lab hours would have great influence on her self-efficacy throughout methods course.

Table 6

The most effective factor on self-efficacy throughout the methods course

Participant	Time 1	Time 2	Time 3
Kate	Group work	Group work Feedback on group work	Lecture hours
Cindy	Feedback on group work	Group work	Group work Peers' presentations
Angel	Group work	Group work Lecture hours	Lecture hours Group work Peers' presentations
Judy	Feedback on group work	Group work	Feedback on group work
Lisa	Group work	Feedback on group work	Lecture hours
Kevin	Group work	Group work	Lecture hours
Amy	Feedback on group work	Lecture hours	Peers' presentations
Rachel	Feedback on group work Peers' presentations	Feedback on group work	Lecture hours Group work Feedback on group work
Becca	Feedback on group work	Feedback on group work	Lecture hours

Throughout the semester, participants thoughts about which component of the course was most effective changed in different ways. Kate, one of the participants who was expecting the group work to have the strongest influence on her self-efficacy, believed feedback on group work was the most effective factor in the mid-semester, in addition to group work. However, at the end of the semester, she was thinking that the most effective factor was lecture hours.

Unlike Kate, Cindy started the semester with the expectation of feedback on group work, especially when provided by the instructor, to be the most effective factor, but in the mid-semester she thought group work had the greatest influence on her self-efficacy. Peers' presentations together with group work were the two factors Cindy described as the most effective components of methods course at the end of the semester.

Another participant who entered the methods class with the expectation of feedback to be the most effective factor was Judy, particularly mentioning Dr. T.'s feedback on group work. A change in her thoughts was evident in the second interview when she viewed group work as the most effective factor. Yet, the last interview revealed that Judy perceived feedback from Dr. T. as the strongest influence on her efficacy beliefs.

The other two participants who believed that feedback on group work would be the most effective factor were Amy and Becca. Even though Becca was still considering those feedback as the greatest impact on her self-efficacy in the mid-semester, both of the participants' thoughts changed at the end of the semester. Lecture hours had the greatest effect on Becca's self-efficacy, as she uttered during the last interview. Amy, on the other hand, thought that her peers' presentations were the greatest influence on her judgement of her capabilities, when we met for the last interview, even though she stated that lecture hours was the most effective factor on her self-efficacy in the mid-semester interview.

Rachel was the only participant who was expecting feedback from both the instructor and her peers to have the greatest effect on her self-efficacy throughout the methods course. She also believed her peers' presentation of their tasks in lab hours on Wednesdays would strongly influence her self-efficacy. During the semester, feedback was the most effective factor alone on her self-efficacy; however, at the end of the methods course, she explained that lecture hours, feedback, and group work influenced her self-efficacy all together, none of them was more effective than the others. Similarly, Angel weighted three factors (i.e. lecture hours, group work, and peers' presentations)

equally when judging her capabilities at the end of methods course. Yet, Angel entered the course believing only group work would have the greatest effect on her self-efficacy, and she thought group work and lectures were the two most effective factors in the mid-semester.

The other two participants (Lisa, and Kevin) were expecting that group work would be the most effective factor on their self-efficacy throughout the methods course. Findings of the second interviews showed only one of these participants (Kevin) described group work as the greatest effect on his self-efficacy, though. Lisa's views changed from the *instructor* to *feedback* as the strongest influence when judging her capabilities later. At the end of the semester, both Lisa and Kevin believed that lecture hours influenced their self-efficacy for preparing and implementing tasks the most.

In general, at each time point, some of the participants were talking about completely different factors from their expectations, whereas some of them went back and forth among factors. As a result, there was a decrease in the number of participants who defined group work as the strongest factor throughout the course, 4 at the beginning of the semester and 3 at the end. A greater decrease occurred in the number of participants to describe feedback as the most effective factor on their self-efficacy. The number of these participants were 5 at the beginning of the semester which decreased to 2 in the end. In contrast to this decline, there was an increase in the number of participants who thought lectures influenced their self-efficacy the most throughout the methods course. In other words, while there was no participant expecting lectures to be the most effective component of the course, there were 6 participants who believed that lectures had the greatest influence on their self-efficacy in the last round of interviews. An increase can be seen also in peers' presentations as the strongest factor. Only one participant entered methods course believing this component of the course would have the greatest influence on her self-efficacy, but at the end of the semester, there were 3 participants to rate their peers' presentations during lab hours as the most effective factor. Participants' descriptions of how each of these factors and the rest of the factors,

which findings revealed, are explained in greater in the next part, in the light of the hypothesized sources of self-efficacy set forth by Bandura (1997).

4.2.2 The Effects of Each Factor on Prospective Teachers' Self-Efficacy Throughout the Methods Course

As I mentioned in the previous part, factors related to the methods course that influenced participants' self-efficacy were lecture hours, group work, peers' presentations during lab hours, feedback on group work, examination, and assigned readings. In this part I provide the details of each of these factors and the way they influenced participants' self-efficacy, considering the theorized sources of self-efficacy as defined by Bandura (1997).

4.2.2.1 Lecture Hours

At the beginning of the semester, I asked participants to name their anticipations of the component of methods course which would have the greatest contribution to the beliefs about their capabilities to prepare and implement mathematical tasks effectively, and participants constructed their expectancies based on their experiences from the previous semester. Lecture hours was a component of methods course which was not expected to have a strong influence on participants' efficacy beliefs, as the initial interviews showed (Table 7). During the semester, at Time 2, however, 2 participants viewed lectures as the strongest influence on their efficacy beliefs; and at Time 3, six out of 9 participants stated that lectures were the most effective factor on their self-efficacy.

Table 7

Participants who viewed lecture hours as the most effective factor on their self-efficacy throughout the methods course

	Kevin	Kate	Cindy	Angel	Judy	Lisa	Amy	Becca	Rachel	T
Time 1										0
Time 2				+			+			2
Time 3	+	+		+		+		+	+	6

Even though lecture hours, when compared to other components of the methods course, were not seen as a strong influence until the end of the semester, findings revealed that there was an effect of these lectures on participants' efficacy development; that is, participants interpreted the efficacy-related information provided by lecture hours when judging their capabilities to prepare and implement tasks effectively. Recall that every week on Mondays, the instructor, Dr. T., was giving lectures about that week's subject. Prospective teachers were required to read the assigned chapter from the textbook, as well as the Grades 6-8 Mathematics Curriculum covered in Turkey. From time to time, the instructor administered unannounced quizzes before lectures. Then, she presented the subject by creating an inquiry based environment where prospective teachers were actively involved in the learning process. These lectures affected participants' efficacy beliefs in different ways, positively or negatively, operating through the theorized sources of self-efficacy. Now, I explain how participants described the influence of lecture hours on their self-efficacy beliefs in detail.

The transmission of knowledge and skills.

One aspect of lecture hours that was believed to contribute to participants' efficacy development was the vicarious learning opportunity which Dr. T. provided. Findings revealed that Dr. T.'s lectures were perceived as a transmission of her

knowledge and skills, so lectures operated through vicarious experience source. For example, Angel (I2) stated that she was provided with necessary knowledge of effective teaching mathematics through tasks, and she explained:

> [Dr. T.'s lecturing] is good in terms of providing the necessary knowledge [to prepare and implement tasks effectively]. For example, she showed us to teach multiplying fractions with fraction cards. I don't know what they are doing in other methods courses [at different universities], but [other instructors] might be saying that "This is how you multiply fraction and here is the rule for that" and so on so forth, but here I learn how to teach [effectively through tasks]. . . . [Dr. T.] teaches us different activities and I'm like "Yes, that could also be used, I have never thought about it before!" So I learn [through lectures].

And Kate summarized the influence of Dr. T.'s lecturing as "Even though we are not teaching in real classroom, because our instructor is teaching us like 'You should deal with this point in this way,' guiding us step by step to 'how to be a teacher,' I am taking a class that could be extended to two years" (Kate, I3).

Findings also showed that participants paid attention to what the instructor emphasized in her lectures where she transmitted knowledge regarding the features of worthwhile tasks and the effective use of those tasks. Similar to Kate, who expressed that she "realize that there are things Dr. T. emphasizes through her stress, her repeating, and we refer to them" (Kate, I3), Kevin explained that they, as a group, "assert that what the instructor highlighted during the lectures were important, and prepare tasks to teach those aspects" (Kevin, I3).

Additionally, participants stated that, through the instructor's lecturing, they vicariously learned to prevent leading students to misconceptions and to handle possible obstacles they could face implementing mathematical tasks, especially "considering the contextual factors in Turkey" (Amy, I3), and that they felt more efficacious. That could be seen in Kevin's example:

> Our instructor already tells us that some misunderstandings could occur, she puts an emphasis on them, like "Children can fail to correctly understand this and that." I mean, we learn a lot to prevent the task from

> going wrong… She also teaches us methods to correct them, like "Tell this in that way." For example, teaching definitions, definition of something, let's say ratio and proportion that we discussed this week. The difference between two, emphasizing [the differences, Dr. T. says] "Highlight this in that way," or "This is the definition," I mean, since she is teaching us how to present them, we get ready for any problem that can arise about that subject. Through the lectures, I mean. (Kevin, I2)

In terms of preparing prospective teachers for teaching at Turkish classrooms, Amy described the positive effect of Dr. T.'s lectures. She said that lectures created influence "because the lectures are based completely on daily life, or more on reality," in other words, they were "focused on the standards of [teaching mathematics in] Turkey, like 'This is what you are going to be faced with when you start teaching' kind of realistic knowledge Dr. T. provides" (Amy, I3). This realistic knowledge was a result of Dr. T.'s experiences as a former mathematics teacher, Angel mentioned. The instructor's background in teaching mathematics at elementary school provided vicarious experience for the participants, which she transferred effectively through lecturing. Additionally, Judy pointed to the difference between Dr. T. and some instructors who "know everything, but cannot transfer this knowledge" in terms of Dr. T.'s willingness and effort to share her experiences with prospective teachers (Judy, I1).

However, Lisa was not on the same page with her counterparts, regarding the effects of lecturing that was based on the instructor's experiences. She rather relied on her own experiences as a student at a public school in a small city than Dr. T.'s, who had a background as a mathematics teacher at a private elementary school in Ankara. Counting more on her own experiences, Lisa claimed that she had more accurate information about the situation in Turkish public schools than Dr. T. had.

> I believe this methods course is preparing us for [teaching at] private schools or big cities, but if you ask me if it prepares us for schools where there is no manipulatives or somewhere without sufficient facilities, to me, no, it doesn't. I mean, [that is] because I feel like here we are talking about

> real extreme things, since, for example, I studied [middle school] in [Nova][5], and high school there, but even there I didn't see any manipulative or something. The only thing I have seen was geometric solid things which were kept in a locker in every class that no one cared about. Since in Nova [manipulatives] don't exist, I don't expect it to be [available] in somewhere in the East [of Turkey]. (Lisa, I2)

At the end of the semester Lisa was still thinking that what she learned from Dr. T.'s lecturing was not applicable to Turkish context:

> What she [Dr. T.] tells us are like a story to me. I mean, yes, I want to put this into practice, but at some point she is saying things like literally cannot be implemented. Especially in Turkish educational system, there isn't even enough time for that. When you want to implement them [tasks] step by step, but it is just not possible. (Lisa, I3)

Still, Lisa believed that lectures improved her knowledge and skills in terms of preparing worthwhile mathematical tasks at the end of the semester. She was one of the participants to consider lectures as the greatest contribution to her beliefs in her capabilities to prepare and implement tasks effectively, even though Lisa expressed this benefit of lectures because she believed other aspects of methods course (e.g. group work) did not contribute to her self-efficacy. The following excerpt from our last interview demonstrates her thoughts about the positive effect of lectures:

> Her [the instructor's] lecturing is good, I mean, she is giving examples and such, which is good. . . . At least I know what she [the instructor] emphasizes or she explains how we should teach and we keep that in mind when preparing tasks so that our tasks don't look like drills, [they are worthwhile tasks]. (Lisa, I3)

One other contribution of lectures was that through the transmission of knowledge and skills, as participants explained, the instructor helped them to overcome their existing misconceptions about mathematics they were going to teach. Becca, for example, explained that Dr. T.'s lectures usually started with a question asking the

[5] Pseudonym used.

definition of a concept from that week's subject so as to assess prospective teachers' previous knowledge about the concept. Then, Dr. T. revealed the misconceptions they held, if any, through posing further questions. In case of any misconceptions, lectures were focused on overcoming them which in turn made the participants feel more efficacious. This teaching approach operated through verbal persuasion as a corrective feedback source for participants' efficacy beliefs and created positive effect.

Questioning method.

On Mondays, Dr. T. started her lectures with a question related to the weekly subject, instead of directly starting to present the concept and ideas to prospective teachers. Then, continuing with her presentation projected on the screen over the whiteboard, Dr. T. posed further questions for prospective teachers to explain, discuss, and build on the key ideas from the textbook which she summarized in her presentation. Findings revealed that the instructor's "questions" during lecturing were perceived as an influence on participants' self-efficacy. Those questions were aimed at promoting participants to think of ways how they would implement tasks from the textbook with their future students and to generate ideas for accommodation or modification of tasks from the textbook, like Cindy (I2) stated as follows:

> The lecture is based on activities, too. The instructor is not like "You are going to teach this [subject] in that way," she teaches us like "What is this activity saying here? How would you use this [in your classrooms]?" . . . And this is why it is useful for [development of our capabilities].

Angel (I2) also uttered that "[Dr. T.] is asking questions which makes me think, I keep thinking and thinking [to generate ideas for example], it's not just [listening to] lectures." And Rachel mentioned that when they demonstrated how they would enact those tasks, "Dr. T. was letting us do the talk and she was only guiding" (Rachel, I2). This second aspect of lecture hours, which promoted participants' thinking to enhance and master their knowledge for preparing and implementing mathematical tasks, operated through mastery experience source of self-efficacy.

Participants, moreover, regarded the questioning method as a vicarious learning source where "various ideas show up continuously" and they could "come up with something better" (Angel, I2). For instance, Amy stated that she learned better when Dr. T. facilitated their thinking through her questions, instead of direct teaching of concepts and ideas, and "at the end of this [thinking] process, everyone says something and a lot of things [e.g. ideas] show up, and those are things that don't exist anywhere else, all unique to that person, so it makes better sense to me" she continued (Amy, I2). Yet, Angel expressed some discomfort in terms of concluding the ideas her friends generated, for she believed that the instructor sometimes did not bring the session to a clear end, so she felt as if she was left in uncertainty:

> Sometimes she [the instructor] asks us, for example in Decimals chapter, she asked us the definition. I still have it in my mind, I forgot to ask her about it. Anyway, she said "What else?" and we explained the one [definition] in the textbook, that it is a different way of showing fractions. "What else?" And they [peers] are telling some other things, but I was like I didn't get it, I guess we didn't wind it up in the end. This happens sometimes, everyone says something and I don't understand which one is correct. (Angel, I2)

Lisa was also in agreement with Angel's views about wrap-up part of lecture hours:

> I noticed that, this semester, for example she [the instructor] says something and some people answer [the question], but she doesn't say which answer is right. I got confused most of the time, like "So which one is correct?" If she [the instructor] is going to continue without telling us [what is correct], then there is no point of enrolling in these lectures for me. Ok, I can think of those ideas myself, too, but I don't know what is correct. It is not useful to attend lectures, unless I learn something there. (Lisa, I2)

Basically, though, the questioning method encouraged active involvement where participants enjoyed engaging in the learning process and had fun, unlike in other classes. That is, operating through physiological states of participants, questioning method created positive influence. Cindy told me that she was bored and feeling tense

during other education related or mathematics content courses, but not in methods course. Similarly, Judy enjoyed these lecture hours where she was motivated by the instructor's lecturing in an active manner, encouraging prospective teachers to participate in the lectures. Kate mentioned the positive effect of active involvement in methods class as well, when she was explaining the influence of lecture hours:

> When we were recently listening to some managers from non-governmental organizations about their ideas on their corporations, as a part of Community Service class, I realized that I don't have an instructor who simply lectures and makes me listen. I mean, somehow I find myself involved in that lesson and from this aspect, it is not possible to get bored or distracted in Dr. T.'s class. (Kate, I2)

The instructor's expectations.

Participants' views of Dr. T.'s expectations from them was another aspect of lectures' perceived effects. As stated in the syllabus (Appendix B), Dr. T. "expect every student to read the assigned readings prior to class hour." This expectancy was regarded as an impact on the level of effort that participants put forth and the amount of effort they expended affected the inferences of their capabilities. Thus, the instructor's expectations from participants created influence through their mastery experiences. For example, Angel believed the expectations which Dr. T. was holding were "really high," which encouraged Angel to read and work harder to "go further each time" (Angel, I2). Thus, she believed she was "definitely better than others [prospective teachers from other universities] to meet [Dr. T.'s] expectations," showing that she was confident in her capabilities (Angel, I2).

Lisa, on the contrary, was negatively affected from those expectations. Recall that, in addition to their assigned readings from the textbook (Van de Walle, Karp & Bay-Williams, 2010), prospective teachers had to study the Mathematics Curriculum so as to discuss the ideas in Van de Walle, Karp, & Bay-Williams's book in the light of the curriculum. The instructor also suggested a methods of teaching mathematics book of a Turkish professor in mathematics education, which would help prospective teachers to

deepen their knowledge and understanding about tasks regarding Turkish mathematics curriculum and classroom context. Putting all these weekly readings together was overwhelming for Lisa. She was taking 8 courses during the semester, an average number of courses for each junior prospective teacher in the program, and, because of the courseload, she said she couldn't spare enough time for readings of methods course. Thus, she was complaining about the demands of methods course which she found was beyond her capabilities.

The instructor's demands from prospective teachers for completing assigned readings before lecture meetings was motivating for Cindy, unlike Lisa. She confessed that at the beginning of the semester she was overwhelmed with the idea of mastering in both the main textbook and the curriculum, but through the semester Cindy saw she could do it and was encouraged to do better as she felt her own improvement.

> Suggesting us to buy the [curriculum] book, for example, this was the first time I have seen such thing. Well, other instructors say "There is this and that book in the library," okay, but the first instructor to put so much effort, telling us to buy 6-7-8 [curriculum handbook], to look for this and that, to study the curriculum was Dr. T. At first I was like, I easily stress out, it is in my nature to panic, so I was panicked, I mean, "Oh God!" I said "We have to read this and do that before class, how are we supposed to get it done?" And there were times I couldn't finish [reading], I couldn't make it hunky-dory I mean, but at least I tried to do it and I believe I was positively motivated. (Cindy, I2)

Rachel also explained that she was motivated by Dr. T.'s expectations which helped her develop skills of "discipline to study" (Rachel, I2). In our second interview, Rachel told me "Dr. T. states her expectancies, sometimes it goes beyond us, I don't know, maybe it is because we have other courses than methods [course], it feels too much for me, especially this semester. I have to push myself a lot, but she is doing good. . . . Now I feel real change in me, like I said, I studied the curriculum and Van de Walle [textbook], and went to the class. I would never do that in the previous semester" (Rachel, I2). From this aspect, the instructor's expectations were mostly a

positive influence on participants' self-efficacy and were perceived by participants as challenge to improve their knowledge and skills.

Support for textbook.

As mentioned earlier, prospective teachers were required to complete the assigned readings before participating in lectures on Mondays. The influence of assigned readings, more specifically the textbook, will be discussed later in this chapter as a separate factor. The focus of this part is the effect of lectures, and findings showed that Dr. T.'s lecturing had a complementary role on learning through readings. Participants believed that readings should be supported by lectures because they sometimes misinterpreted information in the textbook or "sometimes [didn't] even understand what the book [was] saying" (Cindy, I3). For instance, Becca stated that they "go to the class [on Mondays] already familiar with the subject, then the instructor is lecturing. If there is something [in the book] that we misunderstood, [lecture] helps us a lot to correct" (Becca, I1). Thus, lecturing worked as corrective feedback and operated through verbal persuasion source for self-efficacy of participants.

When compared to the previous semester, Amy started to experience difficulty in understanding tasks in the textbook and she expressed more need for the support of lectures:

> I read the textbook prior to the lectures, and for instance, there are many figures or tasks that I don't understand there; there are many problems, but we may fail to understand the solutions. When we come to the class, we understand them all. (Amy, I2)

Cindy expressed the importance of lecture hours in correcting or assisting her understanding of tasks from the textbook as well:

> We usually go to class prepared… I mean, instead of meaningless memorization, you first understand it yourself. Let's say, you got it wrong; when the instructor's lecturing, you definitely keep those tasks in mind, you remember like "I got this wrong, but the instructor corrected it." Cindy (I2)

Lecture hours, as a support for the textbook, enhanced participants' learning from textbook as well. Participants described this influence of lectures through expressing the increase in their learning from reading the assigned chapters. This improvement in their knowledge to prepare and implement worthwhile mathematical tasks effectively boosted participants' self-efficacy. For example, Kate believed lecture hours carried her further than what she learned from the book:

> Whatever I do, how much I read the book, things that I learn from the textbook are different before and after Dr. T.'s lectures… I realize that, no matter if I read or not before lectures, there are things that I don't notice. Even when I read in detail, I say, for instance, "I didn't interpret it that way." (Kate, I2)

Interaction with the instructor.

At the beginning of the semester all of the participants described their interaction with the instructor from the previous semester in a positive way. They enjoyed participating in lectures and were motivated by the "friendly" environment Dr. T. built. Participants also felt comfortable when sharing their ideas in the classroom. Moreover, they expressed that they had fun in Dr. T.'s lectures. For example, in our first interview meeting Cindy explained:

> Her [Dr. T.'s] classes are not like lectures, more like something fun. I mean, I don't know, I like her, I am comfortable in her classes. In other instructors' classes I get anxious, but Dr. T. feels like a sister to me, I don't know, I find her so sincere. (Cindy, I1)

Later in the semester, findings showed that, Dr. T. gained participants' liking through talking about their career options, their future teaching practices. Doing so, Dr. T. was able to reach them and make them feel she could understand them, as participants indicated. During our second interview with Cindy, she uttered:

> [Dr. T.] talks about future and stuff, I really like that, I don't know, like [telling us] "You can do this [e.g. apply to graduate programs] as well, you don't have to stay in Ankara [after graduating]," because she has been through this way, she knows about our dreams. She knows we want to stay at

> METU as graduates of METU, for example, most of us don't want to leave Ankara, for we are used to [living] here, but "You can start working at a private school in small cities," or "You better start [teaching] at public school" she says, I like this. (Cindy, I2)

Angel also appreciated Dr. T.'s interest in them as her students:

> Dr C. [another instructor from the Department of Elementary Education] doesn't even know our names :) My friend, Fanny or Audrey, recently told me "I said 'Hi!' to Dr C. and it was an atrophy for Dr C.! I think [that instructor] doesn't know our names," she said. I think it's good that [Dr. T.] learned our names, she cares for us well. (Angel, I3).

Thus, Dr. T.'s interest in both participants and their future after graduating (i.e. their careers) helped her built positive relationship with them. This interaction with the instructor resulted in participants' enjoyment of lectures, and most participants stated positive physiological states which boosted their self-efficacy. There was one participant, Lisa, however, to experience negative emotional states caused by her interaction with the instructor. In our first interview, she expressed her love and admiration for Dr. T. and her friendly, caring approach to them, but during the last two interviews, Lisa claimed that Dr. T. thought "they [prospective teachers] would either study abroad and pursue a graduate degree or teach mathematics in English at private schools, but maybe we won't, she doesn't think about this, she doesn't care" (Lisa, I2), and she was "mad" at this high, unrealistic standards Dr. T. set for them (Lisa, I3). Thus, Lisa lost her interest in the lectures and "most of the time, I don't even listen," she uttered. Yet, at the end of the semester she rated lectures as the most powerful component of the methods course in contributing to her self-efficacy. Again, this was mainly because Lisa didn't believe the other factors (e.g. feedback) were effective.

Classroom environment.

Considering the physical conditions of the classroom where the lectures were held, one participant, Rachel, stated that she was negatively influenced. The classroom

was smaller than the one they met for the lectures during the previous semester and Rachel had difficulty to concentrate on Dr. T.'s lecturing. She explained:

> About lecture hours, this is not about Dr. T., but the classroom is so small that I cannot fully concentrate [on lectures], there is no seating arrangement. . . . I mind the classroom set-up, this is why I always look at nothing else but focus on Dr. T., so that I don't see what is around. The ceiling is very low, the classroom is too airless, and so on, these are physical conditions, of course. (Rachel, I2)

Rachel mentioned this influence of classroom environment both in our second and third interview meetings. "I cannot fully concentrate on lectures. I would fall asleep, if I go to class without reading, I think, because the classroom affects me a lot. It is really small, too stuffy, and this affects," she explained (Rachel, I3). From this aspect, lecture hours had a negative and indirect influence as a physiological states source.

Summary of the perceived effects of lecture hours.

Findings revealed that lecture hours were perceived as an influence on participants' judgements of their capabilities to prepare and implement worthwhile mathematical tasks, and created mostly positive effect. One component of these lectures, Dr. T.'s transmission of her knowledge, operated through both vicarious experience and verbal persuasion as a corrective feedback. The questioning method Dr. T. used provided both mastery and vicarious experiences, as well as affecting participants' self-efficacy through their physiological states. The expectations of her from prospective teachers boosted participants' self-efficacy through mastery experiences when they perceived these expectations as a challenge, but diminished their efficacy beliefs when seen above their capabilities, as in Lisa's case.

Lectures were also described as a support for participants' learning from textbook, which was an influence lectures had through operating as a verbal persuasion source (i.e. corrective feedback). Another source lecture hours operated through was physiological states of participants, where the interaction between the instructor and the participants produced mostly positive effect, and the classroom environment in which

the lectures were held negatively affected Rachel. The classroom environment was not a direct influence, though, because it was not a natural component of the lectures. Rather, the classroom was the context in which lectures took place, so it was excluded from the factors with direct effect on participants' self-efficacy. Each of these components of lecture hours with direct effect and their influence through the hypothesized sources of self-efficacy are given in Table 8.

There was one other component of lectures, videos Dr. T. showed, which participants did not talk about. Recall that Dr. T. brought videos of teachers around the world. These videos were showing implementation of various mathematical tasks in natural classroom settings and could have been a vicarious learning source, but not for any of the cases in this study obviously.

Table 8

Effects of lecture hours through hypothesized sources of self-efficacy

Components of Lectures	Mastery Experience	Vicarious Experience	Verbal Persuasion	Physiological State
The transmission of knowledge		✔	✔	
Questioning method	✔	✔		✔
The instructor's expectations	✔			
Support for textbook			✔	
Interaction with the instructor				✔

4.2.2.2 Group Work

After attending lecture hours, prospective teachers were required to work in groups of 5-6 to prepare their own tasks related to that week's subject and implement these tasks with their counterparts during lab hours on every Wednesday. Findings revealed that group work was an effective factor on participants' self-efficacy. Table 9 shows the participants who rated group work as the strongest influence on their efficacy beliefs at three different time points throughout the semester. Four out of 9 participants expected group work to be the most effective component of methods course, in terms of their beliefs in their capabilities to prepare and implement tasks, based on their experiences in the previous semester. During the methods course, 5 participants stated that group work was the strongest effect on their efficacy beliefs, and 3 of them were the participants who expected this at the beginning of the semester. At the end of the semester, there were only 3 participants to perceive group work as the strongest influence. In other words, there was a decrease in the number of participants who thought that group work was the most effective component of methods course on their self-efficacy. In this part, I present an in depth description of how group work created effect on participants' efficacy beliefs.

Table 9

Participants who viewed group work as the most effective factor on their self-efficacy throughout the methods course

	Kevin	Kate	Cindy	Angel	Judy	Lisa	Amy	Becca	Rachel	T
Time 1	+	+		+		+				4
Time 2	+	+	+	+	+					5
Time 3			+	+					+	3

Group work was where prospective teachers brought theory into practice, through preparing and implementing their own tasks. Preparing and implementing tasks as a part of coursework throughout the methods course provided participants mostly mastery experience which influenced their efficacy beliefs, but findings showed that participants' views differed in terms of preparing and implementing tasks as a group. For that reason, I first explain the perceived influence of preparing tasks as a group, then I continue with the effect of implementing tasks with group members. Findings also showed that working as a group instead of working alone affected participants' self-efficacy, so I explain this effect of group work as well.

Preparing tasks as a group.

Prospective teachers worked together with their group members to create tasks throughout the semester, and findings showed that participants referred to their performances as a source of efficacy-relevant information when judging their capabilities. This way, group work on preparing tasks mostly operated through mastery experience source for participants' self-efficacy. Participants stated that preparing tasks as a requirement of methods course gave them the opportunity to improve their capabilities. Creating their own tasks after attending lecture hours also "let [them] turn theory into practice" (Angel, I2), which "made [their] learning concrete" (Cindy, I2). Following excerpt from the interview with Kevin shows how he perceived the influence of preparing tasks, when compared to lecture hours:

> Lab hour is more effective, I believe, we put into practice what we learn in theory. During lecture hours we only talk about "This is what is taught, that is what is taught, and this is how we teach them," and so on, but because we prepare tasks for Wednesday's class, we learn more by seeing [practicing] what is taught and how it is taught. (Kevin, I2)

Becca also believed that, through preparing tasks, they were showing how well they understood the subject they are going to teach in their future classrooms. Similarly, Cindy thought group work was a *reflection* of her learning from lectures, that she brought something from herself into the tasks they prepared. However, one

participant, Rachel, believed that preparing tasks did not help her to improve herself. She viewed those tasks they prepared as a *presentation* of her learning, that she "transferred" what she learned during lecture hours:

> Preparing tasks, our preparation process, transferring how much we learn from lectures to paper doesn't influence [my judgment of my capabilities] because if we listened with full attention, we prepare a very good task, but if that day we had a headache, we focus on the most important aspects and we are like "We should add this, the instructor already said she wanted it, maybe she likes it," when creating tasks because we try to get sell our task to the instructor, but there is no such thing [like selling tasks]. (Rachel, I2)

Yet, Rachel stated that preparing tasks was a necessity to improve her skills, for she believed preparing tasks as a group "constructs the base for the good activities, effective activities we will create in the future, this cannot be [achieved] without the bad ones we prepare today, I think, so it is a must" (Rachel, I2). And at the end of the semester she expressed strong confidence in her capabilities to prepare tasks, perceiving group work as a powerful contribution to her improvement. The last interview with Rachel showed that she changed her approach to preparing tasks as she gained the practice of preparing tasks, "the habit" she called. Rachel and her group members were "not satisfied with what [tasks] we prepare" (Rachel, I3), and so, rather than "transferring" her learning from lectures into mathematical activities, Rachel focused on creating different types of tasks through including different manipulatives (i.e. hands-on manipulatives and technological tools). This way, Rachel put more emphasis on the mastery experiences group work provided, when judging her capabilities to prepare worthwhile mathematical tasks.

While participants expressed the contribution of group work, which was a source of mastery experience, to their self-efficacy for preparing tasks, Lisa uttered less benefit of group work and her self-efficacy did not improve as much as the rest of the participants throughout the semester. Lisa believed that "it doesn't make sense to spend an hour to write a problem, which will eventually be criticized and you will see if it is

right or wrong or if you should write such problem or not" (Lisa, I3). For her, trying "to prepare *perfect* tasks is a waste of time," whereas two participants, Kate and Cindy, who defined themselves as "perfectionists," made more effort to create worthwhile tasks. When I asked Lisa to further explain why she found preparing tasks "useless," she stated that she thought tasks they prepared for methods course were not *realistic,* that those tasks could not be implemented in real classrooms, for they lack the quality to teach mathematics effectively. Thus, she approached group work only as a requirement of methods course and prepared tasks just to "get it done," not to create something that they could benefit in the future:

> We just want to get it done, so I don't think it is really effective. . . . It is an imaginary classroom [that we prepare tasks for], we don't even imagine a classroom, I mean, it is all like "Let's present our activity in the lab, get our grades, if we don't present an activity, we will have low grades," and so our activities are like this [low quality], and I think I won't be using most of them. (Lisa, I3)

Later in the interview, I found out that Lisa's main concern was the difficulty to prepare worthwhile tasks without a rubric, "a criteria" she said. For example, she had trouble with determining the grade level for a task she prepared and this made her feel less efficacious (Lisa, I2). And as she faced such difficulty, she simply stayed away from pushing herself to do better, instead of putting effort to overcome this obstacle to improving her capabilities:

> Maybe I won't even use the task I prepared, maybe I will have to modify it because it is not known in which classroom I am going to implement. . . . but if we knew the students, I mean, if we meet the students, learn what they can do and can't do, then it wouldn't be this difficult, I think. . . . Let's say, every week we were told to prepare tasks appropriate for 6th graders with such and such difficulties or lacking this and that knowledge, or students who cannot work in groups, then maybe we will have clear criteria for what to include, but this is not the case now, it is all imaginary that we approach to it to get it done. (Lisa, I3)

Contrary to Lisa's negative perceptions of group work, participants talked about the benefits of creating their own tasks as a result of group work. Remember that participants expressed doubt about their capabilities to prepare and implement tasks effectively because they lacked the required knowledge of the Elementary Mathematics Curriculum covered in Turkey. Findings revealed that participants had the opportunity to master the National Elementary Mathematics Curriculum, for they referred to the curriculum book while preparing tasks throughout the semester, and this mastery experience made them feel more efficacious.

Preparing tasks as a group also influenced participants' efficacy beliefs, operating through physiological states. Participants expressed feelings differing from joy and responsibility to boredom and anxiety, when working with group members to create their tasks. For example, Rachel experienced positive affect during preparing tasks, even though she felt intimidated at first with the idea of preparing tasks every week. Rachel stated "when I first learned that, I was like 'That's too much,' I said, 'Are we going to prepare task each week?' but it provided us a routine. Now when I leave the class on Monday, I plan what to do, I mean, as the class is over, I start to think. This gave us the responsibility, too" (Rachel, I2). She added, at the end of the semester, that "we like preparing [tasks], too. In the past we had difficulty when preparing, we were like 'Oh, activities, again!' now we enjoy it" (Rachel, I3).

Kate experienced this responsibility as a reminder of being a future teacher, since she perceived this aspect of group work as "a chance to practice" what she learned, unlike "other education related courses 'You are going to do this and implement in that way' [as they told]" (Kate, I2) which didn't give her such opportunity, and so she paid more attention to the process of task preparation with her group members. On the contrary, Becca expressed "dislike" for preparing tasks because she "had to consider everything while preparing tasks, not only writing the problem, but also if it [task] could be implemented in classroom or not, if the student could understand or not" (Becca, I2). She was overwhelmed with these thoughts to create a task where they generated

different ideas but ended up with using only a few. “This continuous brainstorming [during preparing tasks] cause headaches,” she stated, when we met for the last interview. From this aspect, preparing tasks created negative influence on her self-efficacy to prepare tasks, for it caused negative mood. However, Rachel, one of Becca’s group members, viewed this challenge as means to improve her skills and she uttered that she was “not afraid of preparing tasks anymore,” since she practiced a lot throughout the semester:

> I realized that a task can be prepared about every [subject]. I mean, now we have moved [further from] “There is this subject that we can’t prepare a task for, it’s too hard,” because we made tasks about everything [in mathematics] except for high school mathematics, except the high school geometry, and in the future I can’t have an excuse like that, I can’t say “It’s too hard to prepare task for this [subject],” ‘cause I’ve already done everything before. (Rachel, I3)

Implementing tasks as a group.

During lab hours on every Wednesday prospective teachers implemented their tasks as a group with their peers. They were not required to prepare lesson plans, as explained in Chapter 3, but prospective teachers were expected to explain the objective(s) and the grade level of tasks they prepared as a group, and work on each group’s tasks. This process was perceived as a “demonstration” of real classroom experience by participants, where they could to see the possible obstacles they could face in future teaching practices, like Becca explained. “There is an example of everything in the [methods] class because we imagine that class as if there are students and we are teaching” (Becca, I1).

From this aspect, at the beginning of the semester participants stated that lab hours provided them the opportunity to improve their task implementation skills, as well as classroom management. Findings revealed that, when judging their capabilities to implement tasks effectively, participants referred to these personal performances in the lab. Thus, implementing tasks as a group worked as a mastery experience source for

participants' self-efficacy. For example, Kate viewed in lab implementation as a contribution to the development of her skills, which positively influenced her self-efficacy because she believed that her "peers try their best to help me." The following excerpt, however, shows that Kate thought it would be different to implement tasks with students in real classroom context than implementing with counterparts in the lab:

> Yes, I may not be experienced enough, but I think, in the future, I will be able to say that "In methods class we implemented tasks weekly." Still, some things should be based on reality. Of course, it [implementing tasks in lab hours] will be helpful, but they are my friends. Like I said, with students it will be different. (Kate, I1)

Similarly, there was a change in participants' views throughout the semester. Even though in the initial interviews, when participants described their experiences based on the previous semester, they expressed positive influence of lab hours, during the time of this study participants started to utter the lack of lab hours in terms of gaining mastery experience in actual classroom context. Participants believed real classroom experiences would contribute more to their efficacy beliefs. An example of this change in their perceptions of implementing tasks as a group in the lab could be seen in our second interview with Becca:

> Since we don't implement [in real classroom], maybe we don't know about the problems we will face. Now, we are thinking hypothetically. People [peers] are like "Maybe this can cause trouble here, that can cause difficulty there." Maybe this is difficulty a, this is difficulty b, or difficulty c, but maybe there is difficulty d which we will face when implementing [in future classrooms], but we don't know about it. This semester, [implementing] tasks don't help our development, I can say this, for sure. (Becca, I2)

Rachel believed the instructor was giving them responsibility to control the classroom while implementing their tasks in lab, but she also thought they didn't "care" this much because they were all her friends. Although she valued contribution of implementing activities with her peers in terms of her improvement, "it doesn't work for us" she stated (Rachel, I2). Cindy, too, thought she "need to do student teaching" (Cindy,

I2). Without real classroom experiences, she said she would be concerned about classroom management, despite her participation in the lab. Kevin complained about this situation as well:

> We prepare and present tasks, but it is not really that, we don't implement in the class [with peers because of time limitation] and even if we do, we implement it with university level students, I don't think we can create the same environment as elementary school students. Elementary schoolers are a bit more naughty and we can't exactly know the way they think. (Kevin, I3)

On the other hand, Angel said that implementing their activities as a group contributed to her development, even though she stressed the lack of lab hours in terms of providing real classroom experience. Following excerpt is from the last interview with Angel and reflects her thoughts at the end of the methods course:

> It is not just listening to lectures, cause it remains in the air a lot, even when we prepare activities, it remains in the air, for there is no real student. But, I mean, if I am at this level on Monday [raising her right hand parallel to the ground], we get over that with implementation [in the lab] [raising her left hand a few inches over her right hand], we understand what is what. (Angel, I3)

At the end of the semester, participants explained that when compared to the previous semester's lab hours, in methods class they were not *implementing* their tasks, but they were *presenting* the activities they prepared. This was perceived as a lack of effectiveness of lab hours and didn't contribute their efficacy beliefs. "Our implementation in the first semester was good, since we don't implement this semester, what good will it do?" asked Becca (I2). Similarly, Lisa "believe implementing tasks with people you know is not useful" (Lisa, I2). She thought they should teach "in an unknown context" so that they could see the effects of implementing tasks. She also complained about the change in the quality of their experiences during lab hours:

> "Prepare tasks," [Dr. T. says], yes, we do, but we work on it to [present] for only 5 minutes, or even less. It is a shame to let people show only one problem from their whole tasks, you put so much effort [in preparing that

> task]. If so, then let one group present every week and we will see a real good activity, discuss what is really missing, what isn't, whether it could be implemented in real classroom. (Lisa, I2)

However, Kate valued her experiences in lab hours more than the rest of the participants because she had no other opportunity to work with actual students, as she explained. She stated that the lab was "the only environment I find chance to be active" in implementing tasks (Kate, I3). At the end of the semester, findings showed that her lab hour experiences worked as an effective mastery experience source for her self-efficacy:

> We observe, for example, we have written [problems], but our friends don't think the way we do. That is, we approach this [situation] like "We failed at sending our message we aimed to tell." Or we give them the manipulatives, but they don't use them the way we thought they would. (Kate, I3)

In addition to operating through mastery experiences, working on their activities during lab hours created influence on participants' efficacy beliefs as a physiological states source. For example, Angel expressed boredom as a result of implementing tasks every week. She stated that at the beginning she really enjoyed her in-lab experiences such as "printing handouts, preparing manipulatives, and distributing them," but at the end of the semester, she was bored of this and they, as a group, "just do it" (Angel, I3) in a careless manner. Similarly, Judy was anxious about implementing her tasks in the lab. She stated that she would feel more confident, if she implemented her tasks with actual students because "I interact with people at my age and older than me, I think I get a bit excited and a bit scared, but when we will have children in front of us, I will feel more relaxed" (Judy, I2). This finding showed that, as a physiological states source, implementing tasks during lab hours did not positively influence participant's self-efficacy.

Working as a group.

Preparing and implementing tasks as a group, when compared to working by oneself, was perceived as an influence on participants' self-efficacy. First of all, participants found working in a group easier than preparing tasks by themselves. For example, Cindy stated that one could write reflection papers alone, but it would be more difficult to prepare tasks. Angel explained how group work made things easier for them as follows:

> It [preparing tasks] is more faster [when working in a group]. Let's say, one is writing there, doing the thing, another creating the problem, I am writing and reviewing, one is translating into English, and so on so forth. One can think of what the other can't, searching is easier. I think group [work] is really good. I am so happy with my group this semester. (Angel, I3)

Another advantage of group work was providing different views from group members, as Angel mentioned: "One can think of what the other can't" (Angel, I3). Similarly, Kevin expressed how helpful his peers in the group were with creating their activities and generating ideas: "Even though we care a lot, there can be something missing, but in a group, if there is such thing, we are like 'Then let's do that in this way.'. . . When different ideas come up, we get the final version" (Kevin, I1). Additionally, Kevin believed they could come up with better tasks when working as a group instead of working alone:

> Group work on preparing tasks is good, for it's not the same when one person prepares as it is when 5 people prepare. Having group work in order to prepare better tasks is also good because we are going to use these [tasks] in the future. If we prepare by ourselves, and everyone can prepare something, but I can't decide if something that fits well with the objective could be prepared, or if it would be good. . . . [In group work] one says "Let's prepare this" and then another says "It would be better if we include that" and so on so forth, and there appears something good. (Kevin, I3)

Rachel also stated that group work enhanced her views about tasks, while being helpful: "With my friends in my group, I experience almost no difficulties," she

explained and added that "I think of one thing, [during group work] there are five ideas and it broadens my horizon" (Rachel, I3). From this aspect, findings showed that working in groups operated through vicarious experience source for participants' efficacy beliefs, they could learn vicariously from each other when working together. The following excerpt from Amy's interview is an example:

> When preparing tasks, for example, we are always like "What's that figure mean? Shall we add this figure to our task? I didn't get that part during the lecture," this way the group work is more useful to me. One more thing we always do is that we are not like "You do this week and the next week I will do," instead, we get together as a group and prepare [the task] 5 of us. This does real good. For instance, it creates us the environment for discussion. When there is something we don't understand, and there is definitely some figures that we don't understand through Dr. T.'s lectures, we benefit from each other. (Amy, I1)

Similarly, Cindy exemplified the way they assisted each other's learning during group work:

> I say "What is this saying here [in the textbook]? I didn't understand the activity here," or "This is what I understood [from an activity in the textbook], am I getting it right?" and then my friends [in the group] explain it to me. . . . There is definitely a way of help from others, or you easily see your mistake. (Cindy, I2)

Participants, however, stated that selecting group members right was an important determinant of the contribution of group work. The arrangement of time, and sometimes location, to meet with group members could be a problem, as they explained, whereas having experienced peers in the group contributed their knowledge and skills. Becca described the importance of people in the group through comparing two peers she worked together in the previous semester:

> It's just that you need to choose your group members well. Preparing task thing is a bit problematic for us; time [for meeting] doesn't fit everyone, it is difficult to arrange time for group work, we live in different dorms, there are some coming from outside [of campus]… In my group last semester, we were four, but always worked three of us because one was working at the

> embassy, he couldn't join us. It was always three of us… He used to send us links [to websites] sometimes, what were we supposed to do with the links?! :) They did no good… Ok, you [he] find something related to the subject, but how are you supposed to apply it? Does it even match [with the objectives]?… Or one of us was experienced, she took some other courses already and she was giving examples from there, like "We can use this here." That is, the experienced ones do real good. (Becca, I1)

Judy also had the opportunity to work with an experienced friend, let's call her Rose, who enrolled in practicum course at the same time with methods and joined her group during the time of this study. Judy could benefit from Rose's student teaching experiences which provided vicarious experiences and contributed their self-efficacy. She also stated that she "could see her mistakes when discussing the tasks we prepare" (Judy, I3). On the contrary, Lisa mentioned the problems of group work, adding up to the problems of arranging time and place for meeting:

> In my previous group, I was working with Kate, we couldn't meet with others. Usually it was either me or her, who prepared the task, and then we used to add things to each other's work. Even though this was the case, it felt like it was my classroom and I was the teacher preparing [the activity], when I worked alone instead of working with a group. . . . One more thing is that, when you do a group work, your ideas can be so much different from your friend's. For example, she may not want to prepare the task you want, or you put those [two different] tasks together and they are irrelevant. . . . We get together only to prepare the task and we are like "Let's finish this." When it is just me, it doesn't happen this way; I start earlier and I am like "Ok, that is good, I can add something else later," and meanwhile I have time to think what to do, what to include. But with the group, which was the case in the previous one, let's say you meet, you are like "We should get this done at once," and we don't really pay attention, it is a bit like slipshod. (Lisa, I1)

Our interview with Kate at the beginning of the semester gives clue about her perspective on group work as a member of Lisa's previous group. Kate didn't think she was "a person for group work" because she had "some fixed ideas and try to take them into action" (Kate, I1), which was perceived by Lisa as a problem of group work. Even though working in a group aided Kate "loosen" her strict approach, as a perfectionist, she insisted on making their tasks match her ideas and in the end, she "wasn't mostly

satisfied" with their tasks (Kate, I1). Finally, Kate changed her group and Lisa decided to work alone at the beginning of methods course in spring semester. During the semester, however, Lisa joined a group because "I was tired of explaining [to Dr. T.] why I was working alone," and she enjoyed working in group where "people are more compatible" than her previous group members, at least for a couple weeks until she left her new group (Lisa, I2). In her new group, all of the members were sharing their ideas and Lisa mentioned the contribution of these vicarious experiences to her self-efficacy:

> Now we are working in a group to make activities and in the group we are like "What shall we do?" everyone shows something. For example, we either use one from each member's ideas or we choose [all the ideas from] one of us. I mean, it is really good, like the last time it was about, what was it? Hmm… I don't remember… We were going to prepare [a task] about the Chapter 18's subject, I showed one, another friend was like "This might be too easy, let's make it more like this." From this aspect, I mean, presenting everyone's ideas, it is really good. (Lisa, I2)

Working as a group affected participants' physiological states too. Findings showed that participants enjoyed working together with their counterparts which made preparing tasks more fun. For example, Cindy explained that she "wouldn't take it," if she was working by herself because "it was boring to prepare tasks every week" (Cindy, I2). Similarly, Rachel felt the support of her peers during group work and she was happy to share the fault or success of the end product. Rachel also expressed fun that she had from group work since the beginning of the semester.

Another way of influence working in a group created was the feedback group members provided to each other. Findings showed that these statements from group members influenced participants' judgment of their capabilities to prepare and implement worthwhile mathematical tasks effectively. Two participants, Cindy and Becca, talked about the effects of feedback from group members on their efficacy beliefs. For Cindy, those feedback operated through verbal persuasion, "I feel the contribution of group work in this way, I see people who really think differently or they tell me 'Your idea is really different, it is really good,' and makes me feel more

confident" (Cindy, I1). For Becca, those feedback were more specifically corrective feedback which operated through verbal persuasion as well:

> When preparing tasks, we provide tons of feedback to each other. We are 3 people there and say at least one thing like "This is not good"… I say "That is not good" and we try to choose the best one. When this is the case, we already have a whole world of comments, and after that, when the instructor provides feedback, we get the perfect one. (Becca, I1)

Summary of the perceived effects of group work.

Group work was another component of methods course where prospective teachers prepared and implemented tasks with their peers. Findings revealed that different aspects of group work operated through different sources of self-efficacy, but mostly through physiological states (Table 10). First of all, preparing tasks as a group was perceived as mastery experience and physiological states source of self-efficacy. Second, implementing these activities in lab hours also provided mastery experience and physiological states source.

Table 10

Effects of group work through hypothesized sources of self-efficacy

Components of Group Work	Mastery Experience	Vicarious Experience	Verbal Persuasion	Physiological State
Preparing tasks as a group	✔			✔
Implementing tasks as a group	✔			✔
Working as a group		✔	✔	✔

Regarding the mastery experiences, participants started to value their implementations of tasks in the lab less because of either time limitation which did not

let them work on tasks appropriately or their need for real classroom experiences which they believed would provide more accurate information about their capabilities. And a difference occurred between preparing and implementing tasks as a group. That is, preparing tasks as a group created positive influence, whereas implementing tasks as a group did not provide such contribution to participants' self-efficacy. Task implementations as a group even had negative impact on physiological states of some participants, unlike the previous semester. Participants expressed they used to enjoy both preparing and implementing tasks, but during methods course they uttered that they only had fun when creating activities, not when using them in the lab. Finally, working as a group, when compared to working alone, was also seen as a contribution to participants' efficacy judgments and operated through vicarious experience and physiological states, as well as verbal persuasion source of self-efficacy.

4.2.2.3 Peers' Presentations

Each group of prospective teachers implemented their tasks with their peers as a part of lab hours on every Wednesday, and the influence of this process of preparing and implementing tasks were described in the previous part. Findings also showed that working on the activities their peers prepared and observing their peers' implementation of those activities affected participants' judgment of their capabilities to prepare and implement tasks effectively. In this part, how participants perceived the effects of their peers' presentations during lab hours on their self-efficacy and how this component of methods course, namely, peers' presentations operated through Bandura's (1997) hypothesized sources for self-efficacy are explained in detail.

The findings of the initial interviews revealed that only one participant, Rachel, believed that her peers' presentations in the lab was the most effective factor on her self-efficacy (Table 11). However, she changed her mind throughout the semester. During the second interviews, none of the participants viewed their peers' work as a strong influence on their efficacy beliefs, but at the end of the methods course, there were three participants to think that peers' presentations had the greatest effect on their

beliefs in their capabilities to prepare and implement tasks effectively. Despite the fact that not many participants considered their counterparts and the tasks they brought to the lab and implemented as a strong impact on their self-efficacy, findings showed that peers provided participants the models for creating and using mathematical tasks, and working on their peers' tasks influenced participants' efficacy beliefs.

Table 11

Participants who viewed peers' presentations as the most effective factor on their self-efficacy throughout the methods course

	Kevin	Kate	Cindy	Angel	Judy	Lisa	Amy	Becca	Rachel	T
Time 1									+	1
Time 2										0
Time 3			+	+			+			3

Peers as models.

Observing their counterparts to present their tasks in the lab was mainly perceived by the participants as vicarious experiences. Participants talked about the benefits of observing different tasks related to different aspects of the same subject. Since prospective teachers were expected to prepare tasks for the related week's subject, each group choosing topics (i.e. the objectives of the subject) they would like to create activities about, participants had the chance to "cover all the subject" through the activities every group brought to the lab (Cindy, I1). This way, peers' presentations as a vicarious experience source for self-efficacy also provided various examples of activities which were used in improving participants' knowledge to prepare better tasks, as Becca explained:

> When I see it [peers' tasks], I think of a different task and I'm like "This could have been done, too. Damn, why couldn't we think of it?". . . Different problems, what different problems could be written, I mean, we say

> "Oh, I have never thought of posing that problem!", I don't know, I can prepare [tasks that are] combination of those [peers' tasks]. I want to listen to my friends [their presentations] because of this: Different problems, different problems. (Becca, I3)

Findings showed that participants were vicariously learning new ways of creating worthwhile mathematical tasks through their counterparts as well. For instance, Cindy said that, through her peers' presentations, she could learn about the use of different manipulatives, either hands-on or technological, for the similar tasks related to same subject. Lisa also mentioned the mathematical games she learned through her peers' presentations, which she believed that would make mathematics more fun for students. Similarly, "games are something I have never thought about," Angel stated, "these are all experiences, I am going to use them all in the future" (Angel, I3). Seeing such good examples guided participants when preparing their own tasks, she said, "when we are preparing our tasks, we talk in the group 'Last week this was used, we let's try doing this way' or 'This was the outline of their handouts, let's do ours this way'" (Amy, I1).

Additionally, findings showed that participants learned from their peers' mistakes, too. The following excerpt from the first interview with Rachel explained how she vicariously learned from her friends' presentations, in terms of the mistakes they made:

> There [in the lab] I see 6-7 activities in a day and I say to myself "This could too be prepared." Then I even comment on their tasks, like "This is really good, that is really bad, you could have done this way." I mean, as I see there a mistake I could have done, I am not going to do that [mistake]… This is how it [peers' presentations] helps me improve. (Rachel, I1)

On the other hand, when participant failed to understand tasks in the textbook, observing their peers' presentations helped them to learn how those tasks could be implemented. This finding was similar to the contribution of group work where participants vicariously learned preparing tasks through explaining each other. An

example of the way their counterparts' work in the lab hours from that sense could be what Angel said in our second interview:

> For instance, I didn't understand [tasks in the textbook] and girls were implementing their tasks like "This will be done in that way," I say "How is it going to be implemented?" and they are telling me this and this. I mean, I understand it better when they are doing it. (Angel, I2)

Perceiving their peers as models, participants compared their own performances with their peers', while watching their presentation of activities in the lab. For example, Kate referred to her peers' tasks as reflections of the tasks she prepared with her group members to see if they have made similar mistakes. Similarly, Becca uttered that "every week I compare my task with theirs, with what they have prepared" and she was "surprised" to see her peers could create original tasks, "feel like I want to applaud them because you spend 2-3 hours on thinking, go through different resources trying to find something and you find something on average, but they find something perfect!" (Becca, I1).

However, the effect of tasks that other groups prepared on participants' efficacy beliefs was dependent on the quality of those tasks. Participants explained that when their peers brought high quality tasks or presented interesting ideas, they felt motivated to do better, while using those ideas as a vicarious learning source. For example, Rachel stated that she compared her tasks with her peers' high quality tasks and creative ideas, and felt the "push" to put more effort into group work to improve her skills. On the contrary, when participants were given low quality tasks or brought "ordinary examples" to the lab, they did not value such tasks and as a result, their self-efficacy was not influenced. Cindy described this difference and the importance of the quality of peers' presentations well:

> When they raise the bar, I'm like "Wow!", let's say that group is Single Ladies :), "They did this, look at our activity, it is like a child's play," this is what I think sometimes, or "Our activity has excelled itself," I say. I mean, it is like comparison, but not in a childish way. But still, I decide like "Look at others' effort, we too make an effort [to prepare worthwhile tasks], but seems

like it is not enough. Next time, let's do better when preparing the next activity." (Cindy, I2)

Lisa was not impressed with her counterparts' well-prepared tasks, though. In contrast to her thoughts at the beginning of the semester, Lisa was the only participant to state that peers' presentations didn't effect her beliefs in her capabilities. "I'm not like 'They did this and I should do like that, too', I mean, I just look at what they do and there are some good ones that I plan to implement in the future," she explained (Lisa, I1). From her aspect, peers were not effective as a source of vicarious experiences and she didn't value her other groups' work. Lisa wasn't either learning from her peers' mistakes:

> I see some activities that I would never implement. Sometimes I don't even understand their activities, they are including some ridiculous things and I'm like "I don't even understand it myself, why should I give this to the students?" Okay, they [such tasks] look appealing, but make no sense to me and probably make no sense to students, either. (Lisa, I2)

A similar thought was also spoken by Becca later in the semester. Recall that participants started to complain about the lack of time spent for lab implementations. Considering their peers' presentations, participants stated they were not influenced because there was no actual implementation due to time limitations. As a result, Lisa and Becca believed, the quality of peers' tasks dropped down. Becca claimed that her friends did not pay attention to the solution of the activities they created, for they were not working on each others' tasks closely, and so peers' work included mistakes. For example, "she says 'I am going to present this with the 1/7 fraction bar,' do you even have a 1/7 fraction bar? . . . They don't pay attention to numbers [in their tasks]" (Becca, I2). Lisa also explained:

> Most of us use what we find online and most of our tasks are similar. Instead of doing this, if one group had prepared real good tasks each week, we could have seen what was missing or so on. I really think/there are 6 groups, 5 or 6 groups, and each of them prepare tasks, and we don't even look at all of those 6. This is a waste of effort, I think. (Lisa, I2)

Working on peers' tasks.

Prospective teachers not only observed but also worked on each others' tasks, even though participants thought there was a decline in the time spent on implementing tasks. Findings showed that working on peers' tasks operated through the physiological states and created effect on participants' self-efficacy. Again, the quality of peers' work was a determinant, as seen in the following excerpt from Angel's interview:

> Some [tasks that peers prepared] are boring. For example, they are too long and I can't concentrate, I don't feel like reading. Some directly copy [what they find] from the internet, some [mathematical] games are too long, I don't like such [tasks] usually, but some contribute in some way, like today, which group was it? They did really good job, I really like it. Secret Circle, they prepared very well. (Angel, I2)

Becca enjoyed working on the tasks her counterparts brought to the class and found it easier to do than preparing tasks:

> Working on [tasks] is really good, but preparing, to prepare it, you need to know the way it is going to be implemented. I really don't like preparing. . . . This is why I like peers' tasks better, I don't have to think over, I just work on a prepared task. It's just "Hmm, can I implement this [with students] or not?" (Becca, I2)

Even though Becca enjoyed working on her peers' tasks, she felt like they were in a rush during lab hours, as a result of time limitation. "We go there [to the lab] and we are immediately like 'I prepared this, I wrote this problem,'" she complained, they were not working on each other's tasks like they did in the previous semester (Becca, I2).

Summary of peers' presentations.

A part of lab hours, peers' presentations were perceived as an influence on participants' self-efficacy. This component of methods course created effect on participants' judgment of their capabilities to prepare and implement worthwhile mathematical tasks in two ways. Participants, first, regarded their peers as models, and they vicariously learned from these counterparts' implementation of tasks in the lab.

Moreover, working on their peers' tasks affected participants' self-efficacy through operating as a physiological state source. Either way, the quality of the activities their friends brought to the class determined the influence it would make. That is, when participants did not appreciate the quality of their peers' tasks, they neither learned vicariously from them, nor enjoyed working on them. Table 12 summarizes the effects of feedback created through operating the theorized sources of self-efficacy.

Table 12

Effects of peers' presentations through hypothesized sources of self-efficacy

Components of Peers' Presentations	Mastery Experience	Vicarious Experience	Verbal Persuasion	Physiological State
Peers as models		✔		
Working on peers' tasks				✔

4.2.2.4 Feedback on Group Work

Another factor which was perceived as an influence on participants' judgements of their capabilities to prepare and implement worthwhile mathematical tasks effectively was the feedback on group performances. Feedback included the statements participants received from the instructor and from their peers. Prospective teachers and the instructor discussed each group's work as a part of lab hours on every Wednesday, following each group's implementation of their tasks.

Findings of the initial interviews revealed that 5 out of 9 participants viewed feedback as the most effective factor on their self-efficacy (Table 13). However, there was a decrease in this number throughout the semester, and at the end of the semester only 2 participants, Judy and Rachel, believed feedback had the greatest impact on their efficacy beliefs. Those two participants were also expecting this influence of feedback

on their self-efficacy from the beginning of the methods course. Even though Judy changed her mind in the mid-semester interviews, at the end of the semester she was one of the participants to state that feedback was the most effective component of methods course in terms of influencing her efficacy beliefs to prepare and implement mathematical tasks effectively. The other 3 of the 5 participants, Cindy, Amy, and Becca, who expected feedback to be the strongest factor didn't think that feedback made such a strong contribution to their judgements of capabilities, after completing methods course.

Table 13

Participants who viewed feedback as the most effective factor on their self-efficacy throughout the methods course

	Kevin	Kate	Cindy	Angel	Judy	Lisa	Amy	Becca	Rachel	T
Time 1			+		+		+	+	+	5
Time 2		+				+		+	+	4
Time 3					+				+	2

Regarding *how* feedback created effect on participants' efficacy beliefs, even among those who didn't view feedback as a strongest component of methods course on their self-efficacy, findings showed that feedback provided by their peers and the instructor influenced participants' self-efficacy. For example, Kate stated that "since we don't have the opportunity to implement [tasks] in real classroom context, I rather rely on my peers' and Dr. T.'s feedback" (Kate, I3). In this part, perceived effects of feedback on participants efficacy beliefs are explained in detail, from the lens of theorized sources of self-efficacy. First, I describe how feedback in general helped participants to improve their knowledge and skills, which in turn contributed to participants' confidence in their capabilities to prepare and implement tasks effectively. Then, I explain how feedback from the instructor and peers affected participants' self-efficacy, respectively.

Recall that fieldwork was not included in the methods course. However, through feedback participants received on their group work of preparing and implementing tasks, "we can imagine the implementation [of our tasks] in actual context" (Kevin, I1). This way, participants could see what they did wrong either in their tasks or their implementation of those tasks and learn how to improve themselves, which in turn boosted their efficacy beliefs operating through verbal persuasion source. Lisa described how feedback provided different perspectives on creating tasks and contributed the development of her capabilities as follows:

> I am listening [to the feedback] and there are really different suggestions, and I'm like "Why couldn't I think that before?" or there are [others] finding mistakes in the problem you have written or suggesting to do it in different ways and you see that you didn't think that way, this is a good thing. . . . It is a good thing to tell people their imperfections, I think, it is good to know what your deficiencies are so that you can improve that. But if you don't know, if no one tells you that, you may feel like "I am efficacious.". . . For example, when I don't like it [peers' task], I say it, why shouldn't I? Or I say "It would have been better this way, I wish you did it that way," and I think it is useful to me that they tell me so because if they don't, I prepare the same thing [task] all the time, they should tell me so that I change it. (Lisa, I1)

As seen in the above excerpt, Lisa perceived the influence of feedback in a positive way generally and experienced contribution to her efficacy belief from this verbal persuasion source of self-efficacy. Lisa also explained that she relied on the feedback to judge her capabilities, "to see if I can really do it or not, or what my deficiency is" that she could improve the ways she prepared and implemented tasks (Lisa, I3). From this aspect, participants referred to the feedback not only they received, but also to their peers received. That is, when they were observing their peers' presentations, they were also paying attention to the feedback provided to their peers and learned from those feedback, too. For example, Kate explained:

> I weight the feedback provided to them [peers] for myself to see if there are similar issues with the task I prepared as well. Sometimes I even think of my previous tasks, like "Were there such issues with mine?" . . . I

> try to assess not only the feedback provided to me, but also feedback to other [peers'] tasks this way, I am here to improve. (Kate, I1)

Similarly, Angel stated that "we see, understand when others' mistakes are spoken too, not only ours" (Angel, I1). Another participant, Judy, mentioned that feedback on her peers' tasks influenced her judgment of skills, because "when my peers are presenting their tasks, I say 'If I had prepared that same task, I would have presented it in the same way they did, so I would have made the same mistake which received the instructor's feedback'" (Judy, I1). These findings showed that participants' peers provided models, as explained in the previous part, that they could vicariously learn from the feedback their counterparts received. However, this aspect of the influence of feedback was stated only at the beginning of the semester. Throughout the semester participants did not mention the effect of feedback provided to their peers. Thus, the influence of feedback as a vicarious experience source is not included in the effects methods course created.

In terms of the feedback they received, it was found that participants used those feedback on their previous week's tasks as guides to prepare their next week's tasks. Amy stated that during their group work, they reminded each other what the instructor or their peers talked about and tried to handle those issues based on the suggestions they received through feedback. She believed that this way she felt the positive influence of feedback on her self-efficacy. Similarly, Kate explained that through feedback she could "see what I missed, but they could see" and improve herself (Kate, I2). Angel also talked about the difference between positive and negative feedback, expressing that negative feedback contributed her development more:

> If it is positive, it is good, it motivates. [Positive feedback] don't contribute, but just motivates and it's good. If it is negative, we are like "Hmm, this and this we did wrong, then we should correct that" and it provides positive contribution. . . . Because, to me, the task I prepare is good, I have nothing for that, but if I prepare something bad, it makes me happy when it is fixed. I mean, I did it wrong and it was corrected, I didn't continue

> doing it wrong, I learned how to do it right, and this contributes a lot. (Angel, I2)

When I asked each participant to describe how the feedback they received during the methods course affected their judgement of capabilities, they treated the feedback provided by the instructor and by their peers from other groups differently. Thus, these two sources of feedback as components of methods course were analyzed separately, and the impact of each type of feedback is presented next.

Feedback from the instructor.

Findings showed that the instructor's feedback operated through verbal persuasion source for participants' judgements of their own capabilities to prepare and implement mathematical tasks. Participants believed they could create worthwhile tasks, when "the instructor told us that [our task] is good" and they realized their progress (Angel, I1). Considering the ways the instructor framed her feedback, Amy stated that Dr. T.'s feedback always had a positive influence even the feedback she provided were negative because "if the instructor tells that it [task] is good, then you use if :) and if she says it's not good, then you try to avoid using it. That means it is always useful, always leads you to the better" (Amy, I1). This finding was partly a result of the lack of real classroom experiences, though. Participants relied on Dr. T.'s feedback, for they were not able to see the outcomes of their task implementations in actual classroom context. Becca explained this:

> Preparing tasks is not the issue, but knowing whether it is right or wrong is. I mean, okay, you prepared the task, but you are not implementing it, maybe you are bad at classroom management? maybe you don't have the capability? maybe you are deficient at something? The instructor's feedback will be important for me. (Becca, I1)

Additionally, participants referred to the instructor's feedback when preparing and implementing tasks, like they did when judging their capabilities. For instance, Amy explained:

> What would happen if we prepared a task, but the instructor didn't see it? Would it be appropriate to implement that task in classroom? When she tells us to change this and that, we see the task could not be implemented in classroom. So, it is really important that the instructor provides us feedback. . . . We prepare the task, okay, this is good, but maybe we have done something wrong, if the instructor doesn't make any comments, I can't know whether it is appropriate to implement this task. I can't learn this from anywhere, and this is why I say the instructor's feedback are important. (Amy, I3)

Similarly, Angel emphasized the importance, and the necessity, of receiving feedback from Dr. T. as follows:

> Then, for example, she [Dr. T.] looks at each of our [tasks], provide feedback. If she didn't do this, we would prepare it shoddily, like "The instructor doesn't even read it, doesn't look at it," isn't it just a homework, then? We are still students, we are not aware of it [the importance of preparing tasks effectively] :) And we have other homework. We would just prepare [tasks] shoddily and bring it here. It is important to improve preparing tasks that the instructor provides feedback, [such as] "Correct this in that way, do this other thing." (Angel, I2)

Findings also revealed that participants put much emphasis on the instructor's feedback, since they regarded Dr. T. as knowledgeable and credible. Thus, participants valued feedback from the instructor more than the feedback their counterparts provided. Judy, for example, believed Dr. T.'s feedback were more "reasonable" than her peers' feedback. And Kevin explained the difference between feedback from Dr. T. and his counterparts in our mid-semester interview:

> Dr. T. tells us our mistakes which is useful for us to prepare better task. . . . Let's say we are criticizing but it feels like we are talking about small details. One should have the knowledge of the content to provide feedback, should be really experienced and this is what Dr. T. has. I mean, this is why her feedback are better. . . . She is telling us what is missing in our tasks, how to prepare it more effectively, what misconceptions students can face and how we can get over them; we learn about these aspects and it is like gaining teaching experience without actually teaching. (Kevin, I2)

As seen in the above excerpt, the instructor framed her negative feedback focusing on the ways to improve the tasks participants prepared and as a result, her feedback were perceived as a contribution to participants' improvement of required knowledge and skills. From this aspect, when participants received less negative feedback, they expressed stronger beliefs in their capabilities. An example from the interview with Kevin again could be that at the end of the semester he said that was feeling efficacious because "Dr. T. is not criticizing that much as she did in the previous semester" (Kevin, I3). The less he and his group members received negative statements from the instructor, the more efficacious Kevin felt. Similarly, Cindy uttered "Compared to the previous semester, the instructor likes our activities more, 'You improved a lot' or she talks about mistakes less, and I like this" (Cindy, I2). In this example, the instructor's positive feedback with a focus on the progress in the work of Cindy and her group members boosted Cindy's efficacy beliefs. Still, as a perfectionist, sometimes she found it hard to receive negative feedback.

> When I am the one assessed, it feels a bit frustrating, feels like I am making mistakes all the time. Actually I didn't receive much negative feedback, but when I think like a perfectionist, even with tiny bit of criticism from the instructor I am like "I spent hours on that and still there is a problem," I mean, I feel bad when I think like a perfectionist. . . . Let's say we prepare an activity, when the instructor likes it, I get happy like "Yes, I can prepare activity", I mean, it [instructor's feedback] has a positive effect there. (Cindy, I2)

Kate, another participant who described herself as a perfectionist, expressed dislike for negative feedback as well. But unlike Cindy, Kate said she could manage not to feel the negative influence of such feedback, for she was aware of the contribution of negative feedback to her improvement. Yet, there were other participants who talked about the negative influence of those negative statements. Findings from the second round of interviews showed that participants started to experience negative effect of the instructor's feedback as they perceived Dr. T.'s statements like "criticism." For instance, a recipient of negative feedback from Dr. T., Judy uttered that she felt "humiliated" when

the instructor made comments on their (i.e. prospective teachers') performances or capabilities. She regarded negative feedback which focused on her abilities as a negative influence. Following excerpt from the last interview with Judy describes her thoughts about this:

> "You can't do it, it has left only a year, how are you supposed to do it?" Actually, we need [to hear] this a little, but it shakes my confidence a bit, I feel anxious. Maybe this is a different technique that the instructor has to use, but it makes me a little sad :) (Judy, I3)

Still, Judy was able to handle the negative feedback Dr. T. provided, for she also received positive comments on her progress from Dr. T. Thus, instead of avoiding from putting effort to improve her skills, she persevered regardless of the criticism:

> Let's say, when we are not prepared for the subject, she says heart-breaking things, but when I study, it's reverse, she says things like "You didn't study last week, but you are doing better lately, you see." I mean, she is aware of everything. So, even the times she hurts me, I realize that it is my deficiency. Then, she has the right to get angry like that. (Judy, I3)

Becca, on the other hand, stated that the instructor's negative feedback didn't affect her emotions negatively, at the beginning of the semester:

> For example, there are times when the instructor doesn't like the activity at all, says "This is completely imperfect. What kind of thing [task] is that?" But I never get upset those times, don't take it personal. Why? Because everyone in the lab are my friends, why should I be ashamed in front of them? Or, I am still learning this thing [preparing tasks], it is so normal that I make mistakes, I am not an expert to bring something perfect here. . . . The best method of learning is to get your fault corrected, no one ever forgets this. So, the instructor's criticism doesn't influence me emotionally. (Becca, I1)

However, in parallel with the change in her perceptions of Dr. T.'s feedback, Becca started to feel the negative influence of those feedback and got overwhelmed when preparing tasks. She uttered that her confidence was shaken because "the instructor doesn't approve anything" like she did in the previous semester, "she used to like almost all of our activities," she claimed (Becca, I2). Becca believed the tasks they

prepared in the previous semester received "soft criticism", but in spring semester the criticism got "harsh," she said, "Wouldn't any of our activities get likes?!" And regardless of how much effort she expended to prepare worthwhile tasks, she claimed to receive "criticism" which also influenced her affective status negatively:

> [Dr. T.'s] feedback started to be more harsh… I mean, she might be expecting some things from us, we have taken this course in the first semester, right? Then we should prepare better tasks. But what was our trouble in the first semester? It was [determining] the grade level, we couldn't match [the tasks with] the grade level. Now we are always checking the curriculum, adjust the grade level, we know what the instructor likes, she wants examples, like when we provide examples, she used to like it a lot, and we do so, we write everything in detail, we create tasks to promote manipulative use [. . .] go through different books and so on, then we receive harsh criticism and it hurts. And can't anything get likes? We can't get our activity liked for the last few weeks. (Becca, I2)

At the end of the semester, because Becca believed she improved as she followed Dr. T.'s suggestions, she started to "mind" Dr. T.'s negative feedback less so as to avoid the negative influence on her self-efficacy:

> In general, we prepare [tasks] based on [feedback from] Dr. T., not on the subject, "Would Dr. T. like this? Would Dr. T. say that?", so this is why we always have difficulty. . . . For example, we used to add estimation at the end of the task, now we took it to the beginning, because Dr. T. says "Why do you give it at the end? Let the child estimate first, then she will find the answer and compare her result" and we pay attention to that. I mean, since we prepare [the task] focusing on what Dr. T. likes, what she wants, it is hard. . . . When I say 'what Dr. T. likes', I mean 'the most appropriate activity', because the instructor is pushing us to do the perfect [task], so it means this is the best one and we will pay attention to it the next time. . . . We do everything so that the instructor won't say "Yeah yeah… Okay, just another typical [mathematical] problem. . . . I used to get pissed off at the beginning [of the semester], like "I read [the chapter], did what she said, why am I scolded?", but not I no longer/I mean, if I can answer [Dr. T.'s questions], then it's fine. (Becca, I3)

Feedback from peers.

Feedback from peers were also found to be effective by participants on their efficacy beliefs for preparing and implementing worthwhile mathematical tasks. Feedback from peers were provided by their counterparts who were members of groups other than participants' own groups. Entering the methods class, as a result of their experiences from the previous semester, the contribution of comments by peers on participants' work was what participants expected. Based on the feedback they received before from their counterparts, participants described their peers' feedback as a positive impact on their self-efficacy and valued these feedback when judging their own capabilities. For example, following excerpt shows how Rachel described the effect those feedback:

> My friends' thoughts are really important to me, because they comment directly without any worries about grading. "Wish you added a few more examples, it would be better if you used manipulatives, this problem is too long," they see what we can't see and tell us that. (Rachel, I1)

Similar to Rachel's explanation, participants received negative feedback from peers which included information to enhance their knowledge and skills to prepare and implement tasks effectively, and they valued those statements. Even though participants regarded their peers' feedback as a verbal persuasion source for their efficacy beliefs, their friends' opinions were less powerful than the instructor's. Findings revealed that participants sometimes tended to ignore their counterparts' feedback because their counterparts were "newbies," like Judy described:

> My friends are like me, indeed, they are newbies. I may doubt the reliability of their feedback. For example, if a friend criticize me and I believe that I am right, then I might think like "She couldn't see how much time I spent on that part of my presentation and this is why she made such wrong comment." (Judy, I1)

There were also participants who found their peers' comments "ridiculous," when their performances drew criticism rather than helpful guidance on improving

knowledge and skills. Cindy, for instance, explained that some of her friends tried to make small mistakes appear like big issues and criticize those aspects of tasks, instead of simply covering them. She also didn't care much about feedback from peers who stick to one way of doing things, when Cindy preferred to go with different ways. Thus, she didn't pay attention to feedback from her peers, unless the instructor supported them through her comments such as "Yes, I agree with that. See, your friend is saying this and I think you should fix this.":

> Some friends can also make ridiculous comments :) But, of course, friends influence [self-efficacy], too. If one made a reasonable comment, which makes sense to me, and if the instructor supported [that comment], it makes greater effect. But if the instructor didn't support him and corrected what he said, then it feels like, I don't care about it at all. But if the instructor didn't support when a friend makes reasonable comment, I might take into account. I mean, if the instructor doesn't support [a comment], but that [comment] makes sense to me, then I take it [as an influence]. (Cindy, I1)

And Cindy later explained in our last interview session:

> Rather than the responds from the class, respond or criticism from someone who knows it all makes more sense to me. I mean, we are all on the same base here, same views with my friends, we all reached to a certain point in some ways, we all try to improve. If we think our levels are equal, would it matter more what they say or what someone who knows it all? Of course Dr. T. .knows everything better, she affects me more. I mean, when she says something, I change it. But, let's say, she didn't care much about it, I mean she liked it without making it a big deal, and one of my friends said "This is not good", then I don't change it :D (Cindy, I3)

Throughout the semester, there was a negative change in the way participants described their peers feedback. As findings revealed, participants started to think that their counterparts made comments on their performances just because they had to, that is, because Dr. T. required prospective teachers to assess each other's work. Thus, these obligatory statements lacked the quality to contribute participants' efficacy beliefs and participants believed their peers' feedback were "useless." Like Angel stated, peers were reluctant to provide feedback which would help with her progress, and when they did,

they spoke "nonsense" (Angel, I2). She explained how her initial perception about the quality of her peers' feedback changed throughout the course:

> I remember saying that "there is no ulterior motives [behind peers' feedback], they are doing it so well" and so on, but this semester I don't think that is true, it feels to me like they are looking for things [e.g. mistakes], some of them are intentionally like "This is wrong. You should have used that," some make good comments, but some of them are saying that to criticize, I think. And these are all effects, of course. Today I was thinking like, to be economical, I narrowed paper margins before printing out our handouts, then I told Becca "The margins are too narrow, we must not let them ask 'Where is the space for students to write their solutions?'" so we changed it right there on the word file and said "We will explain that we narrowed the margins on the handout to be economical," we are even thinking of such things [to avoid criticism] :) (Angel, I2)

In our last interview, Becca mentioned the decline in the quality of feedback from peers as well:

> Last semester, I was in the other section. Now it's changed, it's all girls' section, everyone is a chatterbox, everyone takes things too serious. I'm not saying they shouldn't take it serious, but they are making it a big deal, they go over issues too much, I didn't like this. They are all my friends and I love them, but it's not good that all those girls are together, it's a problem. The instructor is criticizing [our tasks] already and then they criticize, too. Instead, let's pay attention to the language, "Dr. T., wouldn't it be better if we handle this [issue] in that way? You did this [task], but wouldn't it be better if you have done it that way?" I mean, they don't even say "Wow! That's great!" when they see good [tasks]. (Becca, I3)

As seen in the above excerpt, participants started to view their peers' statements as harsh criticism, rather than as means of providing different ideas and suggestions to develop skills. Peers' feedback, operating through verbal persuasion, did not create negative influence on participants' efficacy beliefs, though. Because participants preferred not to take into account the negative statements, or criticism, they received from peers, findings showed no negative effect of those feedback on their self-

efficacy. Amy, for instance, explained how she ignored such criticism from peers as follows:

> There was nothing wrong with our task, the instructor said nothing, but, for example, there was one [peer] telling us that "There were many other problems to write about this subject." I mean, instead of saying this, saying nothing is better. There were some [peers] making comments just to be saying something. Of course, one shouldn't stuck on these [comments], but I was really upset. I mean, not really upset, but more like pissed off, because it was an unnecessary comment. If you need to make a comment, then do so and if I am wrong, I take it into account. We really take into account when we make a mistake, "See this? We missed it. Last week we received such feedback, how come we missed that?" and so on. But if there are such comments, we don't care about them. In the end, it [problem(s) in the task] was what we wanted to ask, okay, there are many other problems to write, but this is what we wrote. (Amy, I3)

Summary of the perceived effects of feedback.

In this part, the influence of feedback on group work was explained. Findings showed that feedback from the instructor and their peers affected participants' efficacy beliefs for preparing and implementing worthwhile mathematical tasks, and feedback mainly operated through verbal persuasion source of self-efficacy (Table 14). However, there was a change in how participants interpreted the information these feedback provided. On the one hand, the credibility of the person who provided the feedback was important for participants. Thus, feedback from Dr. T. had a stronger influence that the feedback participants received from their peers. On the other hand, the type of feedback also determined the impact on participants' self-efficacy. When feedback, even in negative, included guidance to improve knowledge and skills to prepare and implement tasks, participants expressed positive contribution to their efficacy beliefs. But when feedback were formed as criticism, participants uttered negative effects, and these effects also operated through physiological states source. Findings revealed that when participants were faced with criticism from Dr. T., they were affected negatively, but they persisted to work on their improvement because they were aware of their progress.

This state of awareness also helped them overcome the harsh comments of their peers that they simply "ignored."

Table 14

Effects of feedback on group work through hypothesized sources of self-efficacy

Components of Feedback	Mastery Experience	Vicarious Experience	Verbal Persuasion	Physiological State
Feedback from the instructor			✔	✔
Feedback from peers			✔	

Finally, feedback also operated through vicarious experience source, as findings of the initial interviews revealed. Listening to the comments their peers' received, participants could vicariously learn to improve their own knowledge and skills to prepare and implement tasks. Throughout the semester, though, participants did not talk about the influence of feedback provided to their peers, and so, this aspect of feedback is not regarded as an effect of methods course in this study.

4.2.2.5 Assigned Readings

Prospective teachers were required to complete assigned readings prior to lecture hours. These readings included a chapter from the main textbook, *Elementary and Middle School Mathematics: Teaching Developmentally* (Van de Walle, Karp & Bay-Williams, 2010). A methods of teaching mathematics book written by a Turkish professor in mathematics education and the Grades 6-8 mathematics curriculum covered in Turkey were suggested to the prospective teachers to help them relate the chapter from main textbook to the Turkish mathematics curriculum and classroom context, as well as to provide sources for prospective teachers to prepare tasks that are appropriate to Turkish context and could be implemented in their future teaching practices.

Additional reference books about teaching mathematics were also provided in the course syllabus (Appendix B). Findings showed that the assigned readings (i.e. textbook and additional readings) were perceived as an effect on participants' judgment of their capabilities to prepare and implement tasks effectively. The way that required readings influenced participants' self-efficacy and how this component of methods course created effect in terms of Bandura's (1997) hypothesized sources for self-efficacy are explained in this part.

Textbook.

The textbook used in methods course was *Elementary and Middle School Mathematics: Teaching Developmentally* (Van de Walle, Karp & Bay-Williams, 2010), and findings showed that participants regarded this book as a vicarious learning source which contributed to their knowledge of preparing and implementing worthwhile tasks effectively and, as a result, boosted their self-efficacy. Amy, for example, described the contribution of textbook: "[The textbook] is really really good, I mean, there are really comprehensible tasks in the book, and because the content [of the book] includes a lot variety [of tasks], I think this semester it is real good" (Amy, I2).

However, at the time of this study, this book was found only in its original language, English, which caused trouble for some participants. Regarding her experiences in the previous semester, in our first interview session Angel stated that she got bored when reading the assigned chapter because couldn't concentrate when reading in English. Thus, she did not talk about the positive influence of textbook on her self-efficacy. Yet, she did not mention this difficulty again in our following interviews, which suggests that Angel could get over this problem. Amy, on the other hand, stated that reading a book in English was a negative influence on her performance in quizzes that were given prior to lecture hours. She explained this as follows:

> If I were reading [chapters] in Turkish, if the language of education here was in Turkish, I could have easily attend lectures well-prepared. And my probability of failing at the entrance quizzes when compared to this education in English, would be much lower. But when reading this chapter

> [in English], for example, it as 35 pages long today, how am I supposed to read it all? We could have a quiz, there are too many [examples of] activities [to comprehend], we didn't have a quiz in the end, but if we had, that would have been real trouble for me. (Amy, I3)

When compared to previous semesters' readings, Cindy also complained about the difficulty of reading long and dense chapters, for it took longer time to finish than it did in the previous semester to read shorter and lighter chapters: "In the previous [semester's readings] I spent, let's say, half an hour [for reading], now I spend 1,5 hours or so because I have difficulty to understand the activities" (Cindy, I2). Regardless of the trouble she experienced, since Cindy believed in the "positive outcomes" of reading prior to lecture hours, she put more effort to improve her learning from the textbook. And in the end, she perceived the textbook as a positive influence on her self-efficacy.

> And [reading the assigned chapter] has some positive outcomes, like I said, instead of teaching through nonsense memorization [in the future], you understand [the subject] yourself first. If you understood it wrong, let's say you got it wrong, you definitely learn something when the instructor is lecturing, you remember the activities [from that week's chapter] like "I got this wrong, but the instructor corrected." . . . Because if I go [to the class on Mondays] without understanding [the chapter] beforehand, I stare into space during lectures. I mean, this semester is literally pushing me harder, but it doesn't mean that I understand nothing [from the methods course], I still understand, but I need to expend more effort. (Cindy, I2)

Additional readings.

Although prospective teachers were required to read the textbook before lecture meetings on every Monday, the instructor was also expecting them to take a look at the curriculum and that methods book in Turkish so that they could discuss the assigned chapter in light of Turkish context. However, findings showed that Lisa and Cindy were overwhelmed by the workload of methods course adding up to the assignments of other courses. Lisa explained her situation as follows:

> The instructor is always asking as to both read Van de Walle and look at the 6-8th curriculum and the methods book in Turkish. I'm not taking only

> methods course, I enrolled in 8 courses, and I can't spare time for each [course]. If [Dr. T.] told me like "This [book] is enough," okay, maybe it won't really be enough, but when I read Van de Walle, I don't feel the need to have a look at the others. (Lisa, I2)

As described in the excerpt from Lisa's interview, the overload of course demands, regarding methods course and other courses, negatively affected Lisa, and she did not view additional readings as a means of enhancement in her knowledge. In contrast to Lisa's views, Cindy described the influence these readings created as positive, despite her being overwhelmed because of the courseload. The findings of the interview with Cindy showed that she believed she was vicariously learning from these symbolic modeling sources (i.e. additional readings), which boosted her self-efficacy. Even though "there are times when I feel all the magnitude of courses, like [I] have to go to bed at 3 a.m." just to complete the assignments, she thought these readings, of the curriculum for example, helped her "keep up with the future" (Cindy, I3). This perception of being familiar with the curriculum which is currently implemented by teachers enhanced Cindy's self-efficacy. Rachel and Amy also mentioned this positive effect of reading curriculum book. For example, Rachel explained:

> If there wasn't methods course, I don't think I would ever buy the methods book in Turkish or [be like] "I'll buy the curriculum book already, have it as a bedside book," I would never do such thing, and actually, after I purchased these books, I realized that they were necessary. . . . Now the curriculum book provides us real help because we already look at what is in it, in the future, I mean, the thing our current teachers are looking at, we study it now. This gives us little acquaintance [with the curriculum], improves us a lot. (Rachel, I3)

Describing the positive contribution of learning about the Grades 6-8 mathematics curriculum in terms of getting familiar with the content she is going to teach in the future, Amy also mentioned the need for reading the curriculum in addition to the main textbook.

> I have to look at the curriculum, in the end I learned something related to the American [mathematics education] system [from the textbook], I will study the curriculum today [to see] where we are, what we are doing, what [the concepts] are called in Turkish. . . . I think [studying] the curriculum book this semester is great. I mean, now I can recall the lesson plan [in the curriculum book], what is written on which page, I can even picture the images in an activity I have seen [in the curriculum]. I mean, toward the [curriculum] book/at least we have touched it, seen it, read it, like what kind of activities there are, or else we would be a stranger [to it]. (Amy, I3)

Summary of assigned readings.

Findings showed that participants perceived assigned readings as an influence on their self-efficacy beliefs. The textbook which was used as the main book of methods course and additional readings which included the curriculum and the other books on teaching mathematics (especially a methods book in Turkish) constituted the "assigned readings" factor. This factor was mainly described as a positive effect operating through vicarious experience source of self-efficacy (Table 15). Participants enhanced their knowledge through these books which provided symbolic models for preparing and implementing worthwhile mathematical tasks. Yet, the language of the textbook and the load of required readings could overwhelm participants. Still, of the participants who complained about reading in English and overload of readings, Lisa did not persevere in the face of these difficulties, while other participants' judgments of capabilities were not negatively affected as they put more effort to overcome such obstacles.

Table 15

Effects of assigned readings through hypothesized sources of self-efficacy

Components of Assigned Readings	Mastery Experience	Vicarious Experience	Verbal Persuasion	Physiological State
Textbook		✔		
Additional readings		✔		

4.2.2.6 Examination

As a part of methods course, unannounced quizzes right before lecture hours, a midterm, and a final exam were used to evaluate prospective teachers' performances. Findings showed that examination was perceived as a factor that influenced participants' self-efficacy. The examination factor included unannounced quizzes and the midterm, but not the final exam because the data collection for this study was ended on the 12th week of 14 week-long methods course[6]. In this part, the perceived effect of examination and the ways it created effect on participants' judgment of capabilities are explained in light of theorized sources of self-efficacy (Bandura, 1997).

Unannounced quizzes.

Throughout the semester there were several unannounced quizzes prospective teachers were assigned prior to the lectures on Mondays. There were two-three open-ended questions in each quiz, and these questions were based on that week's chapter from the textbook. The top score a prospective teacher could get from a quiz was 10, and at the end of the semester the average of all quizzes constituted at most 10 points of overall grade. Considering the impact of these quizzes on their grades and the unannounced characteristic of quizzes, participants indicated more responsibility to

[6] Recall that prospective teachers who enrolled in methods course in the spring of 2012 participated in another study which was conducted throughout the last two weeks of methods course (see Chapter 3).

complete the assigned readings. Cindy, for instance, uttered that "there are quizzes every week, I mean, we prepare [for the lectures] as if there is a quiz every week. . . . Students prepare [for the class] because of the quizzes, and we do so, we go to the class prepared" (Cindy, I2).

From this aspect, the unannounced quizzes created an indirect effect on participants' self-efficacy through influencing their performances in vicariously learning from the textbook while preparing for the lectures by reading the textbook, that is, promoting their vicarious experiences. However, for Lisa, quizzes did not have a positive impact on their reading performances. Lisa was reading the chapters in textbook just because of the possibility of having a quiz, but not because of the intention to enhance her knowledge. This was a result of her perception of the quizzes that she believed the questions there required memorization of concepts in the textbook, instead of comprehended ideas.

> [The instructor] tells us to study before the lectures, okay, we do study; she doesn't want us memorize, we prepare for [the quiz] and the question she is asking there is "What is the definition of ratio?" So? . . . I mean, the quiz has no use for me, assign me [the quiz] or not, I don't even care. The question [Dr. T.] asks there, or the thing [textbook] I read, I read it only for the quiz, I mean, for the exam, not to learn something. (Lisa, I2)

Similar to Lisa, Angel was reading the beginning of a chapter because she thought the questions in the quiz were focused on the first few pages such as the definitions of concepts or any ideas that she could memorize easily. On the contrary, like Kate, Rachel regarded quizzes as a test of her prior knowledge. This was she perceived quizzes as a source of mastery experience from which the information she used to judge her capabilities for preparing and implementing tasks.

> I went through the curriculum and Van de Walle [textbook], and went to the class. I would never do that last semester. Let alone [reading] the curriculum, I was reading Van de Walle, the definitions there, with the logic of "What is the definition here? What questions can be asked in the quiz?" And it always felt like the quizzes asked the definitions, but now, I have noted last semester's quiz questions, and I look at them and see that [Dr. T.]

> was not actually asking the definitions, I mean, it was my perception because I only studied the definitions. Now I look at it, the quizzes from a different perspective. I mean, the quizzes are more like [testing] prior knowledge, whether we are ready for that class, not the definitions actually. (Rachel, I2)

Still, not being foretold, quizzes created effect on participants' physiological states. Cindy and Rachel even used "the fear of quizzes" expression when describing the influence of unannounced quizzes. Rachel, for example, stated that she "found the motivation to read more with the fear of quiz" (Rachel, I3), where she experienced her negative emotional state (i.e. fear) as a positive influence (i.e. motivation) on her performance. On the contrary, Cindy experienced negative emotional state only. Like explained in the previous part, the difficulty she experienced when reading the textbook also caused a dislike for quizzes. And mentioning her dislike for the unannounced characteristic of quizzes, Cindy, as a perfectionist, expressed negative influence:

> I am this kind of person, let's say, there is thing that something I am responsible for, it turns into a pressure for me, I mean, [I feel like] I definitely have to do it well. Indeed, I might not even care if I get 3 from this one [quiz], 5 from the other. . . It's not because of the grades, it's because I feel like I couldn't do it well. . . . I could have been like "[My performance on the quiz is not important, since] I learned it [in class]" and move on, but I just can't [do this]. I feel bad about not performing well. (Cindy, I3)

Yet, Cindy confessed that she would give her future students such pop quizzes as well because she believed in the contribution of these quizzes. She added in our last interview that "during lectures, it [the subject] catches my attention more" when she failed to answer questions in the quiz correctly. Holding not a feeling of fear, but rather dislike for quizzes, Kevin also admitted that having unannounced quizzes made it easier for him to prepare for the exams. He explained the influence of quizzes as follows:

> Since it is not known that which questions will be asked [in the quizzes], reading [assigned chapter] in detail is kind of problem. . . . And [reading textbook] also helps with the exam, [since] we have everything in our minds and put less effort to prepare for the exam. (Kevin, I3)

Midterm.

Another aspect of examination was the midterm which affected participants' judgments of their capabilities, operating through mastery experiences. For example, Rachel described midterm as an assessment of her own performances "because in all part of this [methods] course we are a group, whole class is a group while listening [to the lectures] in the classroom, we are a group when preparing tasks, during the exam we are all alone" (Rachel, I2). And when she scored high at the exam, her self-efficacy was boosted: "Many of my exam scores are high, my grades are real high, and I said 'This means I can do it,' I felt relieved" (Rachel, I3).

Amy pointed out the contribution of midterm from another perspective. She regarded this exam as an assessment of her performance as well, but she explained that she also learned through her mistakes in the exam.

> The feedback from the exam is very important, in the end you learn something from the exam too. For example, the [representation of] fractions with area models, even though the instructor emphasized so many times like "Show the whole," [I realized that] I didn't do so. (Amy, I3)

Summary of examination.

Examination was another component of methods course which was perceived as an effect on participants' self-efficacy beliefs for preparing and implementing worthwhile mathematical tasks. Examination included unannounced quizzes and midterm, both of which provided mastery experience source for participants' judgments of their capabilities (Table 16). Operating through mastery experience source, midterm was found as a positive effect on participants' self-efficacy.

Table 16

Effects of examination through hypothesized sources of self-efficacy

Components of Examination	Mastery Experience	Vicarious Experience	Verbal Persuasion	Physiological State
Unannounced quizzes	✔			✔
Midterm	✔			

Among the participants who talked about the influence of unannounced quizzes, only Rachel regarded the quizzes as a direct effect on her self-efficacy that she believed her performance in the quizzes as a mastery experience provided information for her ability judgments. For others, these quizzes created an indirect effect through enhancing their learning from the textbook as a vicarious experience source because they were trying to complete reading the chapters to prepare for the unannounced quizzes. Lisa talked about the indirect impact as well, but she did not experience contribution of quizzes on their reading. This was because she thought the quality of the questions did not require a deeper understanding of the assigned chapter for reading, so she was doing a superficial reading.

Additionally, as findings revealed, unannounced quizzes also operated through physiological states of participants. Even though quizzes caused negative emotional states as a result of being unpredictable, participants did not weight their negative emotions much heavily, for they believed in the contribution of quizzes in their learning. For example, participants found it easier to prepare for the exam, after studying weekly for the quizzes throughout the semester. Moreover, as a participant with high self-efficacy level, Rachel experienced this negative influence as a motivation to perform better.

4.2.2.7 Summary of Findings

The purpose of this study was to explore prospective elementary mathematics teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks throughout a methods of teaching mathematics course and to examine the perceived influence of methods course on prospective teachers' efficacy judgments. Regarding prospective teachers' self-efficacy, findings revealed that participants entered methods class with at least a moderate level of self-efficacy, since they started to gauge their beliefs about their capabilities to prepare and implement tasks in the previous semester at ELE341. While 4 participants expressed strong beliefs in their capabilities at the beginning of the semester, 8 of the 9 participants completed the methods course highly efficacious for preparing mathematical tasks. However, there was not much increase in participants' self-efficacy for implementing tasks.

As findings showed, 3 participants were holding strong self-efficacy at the beginning and after completing methods course, 5 participants described themselves as highly efficacious, whereas 4 of them had moderate level of self-efficacy. The difference between the improvement in participants' self-efficacy for preparing and implementing tasks was mainly because participants with moderate level of confidence for implementing tasks thought that they were lacking real classroom experience of using mathematical tasks with students, and this caused them to doubt about their capabilities to implement activities effectively. More specifically, these participants believed that they could not effectively handle possible classroom management issues in their future teaching.

Participants weighted and interpreted efficacy-relevant information provided by different components of methods course to judge their capabilities for preparing and implementing mathematical activities. Findings showed that 6 factors related to methods course were responsible for the change in participants' self-efficacy. These factors were lecture hours, group work, peers' presentations, feedback on group work, assigned readings, and examination. When compared to other components of methods course,

lecture hours, group work, peers' presentations, and feedback on group work were factors with which prospective teachers spent most of their time. Thus, I was specifically interested in determining the impact of these factors.

Table 17

Factors and their components influencing participants' self-efficacy and how each component of factors operated through hypothesized sources of self-efficacy

Factor	Component	Mastery experience	Vicarious experience	Social persuasion	Physiological state
Lecture hours	Transmission of knowledge and skills		✔	✔	
	Questioning method	✔	✔		✔
	The instructor's expectations	✔			
	Support for textbook			✔	
	Interaction with the instructor				✔
Group work	Preparing tasks as a group	✔			✔
	Implementing tasks as a group	✔			✔
	Working as a group		✔	✔	✔
Peers' presentations	Peers as models		✔		
	Working on peers' tasks				✔
Feedback on group work	Feedback from the instructor			✔	✔
	Feedback from peers			✔	
Assigned readings	Textbook		✔		
	Additional readings		✔		
Examination	Unannounced quizzes	✔			✔
	Midterm	✔			

Of these four components of methods course, feedback -provided by especially the instructor- were expected to be the most effective factor on participants' self-efficacy as the initial interviews suggested (n = 5). Group work was the second factor expected to have the strongest influence on participants' efficacy judgments (n =

4). However, at the end of the methods course, participants expressed that lecture hours had the strongest impact (n = 6). In other words, lecture hours were perceived as the most effective factor to affect participants' self-efficacy. Analysis of the interviews showed that lecture hours created influence on participants' self-efficacy through *transmission of knowledge and skills* from the instructor to the prospective teachers, *questioning method* the instructor used, the instructor's *expectations* from prospective teachers, *support for textbook*, and the *interaction with the instructor*. Having five different components, lecture hours were the factor with the most varying ways of effects on participants' self-efficacy. Table 17 shows how each of these aspects of lecture hours operated through the hypothesized sources of self-efficacy (Bandura, 1997). In the light of sources of self-efficacy, findings revealed that lecture hours affected participants' efficacy judgments operating through all four sources of self-efficacy.

Group work, as another effect on self-efficacy of participants, included *preparing tasks as a group*, *implementing tasks as a group*, and *working as a group* components. With its three components, group work operated through four sources of self-efficacy. After their group's presentations of tasks, participants observed their peers' presentations, and findings showed that this was another influence on participants' self-efficacy. During lab hours, participants' peers provided models for implementing tasks, and participants referred to these vicarious source of information when judging their own capabilities. This (i.e. *peers as models*) was one component of peers' presentations factor, while working on their friends' activities was perceived as another effect, and so as another component, of this factor. Through these two components, peers' presentations worked as two of the four sources of self-efficacy, which were vicarious experiences and physiological states.

Feedback on group work also had two components (i.e. *feedback from the instructor* and *feedback from peers*) both of which mainly operated through verbal persuasion source. Comparing feedback from the instructor with the statements from peers, participants weighted the responds provided by the instructor more because they

valued the instructor's opinions, her knowledge, and experience. Thus, instructor's feedback could operate through participants' emotions, and findings revealed a negative influence of this component. Yet, since the instructor's feedback were described as informative by participants that they believed these feedback, even in the form of "criticism," contributed to their improvement, participants who expressed negative effects on their physiological states could mostly "ignore" such criticism and they attached less importance when judging their capabilities.

Another factor affecting participants' self-efficacy was assigned readings, which was composed of *textbook* and *additional readings*. Participants regarded all these readings as vicarious learning sources which boosted their efficacy beliefs. Examination, on the other hand, was perceived as mostly mastery experience source. *Unannounced quizzes* and *midterm* were the two components of examination factor. The unpredictable characteristic created negative physiological states, such as stress and fear, though. Still, participants stated that they focused more on the positive outcomes of quizzes (e.g. motivation to prepare for the lectures) and weighted this component less when gauging their efficacy beliefs.

CHAPTER 5

DISCUSSION

This qualitative case study was an attempt to investigate prospective elementary mathematics teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks throughout their enrollment in a mathematics teaching methods course. While exploring the change in participants' self-efficacy through interviews conducted at different time points throughout a methods course, I aimed at disclosing the factors responsible for any change in participants' self-efficacy. And in the process of examination of how each factor was weighted and interpreted as efficacy-relevant information for participants' judgments of their capabilities, I used the hypothesized sources of self-efficacy (Bandura, 1977, 1986, 1997) as my guide.

As explained in detail in the previous chapter, findings revealed that participants completed methods course mostly with strong efficacy beliefs and, in general, there was a positive change in self-efficacy of prospective teachers who participated in this study. Findings also showed that a number of factors related to methods course (i.e. lecture hours, group work, peers' presentations, feedback on group work, assigned readings, and examination) created effect on participants' self-efficacy, operating in different ways through all four theorized sources of self-efficacy. In this chapter, I reflect on these findings in the light of the related research and offer practical implications of findings of this study. I conclude this chapter with limitations of this study and recommendations for future research.

5.1 Self-Efficacy for Preparing and Implementing Mathematical Tasks

The first research question was about prospective elementary mathematics teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks.

When taken altogether, findings showed that the overall effect of methods course on prospective teachers' self-efficacy was positive. That is, after completing the methods course, most of the participants indicated strong beliefs in their capabilities to prepare and implement highly cognitive mathematical tasks effectively. Thus, this study supports that when provided with adequate learning and practicing environment, methods course can help prospective teachers develop strong efficacy beliefs (e.g. Albayrak & Aydın Ural, 2011; Brand & Wilkins, 2007; Çakıroğlu, 2000).

Since participants described their efficacy beliefs regarding preparing and implementing tasks separately, data were analyzed independently for each aspect of participants' perceived efficacy. Because self-efficacy is a content-specific belief and "[p]eople may judge themselves efficacious across a wide range of activities or only in certain domains of functioning" (Bandura, 1997, p. 43), it could be asserted that prospective teachers judge their efficacy beliefs for preparing and implementing mathematical tasks differently. That is, they might feel highly efficacious for preparing mathematical tasks, but they might have doubts about their capabilities to effectively use these tasks with students in mathematics classrooms. Even though findings support this claim, reverse was not true for the participants of this study because all participants with high self-efficacy for implementing tasks expressed only high levels of self-efficacy for preparing tasks. When compared to their efficacy beliefs for implementing tasks, participants' self-efficacy levels for preparing mathematical tasks were higher. Based on findings of this study, then, it is possible that participants of this study had more opportunity to develop their self-efficacy beliefs to prepare tasks than to implement tasks.

Because prospective teachers entered methods class after completing ELE341 in the previous semester, participants already started to construct their efficacy beliefs at some level and any of them expressed low efficacy beliefs. As findings revealed, at the beginning of the semester participants indicated mostly moderate level of self-efficacy for preparing tasks (n = 5). Participants who thought they were still in

the skill development process and felt the need to improve their competencies in preparing tasks for Grades 6-8 were holding moderate self-efficacy beliefs. Again, the content-specific nature of efficacy beliefs might have been responsible for the difference in participants' self-efficacy levels. Although prospective teachers studied how to teach mathematics through tasks effectively in the previous semester, they were focused on tasks for earlier grade levels, so participants had doubts about their capabilities to create tasks appropriate for 6-8 graders.

It is also possible that tutoring experiences have contributed to participants' self-efficacy development. According to Tuchman and Isaacs (2011), tutoring experiences provide sources for prospective teachers' self-efficacy development. Similarly, in this study, two participants with high level of self-efficacy for preparing tasks at the beginning of the semester (i.e. Becca and Rachel) had been tutoring 6-8 graders for a long time and they stated that they were familiar with the curriculum which made them feel more confident for preparing tasks. However, participants who had teaching experiences with high school students (i.e. Amy, Lisa, and Kevin) believed that they had to master the Grades 6-8 mathematics curriculum to create worthwhile tasks and expressed moderate level of self-efficacy.

At the end of the semester, though, almost all participants (n = 8) expressed strong efficacy beliefs for creating mathematical activities. While participants' moderate level of self-efficacy increased, highly efficacious participants indicated stronger beliefs in their capabilities to prepare worthwhile mathematical tasks. Regarding the positive change in participants' moderate level of efficacy beliefs, it could be suggested that their experiences throughout the methods course related to creating tasks for 6-8 grade levels boosted participants' self-efficacy. Previous researchers concluded that mastery of content knowledge and pedagogical knowledge could help prospective teachers' efficacy judgments for teaching science increase (Palmer, 2006). Yet, it could be suggested that pedagogical content knowledge (Shulman, 1986) could also be one of the powerful factors to influence prospective teachers' self-efficacy. Like participants declared, they

learned and practiced not only to design tasks with high cognitive demands, but also tasks appropriate for students at different grade levels and contexts, and the ways to overcome or prevent students' misconceptions while teaching mathematics through tasks. Especially through lectures, which is discussed in detail later, participants' pedagogical content knowledge enhanced and made them feel more competent. Still, increased knowledge itself do not guarantee high level of efficacy beliefs (Bandura, 1997). That is, prospective teachers might have doubts about their capabilities regardless of their knowledge Participants' various experiences throughout the methods course, such as personal performances regarding preparing tasks, observing other activities in the textbook or the ones their peers' provided, as well as the feedback they received, were also responsible for the development of their self-efficacy for preparing worthwhile mathematical tasks, and each of these factors is discussed later.

Regarding their efficacy beliefs for implementing worthwhile mathematical tasks, only 3 of the participants started the semester strongly efficacious, whereas other 6 participants were holding self-efficacy beliefs at moderate level. Findings showed that participants were mainly concerned about classroom management issues they could be faced with while implementing tasks in their future classrooms. It has also been reported that prospective teachers' beliefs about classroom management play a role in their efficacy judgments about teaching (Gencer & Çakıroğlu, 2007; Woolfolk & Hoy, 1990). Therefore, participants' self-doubts about their classroom management skills might have negatively influenced participants' efficacy beliefs, so that they might have expressed moderate levels of beliefs in their capabilities for implementing tasks.

Still, methods course had a mostly positive impact on participants' efficacy judgments, and upon completing methods course, 5 of the 9 participants indicated high level of self-efficacy for enacting mathematical activities effectively. As a result of content-specificity of self-efficacy, it might be that, when enrolled in a methods course with a focus on Grades 6-8, prospective teachers felt more efficacious. That is, similar to their self-efficacy for preparing tasks, as participants developed their skills and

knowledge to implement mathematical tasks effectively at 6-8 grade levels, their self-efficacy for implementing tasks increased. This finding is important because it shows that, regardless of implementing tasks with actual students, the development of prospective teachers' efficacy beliefs for using mathematical tasks effectively might be supported through providing adequate experiences during methods course. Indeed, researchers have suggested that prospective teachers with little or no actual teaching experience tend to depend more on other influences to judge their capabilities for teaching (Tschannen-Moran & Johnson, 2011; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). This study provides evidence how prospective teachers, in the context of methods course, might develop strong efficacy beliefs through various factors such as lectures in which the instructor transmit knowledge of effective use of mathematical tasks in classrooms or implementation of tasks in the lab with their peers than actual students.

The other 4 participants, however, were focused on the real classroom experiences which they lacked, and experienced no positive change in their confidence for implementing tasks after enrolling in methods course. Considering the powerful role of mastery experiences in the development of self-efficacy (e.g. Usher & Pajares, 2009), participants might have not valued their experiences throughout the methods course. Thus, the methods course might have not effectively contributed to participants' self-efficacy for implementing tasks as much as their efficacy beliefs for preparing tasks.

Considering the impact of participants' tutoring experiences, findings showed that these teaching practices did not cause difference in participants' self-efficacy beliefs for implementing tasks. Although previous research suggested that tutoring might contribute to the development of prospective teachers' efficacy beliefs (Tuchman & Isaacs, 2011), in this study, only one participants (i.e. Rachel) with background in teaching described herself highly efficacious for implementing tasks. She was also holding positive beliefs about the effectiveness of worthwhile mathematical tasks in classroom management. This could be a result of her experiences in teaching mathematics through tasks. Unlike other participants who had been teaching

mathematics using traditional teaching methods (i.e. direct teaching), Rachel had previously enacted tasks with students in classroom environment, which might have created positive influence on her self-efficacy. Therefore, it could be suggested that, the quality of tutoring practices make difference in the impact of these experiences on prospective teachers' efficacy judgments.

Finally, different from her counterparts, her negative perceptions of the effectiveness of methods course led Lisa to experience no positive contribution of methods class to her efficacy judgments about both preparing and implementing tasks. Even though ELE341 was one of her favorite classes and Dr. T. was one of her favorite instructors in the program that she enjoyed participating in the class, a negative change was obvious in her views about methods course which caused her to block out the benefits of the course. Mainly blaming Dr. T. for her demotivation, Lisa lost her interest in the class and was neither enthusiastic about joining class meetings nor willing to fulfill course requirements adequately. Research also showed that instructors as perceived by students nurture the effects of instruction on students' mastery of skills (Usher, 2009). According to Usher, as students credited their teachers' instructional practices for their successes, their efficacy judgments were perceived to be more persuasive. In Lisa's case, this process worked in negatively. Lisa chose to put less effort to complete assigned readings and prepare for lab hours, and she attributed this decline to the instructor's high expectancies.

5.2 Factors Affecting Self-Efficacy for Preparing and Implementing Mathematical Tasks

Similar research conducted to explore how teacher training programs influenced prospective teachers' self-efficacy beliefs either focused on the general impact of the programs on prospective teachers' judgments, disregarding how such programs created effect through hypothesized sources of self-efficacy (e.g. Işıksal & Çakıroğlu, 2006; Swars, Hart, Smith, Smith, & Tolar, 2007) or researchers examined which hypothesized sources of self-efficacy prospective teachers relied on when judging

their capabilities, without considering the role of the program in detail (e.g. Brand & Wilkins, 2007; Palmer, 2006). Such studies did not aim at identifying the factors provided efficacy-relevant information as sources of self-efficacy which could have given teacher educators the guidelines to review their programs.

This study, however, was aimed at disclosing the factors responsible for the change in prospective teachers' efficacy judgments throughout the methods course and how these factors operated through the sources of self-efficacy as theorized by Bandura (1997). According to Social Cognitive Theory, personal factors, behavior, and environmental factors affect one another mutually (Bandura, 1997). Because this study concerned the effects of methods course, data were analyzed considering the components of methods course, and findings revealed that 6 factors related to the methods course (i.e. lecture hours, group work, peers' presentations, feedback on group work, assigned readings, and examination) were perceived as influences on participants' efficacy judgments. I was also interested in participants' views about the most effective component of methods course to determine the most powerful aspect of methods course as described by participants. All of these findings are discussed next.

5.2.1 The Most Effective Components of Methods Course

Based on their experiences in ELE341, four participants were expecting group work to be the strongest influence on their efficacy judgments at the beginning of the methods course. Other 5 participants thought feedback would be the most effective component of the methods course and one participant expected that both feedback and peers' presentations would have the greatest effect. At the end of the semester the numbers of participants who believed group work and feedback would be the most powerful components of methods course declined. Three participants perceived group work as a strong impact, whereas only 2 participants thought feedback on group work had the strongest effect. On the contrary, there was an increase in the number of participants to view lectures as the most effective factor. Although none of the prospective teachers participating in this study expected lectures to be a powerful

influence on their self-efficacy when they entered methods class, there were 6 participants who stated that lectures had the biggest effect at the end of the semester. The number of participants who rated peers' presentations as the most effective factor also increased from 1 to 3. Three participants also believed group work was the strongest influence on their self-efficacy.

According to Bandura (1986, 1997) and other researchers (e.g. Usher & Pajares, 2009), mastery experiences are the most powerful source of self-efficacy beliefs. From this aspect, these findings about the most effective component of methods course are interesting because one might expect that group work would be the most powerful influence on prospective teachers' self-efficacy beliefs, when group work is taken as a mastery experience source which provides prospective teachers the opportunity to prepare and implement tasks in the context of methods course. However, findings revealed that participants' relied more on the efficacy-relevant information which lectures presented, even though mastery experiences, as the strongest source of self-efficacy, provided by lectures are limited when compared to group work. Thus, it could be asserted that the quality of each learning and practicing experience that methods course, or teacher education programs in general, made available for prospective teachers is a significant determinant of the influence these experiences could create. In the following sections a detailed discussion of each of these major components of methods course together with the other factors related to methods course is presented.

5.2.2 Lecture Hours

Several components of lectures (i.e. transmission of knowledge and skills, questioning method, the instructor's expectations, support for textbook, interaction with the instructor, and classroom environment) have been found to affect prospective teachers' efficacy judgments about preparing and implementing mathematical tasks. During methods course, lectures were held on every Monday and mainly provided a means for the transmission of knowledge and skills from the instructor to prospective teachers. Because knowledge and skill transmission is a source of vicarious influence

(Bandura, 1997), lectures operated through vicarious experiences of participants and contributed to their efficacy development. Interestingly, previous studies on sources of prospective teachers' efficacy beliefs failed to provide evidence of the contribution of lectures in terms of knowledge transmission. For example, Palmer (2006) suggested that prospective teachers' mastery of knowledge could support the development of their efficacy beliefs, yet these researchers did not investigate how such improvement in knowledge of prospective teachers occurred. From this aspect, this study contributes to the literature that it shows the power of knowledge and skill transmission from instructors. That is, prospective teachers can learn how to prepare and implement worthwhile mathematical tasks effectively through instructors' lecturing which might make them feel more competent.

During her lectures, the instructor was also successful at helping prospective teachers to overcome their own misconceptions which fueled participants' self-efficacy. Detecting prospective teachers' misconceptions through questioning method, an effective component of lectures on participants' self-efficacy which will be discussed later, and then providing instruction to correct their misconceptions in mathematics content about which they were preparing tasks, lectures positively influenced participants' efficacy beliefs. From this aspect, the instructor provided corrective feedback to improve participants' learning, and this information operated through verbal persuasion source (Bandura, 1997). According to Bandura, to perfect their skills through practices, people need such corrective and instructional feedback on which they can base their judgments of their own capabilities. The feedback received from competent models (e.g. teachers, mentors) carry credible information about individuals' performances and influence their self-efficacy beliefs. Research also showed that corrective feedback is an effective way of overcoming prospective teachers' misconceptions (Mevarech, 1983). Thus, it could be asserted that using corrective feedback as a way of verbal persuasion source during lecture hours might have boosted prospective teachers' self-efficacy through enhancing their knowledge to prepare and implement tasks effectively.

In terms of enhancing content knowledge to support prospective teachers' self-efficacy development, this finding not only confirms Palmer's (2006) claims, but also provides evidence of how such increase in prospective teachers' content knowledge can be provided by methods course. The corrective feedback can be a powerful source for boosting prospective teachers' efficacy beliefs by helping them acquire the knowledge of content they are going to teach. And in order to detect prospective teachers' lack of knowledge or misconceptions they hold, instructors might use questioning methods in their teaching.

One of the important findings of this study was that it showed lectures could operate through mastery experiences source of self-efficacy. Educators usually consider lectures as a vicarious learning source where instructors transmit their knowledge to their students (Badger & Sutherland, 2004). In his study of the effects of science teaching methods course on prospective teachers' self-efficacy beliefs, Palmer (2006) also regarded lectures as a direct teaching method and prospective teachers as passive recipients of information provided by the instructor. This study, however, showed that the questioning method instructor used in her lectures promoted prospective teachers' generating ideas on the design and enactment of tasks in the textbook, while encouraged them to enhance and master their knowledge. In other words, when prospective teachers voice their ideas about creating new activities or modifying existing ones, different ways to implement tasks in various contexts or with different manipulatives, they might develop knowledge and skills to effectively teach mathematics through tasks. Thus, teacher educators can help prospective teachers gain personal experiences by guiding them with questions and engaging in thinking processes to prepare and implement tasks.

Throughout this process, participants could also benefit from each others' ideas which provided vicarious learning opportunity. This way, questioning method operated through vicarious experiences as well. Previously, Brand and Wilkins (2007) found that prospective teachers can gain vicarious experiences from their counterparts during their interaction in group activities. In this study, group work has also been as a

factor which provided prospective teachers vicarious experiences. But this study also showed that, in an environment where participation in class discussions is encouraged, prospective teachers might be given the chance to learn from their peers. That is, while building on their own learning, they can also help their peers to enhance their knowledge which might make them feel more competent.

Another source questioning method provided to support prospective teachers' self-efficacy development was physiological states. Motivating prospective teachers to actively participate in lectures with the use of questioning method, the instructor was also able to positively influence their emotions that participants enjoyed to take part in lectures, express and discuss their ideas about worthwhile tasks. Participants' positive physiological states, as supported by questioning method, boosted their efficacy beliefs for creating and using worthwhile mathematical tasks. Other researchers asserted that methods course could help prospective teachers overcome their negative emotions (e.g. fear and anxiety) to increase their efficacy beliefs, they did not find the positive influence methods course created on prospective teachers' physiological states (Brand & Wilkins, 2007; Palmer, 2006). From this aspect, this study contributes to the literature that during methods course, and more specifically through lectures, teacher educators can have a positive impact on prospective teachers' affective states by effectively using questioning method. Thus, it is important not only to use lectures as a direct teaching method where knowledge and skills are transmitted by the instructor, but also to help prospective teachers to actively participate in the lectures. During this process, it is essential to create an environment in which prospective teachers can feel comfortable to voice their ideas and believe that they will not be judged.

Another way lecture hours influenced participants' self-efficacy through their mastery experiences was the instructor's expectations. As a requirement of lectures, participants were required to complete assigned reading prior to attending class. The instructor also expected prospective teachers to take a look at the curriculum and related subjects from Turkish resources, so that they could discuss the ideas in the textbook by

comparing with Turkish context. This expectation of the instructor was an effect on the level of effort prospective teachers mobilized. Findings showed that participants felt more confident in their capabilities when they expended adequate effort to meet instructor's expectations because they believed effort enhanced ability. According to Bandura (1997) setting goals for students a bit higher than what they can actually do motivates them to succeed. Prospective teachers also expressed they felt motivated to complete assigned readings which, in turn, contributed to their development because they could benefit more from the lecture hours when they were prepared for the class. However, for Lisa, a participant with moderate self-efficacy, the instructor's expectations were too high that they created a negative influence, and rather than working harder to achieve, Lisa showed reluctancy to read assigned chapters. This could be a result of deficiency in Lisa's self-regulatory skills. Bandura claimed that a reciprocal relationship exists between self-regulation and self-efficacy (1986), and students' self-regulated learning has been found as a significant influence on their self-efficacy development (Usher, 2009). For example, Rachel, who indicated that the instructor's expectations helped her improve her self-regulated learning (e.g. "discipline to study"), was feeling more efficacious than Lisa. Lisa, on the contrary, stated that because of the courseload, she could not have time to prepare for the lectures. Thus, self-regulation can be a negative influence on her self-efficacy development.

The assigned chapter prospective teachers had to complete weekly were also complemented by lectures. Participants regarded lectures as a support for textbook which enhanced their learning from the book. While discussing the weekly chapter from textbook on Monday class, the instructor focused on what prospective teachers misunderstood (e.g. task examples given in the textbook) and corrected them through instruction. This corrective feedback provided by the instructor operated through verbal persuasion source for participants' efficacy beliefs. Like mentioned earlier, studies on the influence of methods course showed that prospective teachers' knowledge of teaching a specific content (e.g. science) could be enhanced through methods course

(Palmer, 2006), yet, it was not clear how such support could be provided for prospective teachers' understandings of the content. This findings is important that it shows detecting how prospective teachers interpret the information in the textbook and using corrective feedback during lectures could be a way to contribute to the knowledge construction of prospective teachers.

The interaction with instructor during lectures was another perceived influence on participants' self-efficacy. Findings showed that the friendly approach of the instructor and the comfortable classroom environment she created had positive effect prospective teachers' physiological states as a source of self-efficacy. Participants believed that, different from other instructors, in methods course, the instructor cared for their success, career, and future practices which helped them build positive relationship with her. This way, participants enjoyed attending class meetings and were motivated to participate in lectures. Because physiological states of individuals while performing a task provide information for their efficacy judgments (Bandura, 1997), prospective teachers' comfort level when voicing their ideas on preparing and implementing tasks during lectures might have made them feel more confident in their capabilities to create their own tasks and use these tasks in their teaching. Even though researchers have reported that physiological states of prospective teachers who were enrolled in methods course were perceived as a source for their self-efficacy development (e.g. Brand & Wilkins, 2007), this finding builds on previous research that it shows the effect of interaction with the instructor on this source of prospective teachers' self-efficacy.

5.2.3 Group Work

Bandura (1997) asserted that, after gaining knowledge of new skills, guidance and practicing opportunities are required for mastery of these skills. Because practicing skills under actual conditions are not always feasible, Bandura continued, practice in simulated situations is an option for skill development. Learning and improving their abilities under such lifelike conditions, people face less problems when transferring their new skills to real life (Bandura, 1997). Although researchers who

studied the effects of methods course on prospective teachers' self-efficacy found mastery experiences gained through micro-teaching with actual students (Gunning & Mensah, 2011), prospective teachers' teaching experiences with peers have not been found as a source of mastery (Palmer, 2006). In this study, prospective teachers were provided with the lab setting where they could implement the tasks they prepared as groups of 5-6. Findings revealed that mastery experiences gained through group work were perceived as a source of participants' self-efficacy for preparing and implementing mathematical tasks. However, considering participants' efficacy beliefs for implementing tasks effectively which did not increase as much as their self-efficacy for preparing tasks throughout the semester, it could be stated that participants did not weight their enactive experiences in using tasks in the lab equally as their mastery of creating tasks. That is, their in lab practices might have not been enough to support their efficacy development in terms of implementing mathematical activities. This could be a result of limited time spent on each group's presentations during lab hours that participants might have not gain sufficient information about their own performances. So the quality of simulated situations created for prospective teachers to master their skills might have determined the power of mastery experience source.

On the other hand, there is a lack of research to investigate the influence of group work on prospective teachers' self-efficacy. Only Brand and Wilkins (2007) found that collaborating with peers operated through vicarious experience source and influenced prospective teachers' self-efficacy. Findings of this study build on previous research and contribute to the literature on group work's impact on efficacy judgments of prospective teachers. First of all, working as a group to design their activities rather than working alone was a positive influence that created the vicarious learning environment in which participants increased their knowledge through their peers, like Brand and Wilkins concluded. Second, prospective teachers received feedback from their group-mates on their own performances in group work (i.e. evaluative feedback) as well as on their understanding from lectures or textbook to correct each other's mistakes

(i.e. corrective feedback). And such positive messages as verbal persuasion source, either in the form of corrective or evaluative feedback, boosted participants' self-efficacy beliefs. Still, arranging time and place to meet with group members for preparing tasks was perceived as an obstacle by participants, and for one participant (i.e. Lisa) this disadvantage even caused to prefer working by herself than joining a group. This might have been a reason for why methods course did not contribute to Lisa's efficacy development, when it is considered that her moderate level of self-efficacy did not increased throughout the methods course. So enabling prospective teachers to choose their peers for group work might create opportunities to boost their self-efficacy beliefs, but it is also important to take into account the environment in which they are going to work together. From this aspect, it could be suggested that the effect of group work on prospective teachers' efficacy beliefs might be mediated by external factors, such as willingness to participate in group work or organizing meetings for group work.

Finally, group work also affected participants' physiological states. While participants enjoyed working together to create their activities with their peers, through the semester they started to feel bored and anxious to implement tasks during lab hours. According to Bandura (1997), positive emotions and mood fuel self-efficacy, while negative affective states cause doubt about capabilities. In this study, then, it could be concluded that the contribution of physiological states source group work operated through was limited to preparing mathematical tasks. That is, while prospective teachers enjoyed working as a group to prepare tasks, they did not felt the same way for implementing those activities they prepared. Even though participants stated that in the fall semester's lab meetings they had more fun to implement tasks with their peers, during spring semester, there was not enough time for each group to implement their tasks in methods course. Participants, therefore, showed lack of interest in enacting their tasks in lab and they even found it boring to only summarize what activities they prepared. Still, such the negative physiological states did not undermine participants' judgments of their capabilities for implementing tasks. Findings did not show decrease

in participants' self-efficacy for implementing tasks. Moreover, participants who expressed boredom or anxiety to implement tasks with their peers were feeling strongly efficacious for using tasks after completing the methods course. It could be that these participants did not interpret in lab implementation of tasks as their actual performances because they were introducing tasks to their counterparts instead of students and because time limitations did not enable them to perform their tasks. In other words, participants might have believed that lab hours did not provide them the efficacy-relevant information about their performances in using tasks and that group work to implement tasks with peers did not contribute to their efficacy development.

5.2.4 Peers' Presentations

While prospective teachers were enacting their tasks in group during lab hours, observing other groups' work was perceived as another vicarious learning opportunity for participants. According to Bandura (1997), "people compare themselves to particular associates in similar situations, such as classmates" (p. 87). While studies mostly found that the instructor as a model for self-comparison provided vicarious experience source for prospective teachers (Aydın & Boz, 2010; Palmer, 2006), but peers were not perceived as models for prospective teachers to compare their own performances. In the context of methods course under investigation in this study, participants also expressed the impact of peer modeling on their self-efficacy beliefs. Findings showed that vicarious experiences participants relied on were emanated from the information they collected through social comparison with peers. Since prospective teachers were implementing their own tasks in this methods course rather than observing the instructor's enactment of tasks, it could be that participants only focused on their peers' performances and compared themselves to judge their own capabilities.

Another way peer modeling provided vicarious experiences source for participants' efficacy development occurred through seeing and learning from their peers' performances. Bandura (1997) contended that "seeing or visualizing people similar to oneself perform successfully typically raises efficacy beliefs in observers that

they themselves possess the capabilities to master comparable activities" (p. 87). Even though previous studies on prospective teachers' self-efficacy only considered instructors' modeling as a means for vicarious learning (Palmer, 2006), findings of this study showed that prospective teachers' self-efficacy could be enhanced through their peers' modeling of preparing and implementing tasks.

In addition to observing their peers' presentations, prospective teachers were also working on the activities their counterparts created. This process enabled participants to experience tasks from students' perspectives and enhanced their understanding of worthwhile mathematical tasks, how to prepare and implement them effectively. Participants had fun during this process of working on their peers' tasks, and this way peers' presentations operated through the physiological states source of self-efficacy. Throughout the semester, however, as a result of the decline in the time spent on each group's tasks, prospective teachers could not fully concentrate on others' work and enjoy using those tasks. Thus, the positive effect of peers' implementation on participants' physiological states might have been reduced.

5.2.5 Feedback on Group Work

A part of lab hour, feedback received on prospective teachers' group work was found to be an important influence on participants' efficacy judgments. Even though previous research (Palmer, 2006) failed to detect the influence of feedback prospective teachers received in the context of methods course on their efficacy judgments, the messages provided by the instructor as well as their peers carried information on participants' performances regarding their capabilities to prepare and implement worthwhile mathematical tasks. Feedback on group work, therefore, operated through verbal persuasion source for prospective teachers' self-efficacy. According to Bandura (1997), verbal persuasions are "weighted in terms of who the persuaders are, their credibility, and how knowledgeable they are about the nature of the activities" (p. 104). Wilkins, Shin, and Ainsworth (2009) also found that, although teacher candidates valued feedback from their peers, teacher candidates stated that they would prefer receiving

feedback from experts (e.g. cooperating teachers, university supervisors). Findings of this study confirmed that prospective teachers' relied more on the feedback provided by the instructor than their peers.

The framing of performance feedback is a determinant of the impact verbal persuasions will have (Bandura, 1997), and, as findings revealed, participants did not differentiate between the positive and negative feedback, but rather they were focused on how informative the messages were. While positive evaluative feedback boosted prospective teachers' self-efficacy, negative feedback led increases in their effort to perform better. It is widely accepted that positive messages support and add to the effect of performance accomplishments (Bandura, 1997). Negative feedback, however, has been found to negatively influence students' efficacy developments of people with self-doubts or perceived as challenges to improve skills for people of high self-efficacy (Bandura & Cervone, 1983). In this study, negative statements of peers did not create negative effect, but rather they were ignored by prospective teachers, unless such statements included information about the ways to perfect their performances of preparing and implementing worthwhile tasks. This finding is also consistent with Wilkins, Shin, and Ainsworth's (2009) study, who reported that peers' feedback carried more importance for teacher candidates, when they reflected the strength and weaknesses of their performances as well as included ideas on the ways to improve their skills.

Throughout the methods course, however, participants started to perceive instructor's negative feedback as criticism. When participants believed it was constructive criticism that the instructor provided, they regarded these as corrective feedback to improve their capabilities. However, when it was taken as disparaging criticism, participants either chose to focus on positive messages rather than such negative ones, like Judy and Becca did, or they experienced the negative effect of criticism on their efficacy beliefs, like Lisa did. Bandura (1997) suggested that students often tend to depend on others' evaluative feedback, when they are not yet skilled to

make accurate judgment of their own performances. Therefore, it could be suggested that, because participants with strong efficacy beliefs (e.g. Judy and Becca) believed they could assess their own work of preparing and implementing tasks, they relied less on instructor's criticism and avoided the negative influence of it. On the contrary, Lisa was feeling less efficacious and more affected by the criticism.

Similar decline was seen in participants' interpretations of their peers' feedback. As findings showed, evaluations received from peers left participants' efficacy beliefs unaffected because, first, peers were less credible persuaders, and, second, the perceived quality of peers' statements was low. Since participants viewed their peers as less knowledgeable than the instructor, they paid no attention to comments which did not improve their skills to prepare and implement tasks effectively. Participants also believed that when prospective teachers were obliged to reflect on others' performances in lab hours, their feedback lacked a quality evaluation and more framed as criticism. Thus, participants considered such criticism of peers as "useless" and avoided the negative influence. As discussed earlier, these findings are consistent with what Bandura (1997) asserted as well as with previous research results (Wilkins, Shin, & Ainsworth, 2009).

One important aspect of feedback on group work, also a key finding of this study, is that feedback their peers received might operate through vicarious experiences for participants. Even though it was an effect of previous semester's methods course, findings showed that when prospective teachers listened to the judgments of others' on their counterparts' performances during lab hours and learned from their mistakes, they interpreted these information as vicarious experience source which contributed to their efficacy development. Previous research also found evidence of vicarious experiences gained through peer modeling (Palmer, 2006) during methods course that affected prospective teachers' efficacy beliefs, but this study contributed to the literature regarding vicarious information could be provided by observing their counterparts.

5.2.6 Assigned Readings

The main textbook, *Elementary and Middle School Mathematics: Teaching Developmentally* (Van de Walle, Karp & Bay-Williams, 2010), and additional readings, especially the elementary mathematics curriculum covered in Turkey, constituted the assigned readings factor which served as a means of symbolic modeling. Symbolic modeling provided by television and other media is considered as a source of vicarious influence (Bandura, 1997), but in the literature, evidence of gaining vicarious experience through symbolic modeling of the course readings to support prospective teachers' efficacy development was limited. In line with Gunning and Mensah's (2011) findings, though, this study showed that assigned readings as a requirement of methods course positively affected participants' judgments of capabilities to prepare and implement worthwhile tasks. Especially the use of curriculum covered in Turkey had a powerful impact on prospective teachers' self-efficacy.

Still, even though mastering the curriculum made prospective teachers feel more competent, the textbook caused difficulty for some participants because of the language it was written in. By the time of this study, the textbook was only found in its original language (i.e. English) and participants expressed that they it was hard for them to complete assigned chapters or even to understand the ideas presented there. Therefore, studying in programs where the medium of instruction is English might cause trouble for prospective teachers. At this point lectures, as explained earlier, can provide support for the textbook and help prospective teachers to enhance their learning from the book. Then, it could be suggested that the role of the instructor to complement prospective teachers' learning through reading is crucial and teacher educators should be aware of prospective teachers' level of understanding from readings. To achieve this, questioning method or quizzes might be an option to reveal prospective teachers' learning.

5.2.7 Examination

Operating through mastery experiences, examination (i.e. unannounced quizzes and midterm) was another influence of methods course on participants' self-

efficacy beliefs. Bandura (1997) described mastery experiences as students' interpretations of results of personal experiences rather than objective performances. Thus, two students who obtain the same grade might differ in their judgments of capabilities that one might feel more competent, whereas the other can doubt about his capabilities. In this study, qualitative approach enabled me to investigate how exam results were weighted by prospective teachers when judging their capabilities. Findings showed that prospective teachers' test performances were interpreted as efficacy information and higher grades boosted their efficacy beliefs. Even though much of the research on prospective teachers' self-efficacy have not focused specifically on their performances at exams, this finding is consistent with results of Phelps' (2010) study. Unannounced quizzes also motivated prospective teachers to complete the assigned readings and created an indirect effect on participants' vicarious learning from textbook. The unexpected nature of these exams, however, negatively influenced prospective teachers' physiological states. Participants uttered that they had "the fear of quizzes" which caused stress for them.

5.3 Implications

This study was conducted as an attempt to provide teacher educators a guideline for improving their programs to support prospective teachers' efficacy development. One important finding was that the most effective component of methods course was lectures. Teacher educators can put more emphasis on this aspect when designing their courses to increase the effectiveness of courses they are teaching. Especially using questioning method during their instructions, educators can enhance prospective teachers' mastering of their knowledge. Questioning method can also encourage prospective teachers to participate in class and increase their benefiting from lectures. Yet, attention should be placed on the wrap-up part when questioning method is employed because, as findings suggested, prospective teachers might have difficulty in concluding the ideas generated during this process.

While transmitting their knowledge and skills, it is also essential for teacher educators to connect the ideas to real life situations. Participants of this study expressed that the instructor provided them the knowledge of preparing and implementing tasks appropriate to real classroom settings which increased the effect of lectures. As findings revealed, when prospective teachers feel prepared for the obstacles they might be faced with in their future practices, they have more confidence in their capabilities.

Being students of traditional teachers, in this study, prospective teachers might not have been assured of this contribution of mathematical tasks. Even though participants with high self-efficacy believed that effective use of mathematical tasks would help them with classroom control, participants of moderate self-efficacy had thought that classroom management during task enactment would be a problem for them. Thus, it is important for mathematics educators to make sure that prospective teachers acknowledge that implementing worthwhile tasks appropriately can facilitate their management of classroom. One way of teaching them this role of mathematical tasks can be to spare more time for prospective teachers' implementation of tasks in simulated situations (e.g. lab context) where they would not worry about making mistakes or appearing inadequate. Providing prospective teachers with the opportunity of enacting activities in lab and putting them in charge of the class as the teachers of their peers can be persuasive. This would also boost their self-efficacy for implementing tasks. Peers who play the role of students can benefit from this process as well. Vicariously learning through observing other prospective teachers similar to themselves can contribute to their efficacy development.

Findings showed that working in groups rather than working alone hold varying benefits for prospective teachers and provide valuable contribution to their self-efficacy beliefs. However, group work might be an issue for prospective teachers to arrange time and settings for meeting. An extra class hour between lectures and lab meetings can be added to let them create their tasks in classroom, still working in

groups. This can also give instructors the chance to assess their students at work and to provide assistance when needed.

Another important finding was that feedback provided by the instructor as well as their peers were effective influences on prospective teachers' efficacy judgments. Teacher educators, therefore, should give feedback on their students' performances. Messages which lack the information about improving prospective teachers' skills don't enhance their competencies, and such messages are even perceived as criticism which can negatively affect prospective teachers' efficacy development. Thus, educators should carefully frame their feedback and promote other students to do so. However, when prospective teachers feel forced to assess others' performances, the messages they send carry little importance because such feedback don't include quality evaluation of performances, and they are regarded as "nonsense" or "useless." Teacher educators can create rubrics for prospective teachers to use when both preparing their tasks and evaluating each others' work. Such a guideline should also ask prospective teachers to comment on the strength of their peers' work to encourage the framing of positive feedback which would fuel their self-efficacy.

Teacher educators can also consider assigning readings as a course requirement. The choice of textbook is crucial, though; but *Elementary and Middle School Mathematics: Teaching Developmentally* (Van de Walle, Karp & Bay-Williams, 2010) could be used as an effective resource. In Turkish context, encouraging prospective teachers to study the elementary mathematics curriculum would be a valuable effort to enhance their competencies and confidence in their capabilities. Unannounced quizzes can be used to provide such motivation for prospective teachers, and instead of using this kind of examination at the beginning of the class, assigning quizzes at the end can decrease the negative effect on their physiological states. This might also work as a feedback for instructors to evaluate the effectiveness of their teaching. Another option could be that dividing long chapters into two or more lecture hours of discussion so that prospective teachers will not worry about completing the

assigned readings of long chapters, nor will they feel anxious about the unannounced quizzes at the start of lectures.

Finally, teacher educators should collaborate with their colleagues to increase the power of courses they are teaching. Since this study was not conducted in an isolated environment where participants were only enrolled in methods course, but rather it was aimed to examine participants' self-efficacy in the natural context of Elementary Mathematics Education program, findings revealed that must and elective courses participants were taking contributed to their efficacy development. Interestingly, among the must courses participants enrolled in, only Classroom Management (EDS304) course was perceived as an effect. One reason could be that because participants' major concern about implementing tasks was classroom management, learning "how to deal with a class" (Amy, I2) might have helped them overcome their worries and feel more confident in their capabilities. Participants, then, might have only mentioned the effect of EDS304. It could also be that enrolling in EDS304 during the same semester with methods course enabled prospective teachers to benefit more from methods course. Since participants perceived classroom management as an important competence to effectively use mathematical tasks with students, when their learning and experiences in EDS304 enhanced, they might have felt more competent. It could be asserted that EDS304 had a supplementary role on the effect of methods course.

Findings also revealed that elective courses, namely, Hands-On Activities in Mathematics Instruction, Teaching of Geometry Concepts, and Mathematical Modeling for Teachers, were responsible for changes in participants' self-efficacy beliefs. Participants stated that, in these three classes, they could work on and create mathematical activities using various hands-on and technological tools, so they felt more competent. Therefore, it could be suggested that it is essential to connect methods course with courses especially that focus on mathematics education as well as classroom management, courses which are directly related to preparing and implementing worthwhile mathematical tasks, so as to help prospective teachers gain a comprehensive

understanding and raise their efficacy beliefs. For instance, they could be asked to create tasks using the technology they learned in other classes, or in classroom management class they could be provided with examples of enactment of mathematical tasks in actual classroom context.

5.4 Limitations and Future Research

This study was an effort to explore prospective teachers' self-efficacy for preparing and implementing worthwhile mathematical tasks throughout a mathematics teaching methods course. Findings of this qualitative case study are rely on the data gathered from 9 junior prospective teachers in a specific context (i.e. methods course). Even though I tried to increase the generalizability of findings through collecting data from multiple participants at different time points, qualitative investigation of methods courses at different contexts can be useful to determine other implementations in methods course with impact on prospective teachers' efficacy beliefs.

Quantitative approach can also provide a bigger picture of the methods course's effects. However, researchers lack a sound instrument to examine the influence of methods course, or teacher education program in general, on prospective teachers' efficacy judgments, considering the hypothesized sources of self-efficacy. Findings of this study, in terms of the factors perceived as effects on prospective teachers' self-efficacy and the ways these factors operated through sources for their efficacy beliefs, can be used to construct items for the development of such a scale.

Finally, videos are effective means of symbolic modeling which works as a vicarious experience source for self-efficacy (Bandura, 1997). Videos of practicing teachers' classroom enactment of mathematical tasks were shown to prospective teachers during methods course, but participants of this study did not talk about the influence of these videos. Nevertheless, they mentioned the positive effect of videos they watched in Classroom Management course. Future explorations of the quality of videos brought to prospective teachers' viewing are needed to improve the effectiveness of this vicarious experience source for efficacy beliefs of future teachers.

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APPENDICES

A. Undergraduate Curriculum for Elementary Mathematics Education Program

First Year

First Semester	Second Semester
MATH111 FUNDAMENTALS OF MATHEMATICS	MATH112 DISCRETE MATHEMATICS
MATH115 ANALYTIC GEOMETRY	MATH116 BASIC ALGEBRAIC STRUCTURES
MATH117 CALCULUS I	MATH118 CALCULUS II
EDS200 INTRODUCTION TO EDUCATION	CEIT100 COMPUTER APPLICATIONS IN EDUCATION
ENG101 ENGLISH FOR ACADEMIC PURPOSES I	ENG102 ENGLISH FOR ACADEMIC PURPOSES II
IS100 INTRODUCTION TO INFORMATION TECHNOLOGIES AND APPLICATIONS	

Second Year

Third Semester	Fourth Semester
PHYS181 BASIC PHYSICS I	PHYS182 BASIC PHYSICS II
MATH219 INTRODUCTION TO DIFFERENTIAL EQUATIONS	MATH201 ELEMENTARY GEOMETRY
STAT201 INTRODUCTION TO PROBABILITY & STATISTICS I	STAT202 INTRODUCTION TO PROBABILITY &STATISTICS II
ELE221 INSTRUCTIONAL PRINCIPLES AND METHODS	ELE225 MEASUREMENT AND ASSESSMENT
EDS220 EDUCATIONAL PSYCHOLOGY	ENG211 ACADEMIC ORAL PRESENTATION SKILLS
HIST2201 PRINCIPLES OF KEMAL ATATURK I	HIST2202 PRINCIPLES OF KEMAL ATATÜRK II
HIST2205 HISTORY OF THE TURKISH REVOLUTION I	HIST2206 HISTORY OF THE TURKISH REVOLUTION II

Third Year

Fifth Semester	Sixth Semester
MATH260 BASIC LINEAR ALGEBRA	ELE310 COMMUNITY SERVICE
ELE341 METHODS OF TEACHING MATHEMATICS I	ELE329 INSTRUCTIONAL TECHNOLOGY AND MATERIAL DEVELOPMENT
TURK201 ELEMENTARY TURKISH	ELE342 METHODS OF TEACHING MATHEMATICS II
TURK305 ORAL COMMUNICATION	EDS304 CLASSROOM MANAGEMENT
ELECTIVE	TURK202 INTERMEDIATE TURKISH
ELECTIVE	TURK306 WRITTEN EXPRESSION
	ELECTIVE

Fourth Year

Seventh Semester	Eight Semester
ELE301 RESEARCH METHODS	ELE420 PRACTICE TEACHING IN ELEMENTARY EDUCATION
ELE435 SCHOOL EXPERIENCE	EDS416 TURKISH EDUCATIONAL SYSTEM AND SCHOOL MANAGEMENT
ELE465 NATURE OF MATHEMATICAL KNOWLEDGE FOR TEACHING	EDS424 GUIDANCE
ELECTIVE	ELECTIVE
ELECTIVE	

B. Syllabus for Methods Course

ELE 342: METHODS OF TEACHING MATHEMATICS

Monday: 13:40-15:30 / EF 10

Wednesday: 08:40-10:30-10:40-12:30 /MATH LAB

***Course Description**:* ELE 342 is aimed at helping pre-service mathematics teachers develop skills in methods of teaching mathematics to 6-8 students. It focuses on the issues around what can be done to help young learners understand math concepts. There will be an emphasis on critical discussion and applications of strategies to teach specific mathematics concepts.

***Course Objectives*:** At the end of the semester, students should be able to

- Apply the teaching methods to teach Numbers/Algebra/Geometry/ Measurement/Probability and Statistics.
- Understand the misconceptions on mathematical concepts in Numbers/ Algebra/ Geometry/ Measurement Probability and Statistics.
- Understand the errors on mathematical concepts in Numbers/ Algebra/ Geometry/Measurement/Probability and Statistics.
- Be familiar with the new K-8 Mathematics Curriculum.
- Recognize connections among mathematical ideas.
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- Recognize connections among mathematical ideas and other disciplines.
- Use representations to organize, record, and communicate mathematical ideas.
- Apply variety of appropriate strategies to solve problems.
- Analyze mathematical thinking of other classmates.
- Evaluate the effectiveness of their own teaching /their classmates teaching.
- Understand how to use computers and calculators in mathematics course.

- Teach mathematics by using computers and calculators.
- Be self-confident in teaching mathematics.
- Have positive attitude toward teaching mathematics.
- Be motivated to teach mathematics.

Tentative Schedule

NOTE: I expect every student to read the assigned readings prior to class hour. The assigned readings are given below. Additional papers will be assigned according to the topics.

Weeks	***Topic***
1	**Chapter 24-** Developing Concepts of Exponents, Integer, and Real Numbers
2	**Chapter 15-** Algebraic Thinking: Generalizations, Patterns, and Functions
3	**Chapter 16-** Developing Fraction Concepts
4	**Chapter 17-** Computation with Fractions
5	**Chapter 18-** Decimal and Percent Concepts and Decimal Computation
6	**Chapter 19-** Proportional Reasoning
7	**Chapter 20-** Developing Measurement Concepts
8	**Midterm**
9	**Chapter 21-** Geometric Thinking and Geometric Concepts
10	**Chapter 21-** Geometric Thinking and Geometric Concepts
11	**Chapter 22-** Concepts of Data Analysis
12	**Chapter 23-** Exploring Concepts of Probability
13	Models-and-Modeling Activities
14	Models-and-Modeling Activities

Grading & Assignments

Attendance and Participation	10
Group Activities	10
Modeling Project	10
Quizzes	10
Midterm	20
Final	30
Portfolio	10
Total	**100**

Attendance and Participation

The nature of the class activities and course objectives make attendance and active participation important. Therefore, attendance is required in ELE 342. Students who did not attend more than 30% of the sessions will fail from ELE 342. At the end of the semester you will be assigned a score out of 10 based on your attendance and participation.

Group Activities

On every Wednesday you were supposed to prepare activities related to the topic and discuss during the class hour on Monday. You should work in groups while preparing activities.

Models-and-Modeling Project

You will work on examining mathematics problems, writing realistic mathematics problems and evaluating the quality of those problems for two weeks. At the end, you will have a set of realistic mathematics problems (including at least two problems) in the

area that you were assigned, and a RUBRIC to evaluate "realistic" and "mathematical" nature of realistic problems.

Quizzes

There will be several unannounced quizzes.

Midterm & Final

There will be one midterm and final examination.

Portfolio

You were supposed to put all the class works in a folder that you produced during the course.

Academic Misconduct

I hope there will be no need to worry about academic misconduct (cheating, plagiarism, etc.). Plagiarism will not be tolerated.

References

Main Book

Van De Walle, J. A. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7h Ed.). Boston, MA: Pearson Education, Inc.

Other Sources

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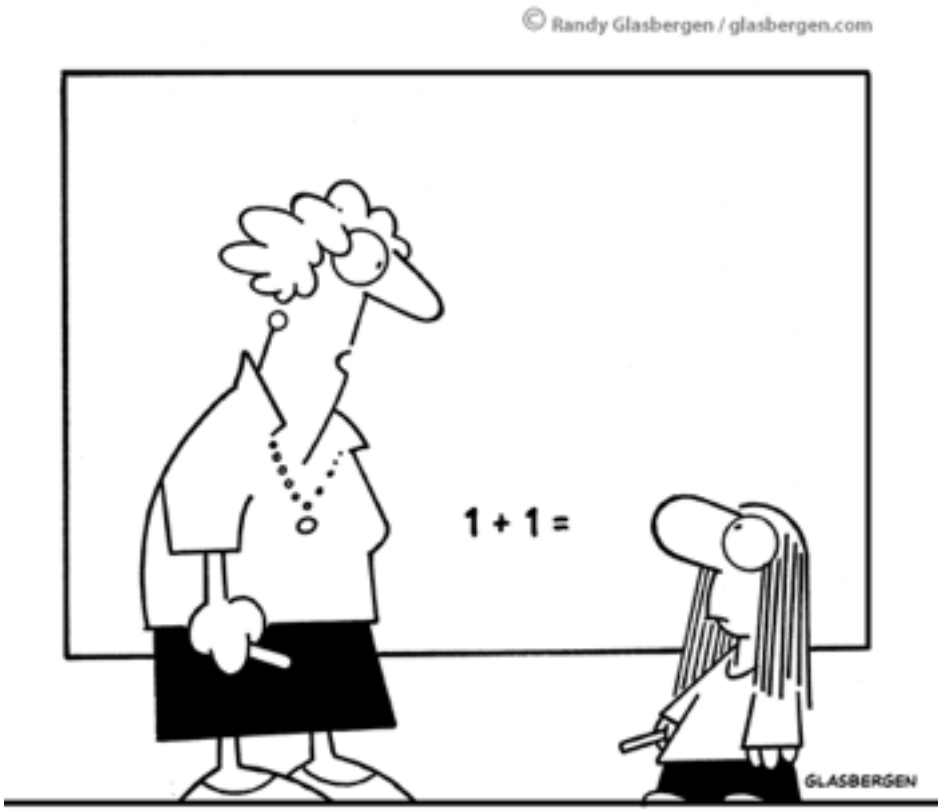

"Yes, this will be useful to you later in life."

C. Interview Questions

1. Bugüne kadar almış olduğun eğitimden bahseder misin?
    - Hangi tür liseden mezun oldun? Hangi bölüm?
2. Bu bölümü isteyerek mi tercih ettin? Kaçıncı tercihindi?
3. Şimdiye kadar herhangi bir öğretmenlik deneyimin oldu mu? (özel ders, dershane veya İLKYAR gibi sosyal kuruluşlarda ya da komşu/akraba çocuklarına ders çalıştırmak gibi)
    - Nerede? Ne zaman? Ne kadar sürdü?
4. Bu deneyimlerinin matematik öğretim yöntemleri dersinde faydası olacağını düşünüyor musun? Neden?/Nasıl?
5. (Matematik öğretmenliği programında) bugüne kadar hangi dersleri aldın? Bu dönem hangi dersleri alacaksın?
6. Daha önce matematiksel etkinlik hazırlama ve/veya uygulama deneyimin oldu mu?
    - Nerede? Ne zaman?
    - Hangi sınıf seviyesinde?
7. Öğrencilerin üst-düzey matematiksel becerilerini geliştirecek matematiksel etkinlikleri etkili bir şekilde hazırlama ve uygulama konusunda kendini ne kadar yeterli hissediyorsun?
    - Bu konuda endişelerin var mı? Varsa neler? Sebepleri?
8. Matematik öğretim yöntemleri dersi süresince kendini yeterli/yetersiz hissetmende
    - pazartesi günkü ders anlatımı,
    - grup çalışması,
    - arkadaşlarının yaptığı sunumlar,
    - hazırladığın/sunduğun etkinlikler hakkında dersi veren öğretim üyesi ve arkadaşların tarafından verilen dönütler nasıl etkiledi?

9. Matematik öğretim yöntemleri dersi boyunca bu düşüncelerini etkileyen en güçlü faktör ne oldu? (pazartesi günkü ders anlatımı, grup çalışması, arkadaşlarının yaptığı sunumlar, hazırladığın/sunduğun etkinliklerin dersi veren öğretim üyesi ve arkadaşların tarafından değerlendirilmesi)

- Neden? Hangi açıdan?

10. Matematik öğretim yöntemleri dersi boyunca bu faktörler dışında düşüncelerini etkileyen bir faktör oldu mu?

- Varsa bu faktör(ler) nasıl etkiliyor?

11. Aldığın diğer derslerin bu konuda (kendini yeterli/yetersiz hissetmende) etkisi oldu mu?

- Neden?/Nasıl?

D. List of Themes and Codes

THEMES	CODES
Lectures	The transmission of knowledge
	Questioning method
	The instructor's expectations
	Support for textbook
	Interaction with the instructor
Group Work	Preparing tasks as a group
	Implementing tasks as a group
	Working as a group
Peers' Presentations	Peers as models
	Working on peers' tasks
Feedback on Group Work	Feedback from the instructor
	Feedback from peers
Assigned Readings	Textbook
	Additional readings
Examination	Unannounced quizzes
	Midterm exam

E. Tez Fotokopisi İzin Formu

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü	
Sosyal Bilimler Enstitüsü	X
Uygulamalı Matematik Enstitüsü	
Enformatik Enstitüsü	
Deniz Bilimleri Enstitüsü	

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Soyadı : Yürekli
Adı : Bilge
Bölümü : İlköğretim

TEZİN ADI (İngilizce) : Prospective Teachers' Self-Efficacy for Preparing and Implementing Worthwhile Mathematical Tasks

TEZİN TÜRÜ : Yüksek Lisans [ ] Doktora [X]

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. [ ]
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. [ ]
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Yürekli, B., Işıksal, M., & Çakroğlu, E. (2014). *Preservice teachers' self-efficacy for preparing and implementing mathematical tasks: A case study.* Paper presented at 2nd International Symposium, New Issues on Teacher Education, Macerata, Italy.

Yürekli, B. (2013). *Effects of a Mathematics Teaching Methods Course on Preservice Elementary Teachers' Self-Efficacy for Using Manipulatives.* Paper presented at the Spring Research Conference, Lexington, KY.

Yürekli, B. (2012). *Preservice elementary classroom teachers' teaching efficacy about using mathematical manipulatives*. Paper presented at the 11th National Symposium on Elementary Classroom Teacher Education, Rize.

Yürekli, B., & Işıksal, M. (2010). *Effects of methods of teaching mathematics course on preservice elementary mathematics teachers' mathematics teaching efficacy.* Paper presented at the 9th National Congress on Science and Mathematics Education, İzmir.

Yürekli, B. (2008). *The relationship between primary school teachers' multiple intelligences and mathematics self-efficacy.* Paper presented at the 7th National Symposium on Elementary Classroom Teacher Education, Çanakkale.

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TURKISH SUMMARY

ÖĞRETMEN ADAYLARININ MATEMATİKSEL ETKİNLİKLERİ HAZIRLAMA VE UYGULAMAYA İLİŞKİN ÖZ-YETERLİK ALGILARI

GİRİŞ

Matematik eğitiminin genel amacı, öğrencilerin problem çözme sürecine aktif olarak katılıp matematiksel kavramları anlamlı bir şekilde öğrenmelerini sağlamaktır (MEB, 2013; NCTM, 2000). Problem çözme süreci içerisinde öğrencilerin kendi çözüm yöntemlerini üretmeleri, ürettikleri çözümleri nedenleriyle birlikte açıklayabilmeleri ve ulaştıkları sonuçları değerlendirebilmeleri, kavramlar arasında ilişki kurabilmeleri, matematiksel düşünceleri farklı gösterimlerle ifade edebilmeleri ve matematiğin dilini doğru ve etkin şekilde kullanabilmeleri beklenmektedir. Söz konusu öğrenme sürecinin merkezinde yer alan problemler (matematiksel etkinlikler) ise sınıftaki öğrenme ortamının niteliğini ve öğrencilerin anlamlı öğrenme düzeylerini belirleyici özelliktedir (Stein, Smith, Henningsen ve Silver, 2009).

Matematiksel etkinlik, "öğrencilerin dikkatlerini belirli bir matematiksel fikir üzerinde toplayan bir tek ya da bir grup problem" olarak tanımlanmaktadır (Stein, Grover ve Henningsen, 1996, s. 460). Araştırmalar göstermiştir ki, öğrencilerin iletişim, akıl yürütme, ilişkilendirme gibi üst-düzey matematiksel süreç becerilerini geliştirecek matematiksel etkinlikleri etkili bir şekilde hazırlayıp uygulayabilmek için öğretmenlerin gerekli bilgiye sahip olmaları gerekmektedir (Sullivan, Clarke ve Clarke, 2009). Ancak gerekli bilgiye sahip olmak başarılı performans için her zaman yeterli değildir, çünkü öz-yeterlik algısı, performansın önemli bir belirleyicisidir (Bandura, 1997).

Yapılan çalışmalar öğretmenlerin öz-yeterlik algılarının, diğer bir deyişle öğretmenlerin öğrencilerin öğrenmelerini ve başarılı olmalarını sağlamaya ilişkin becerilerine olan inançlarının, onların öğretimlerini, öğretime yönelik tutumlarını, sınıf yönetimlerini ve aynı zamanda öğrencilerinin motivasyonlarını, akademik başarılarını ve öz-yeterlik algılarını etkilediğini ortaya koymuştur (Caprara, Barbaranelli, Steca ve Malone, 2006; Pajares, 1992; Woolfolk, Rosoff ve Hoy, 1990). Öğretmenler güçlü yeterlik algılarına sahip olduklarında öğrenme güçlüğü çeken öğrencilerine daha çok zaman ayırmakta ve kullandıkları öğretim yöntemlerini geliştirmek için çabalamaktayken, öz-yeterlik algıları zayıf olan öğretmenler mesleki tükenmişliğe kapılmaya, mesleki tatminsizlik yaşamaya ve meslekten ayrılmaya daha meyilli olmaktadır (Caprara, Barbaranelli, Steca ve Malone, 2006; Klassen ve Chiu, 2010). Bu nedenle, öğretmenlerin matematiksel etkinlikleri etkili bir şekilde hazırlama ve uygulama konusunda güçlü yeterlik algılarına sahip olmalarının önemli olduğu söylenebilir.

Etkili öğretim üzerindeki kritik önemi nedeniyle, öğretmenlerin yeterlik inançları matematik ve fen gibi farklı branşlarda çalışılmıştır. Ancak yapılan çalışmalarda çoğunlukla hizmetiçi öğretmenlere odaklanılmıştır (Klassen, Tze, Betts ve Gordon, 2011). Öz-yeterlik algıları beceri gelişimi sürecinde değişime daha açık olduğu için (Bandura, 1997), öğretmen adaylarının öz-yeterliklerinin çalışılması ve onlara söz konusu inançlarını geliştirme konusunda yardımcı olacak yolların araştırılması önemlidir.

Bandura'ya (1997) göre, öz-yeterlik algısının gelişimi dört ana kaynaktan sağlanmaktadır: Bireysel deneyimler, dolaylı deneyimler, sözel ikna ve duygusal durum. Bireysel deneyimler, ki öz-yeterlik algısının en güçlü kaynağıdır, kişilerin kendi performansları sonucu elde ettiği bildirimlerdir ve başarılar öz-yeterliği beslerken, başarısızlıklar zayıflatır. Dolaylı deneyimler model alınan kişilerin performansları gözlenerek edinilir. Burada kişinin modele ilişkin algısı bu kaynağın öz-yeterlik üzerindeki etkisini belirler, yani birey, kendisininin modele ne kadar benzer olduğunu

düşünürse modelin başarı veya başarısızlıkları o kadar etkili olur. Ayrıca söz konusu model diğer bireyler olabileceği gibi kitap, video gibi sembolik modeller de dolaylı deneyim yoluyla öz-yeterlik algısının gelişimini etkileyebilir. Sözel ikna ise bireyin performansına veya kapasitesine ilişkin olarak diğer bireylerden aldığı dönütlerdir. Son olarak, kişilerin herhangi bir performansa yönelik içinde bulundukları duygusal durum (stres, kaygı, mutluluk, rahatlık vs.) öz-yeterlik algısının gelişimi için bilgilendirici bir kaynaktır.

Bandura'nın (1997) belirttiği gibi, herhangi bir faktör, öz-yeterlik algısının dört kaynağının biri veya birkaçını harekete geçirerek etki yaratır ve insanlar bu kaynaklardan edindikleri yeterliklerine ilişkin bilgileri tartıp yorumlayarak öz-yeterlik inançlarını şekillendirirler. Öğretmen adaylarının yüksek yeterlik algısına sahip olmalarına yardımcı olmak için de öz-yeterlik kaynakları aracılığıyla etki yaratan faktörlerin belirlenmesi gerekmektedir. Öz-yeterliğin bu dört kaynağı göz önünde bulundurularak öğretmen adaylarının yeterlik inançlarını etkileyen faktörlerin araştırılması, öğretmen eğitimcilerin geleceğin öğretmenlerinin güçlü öz-yeterlik inancı geliştirmelerini sağlamalarına ve öğretmen yetiştirme programlarının bu açıdan eksik kalan yönlerinin belirlenmesine yardımcı olabilir.

Fakat öğretmen yetiştirme programlarının öğretmen adaylarının öz-yeterlikleri üzerinde rolünü ve nasıl etki yarattığını açıklayacak yeterli çalışma bulunmamaktadır. Öğretmen adaylarının öz-yeterlik inançları konusunda yapılan araştırmalar genellikle bu inançların bağlantılı olduğu ve etkilediği diğer kavramlara yoğunlaşmıştır. Öz-yeterliğin teorik kaynakları temel alınarak öğretmen yetiştirme programlarının genel etkisini araştıran birkaç nicel çalışma bulunmaktadır (Poulou, 2007; O'Neill ve Stephenson, 2012). Fakat, yöntemsel sınırlılıklar nedeniyle, nicel olarak tasarlanan bu tür çalışmalar öğretmen adaylarının yeterlik algılarını oluştururken hangi kaynakları tartıp yorumladıklarını açıklamamaktadır. Öte yandan, nitel çalışmaların sayısı da oldukça azdır. Gerçekleştirilen bu az sayıdaki nitel araştırmalar (örn; Brand & Wilkins, 2007) incelendiğindeyse öğretmen yetiştirme programlarının

öğretmen adaylarının öz-yeterlikleri üzerinde nasıl etki yarattığını net bir şekilde ortaya koyamadıkları görülmektedir. Çünkü bu çalışmalarda veriler açık uçlu sorular aracılığıyla toplanmış, öğretmen adaylarının görüşleri detaylı bir şekilde incelenememiştir. Oysa bireysel görüşmelerle yapılacak olan bir nitel çalışma, öğretmen adaylarının öğrenim gördükleri programa ilişkin hangi faktörlerin öz-yeterlik algılarında ne tür etkisi olduğuna dair fikirlerini açıkça ortaya çıkarabilir. Bu sayede öğretmen eğitimciler de öğretmen adaylarının yeterlik inançlarının gelişimini destekleyecek şekilde programlarını nasıl düzenleyecekleri hakkında net ve detaylı bilgiye sahip olabilirler.

1.1 Çalışmanın Amacı

Öğretmen adaylarının öz-yeterlik algılarının kaynakları hakkındaki literatürdeki bu eksiklik göz önünde bulundurularak, bu çalışmada matematik öğretim yöntemleri dersi kapsamında ilköğretim matematik öğretmeni adaylarının matematiksel etkinlikleri hazırlama ve uygulamaya ilişkin öz-yeterliklerinin incelenmesi hedeflenmiştir. Araştırmanın amacı, matematik öğretim yöntemleri dersine ait hangi bileşenlerin öğretmen adaylarının öz-yeterlikleri üzerinde nasıl etki yarattığını belirlemektir. Çalışmada matematik öğretim yöntemleri dersine ait söz konusu bileşenlerin öz-yeterlik algısının hangi kaynağı ya da kaynakları üzerinden etki yarattığı öğretmen adaylarının bakış açılarına dayanarak değerlendirilmiştir.

1.2 Çalışmanın Önemi

İlköğretim matematik öğretmeni adaylarının matematiksel etkinlikleri etkili bir şekilde hazırlama ve uygulamaya ilişkin öz-yeterlik algılarına matematik öğretim yöntemleri dersi süresince etki eden faktörlerin neler olduğunun anlaşılması, öncelikle öğretmen eğitimcilerin öğretmen yetiştirme programlarının etkililiğini arttırmalarını sağlamaya yardımcı olacaktır. Bu çalışma, söz konusu programdaki eksikliklere değinerek programda gerekli düzenlemelerin yapılabilmesi için öğretmen eğitimcilere bir kılavuz sağlayabilir. Bu sayede, programın öğretmen adaylarının nitelikli matematiksel etkinlikler oluşturma ve bu etkinlikleri etkili şekilde kullanabilme

konusundaki yeterliklerine ilişkin inançları üzerindeki olumlu etkisini güçlendirilebilir. Öz-yeterlikleri yüksek öğretmen adayları da mesleğe başladıklarında etkinlik merkezli matematik öğretimi konusunda başarı sağlayabilir, öğrencilerin üst-düzey matematiksel becerilerini geliştirecek etkinlikleri seçip etkili bir şekilde derslerinde kullanabilirler. Böylece öğrencilerin matematiği anlayarak öğrenmelerine katkıda bulunabilirler.

1.3 Önemli Terimlerin Tanımları

Matematiksel etkinlik: Öğrencilerin dikkatlerini belirli bir matematiksel fikir üzerinde toplayan aktivite (bir tek ya da bir grup problem)(Stein, Grover ve Henningsen, 1996, s. 460).

Matematik öğretim yöntemleri dersi: Öğretmen adaylarının ilköğretim kademesindeki (4.-8. sınıflar) öğrencilere matematik öğretmek için gerekli bilgi ve becerileri kazanmalarına yardımcı olma amacıyla verilen zorunlu ders. Özel Öğretim Yöntemleri I (ELE341) ve II (ELE342) derslerinden oluşan matematik öğretim yöntemleri dersi, İlköğretim Matematik Öğretmenliği lisans programı kapsamında yer alan ve üçüncü yıla ait bir derstir.

İlköğretim matematik öğretmeni adayları: Eğitim Fakültesi bünyesindeki İlköğretim Matematik Öğretmenliği programına kayıtlı öğretmen adayları.

Öz-yeterlik: Bireyin, verilen işi başarılı bir şekilde yerine getirmek için gerekli olan faaliyetleri düzenleme ve harekete geçirme konusundaki yeterliklerine ilişkin inancı (Bandura, 1997, s. 3).

Etkinlik hazırlama ve uygulamaya ilişkin öz-yeterlik algısı: Öğretmenlerin, öğrencilerin üst-düzey matematiksel becerilerini geliştirmelerini sağlayacak matematiksel etkinlikleri hazırlama (seçme ya da oluşturma) ve sınıflarında etkili bir şekilde uygulama konusundaki yeterliklerine ilişkin inançları.

Öğretmen öz-yeterlik algısı: Öğretmenlerin, öğrencilerin öğrenmelerini ve akademik açıdan başarıya ulaşmalarını sağlama konusundaki yeterliklerine ilişkin inançları (Tschannen-Moran ve Woolfolk Hoy, 2001).

YÖNTEM

Çalışmaya yön veren araştırma soruları aşağıdaki gibidir:

1.Matematik öğretim yöntemleri dersi süresince ilköğretim matematik öğretmeni adayları matematiksel etkinlikleri hazırlama ve uygulamaya ilişkin yeterlik inançlarını nasıl tanımlamaktadır?

2.Matematik öğretim yöntemleri dersi süresince ilköğretim matematik öğretmeni adayları matematiksel etkinlikleri hazırlama ve uygulamaya yönelik yeterliklerini etkileyen faktörleri nasıl tanımlamaktadır?

a. Matematik öğretim yöntemleri dersi süresince öğretmen adayları dersin ana bileşenlerinden (ders anlatımları, grup çalışması, arkadaşların sunumları ve grup çalışmasına ilişkin alınan dönütler) hangilerinin öz-yeterlik algıları üzerinde en güçlü etkiyi yarattığını düşünmektedir?

b. Öğretmen adaylarının öz-yeterliklerini etkileyen her bir faktör öz-yeterliğin kaynaklarından hangisi ya da hangileri üzerinden etki yaratmaktadır?

2.1 Katılımcılar

Nitel durum çalışması olarak tasarlanan bu araştırma, Orta Doğu Teknik Üniversitesi Eğitim Fakültesi bünyesindeki İlköğretim Matematik Öğretmenliği programına kayıtlı öğretmen adaylarıyla gerçekleştirilmiştir. Programdaki üçüncü yıllarında Özel Öğretim Yöntemleri dersini alan 40 öğretmen adayından 9'u çalışmaya katılmayı kabul etmiştir. Katılımcılardan 8'i kadın, 1'i erkektir. Program boyunca öğretmen adaylarının almak zorunda oldukları diğer dersler cebir, analitik geometri gibi matematik derslerini, eğitim bilimleriyle ilişkili eğitim psikolojisi ve sınıf yönetimi gibi dersleri, aynı zamanda Türkçe, İngilizce ve temel fizik derslerini içermektedir. Matematik eğitimiyle alakalı seçmeli dersler ise İlköğretim ve Ortaöğretim Matematik

Öğretmenliği programları kapsamında açılmaktadır. Staj dersleri ise programın son yılında verilmektedir.

2.2 Matematik Öğretim Yöntemleri Dersi

İlköğretim Matematik Öğretmenliği programında öğrenim gören öğretmen adayları, üçüncü yıllarında Özel Öğretim Yöntemleri dersini almakla yükümlüdür. İki dönemlik bu ders, öğretmen adaylarının matematiksel etkinlikleri etkili bir şekilde hazırlayıp uygulamayı öğrenmelerine, aynı zamanda matematik eğitiminde somut materyalleri ve teknolojiyi kullanmalarına yardımcı olmayı hedeflemektedir. Dersin merkezinde Türkiye'de okutulan Matematik Öğretim Müfredatı ve NCTM İlkeler ve Standartları yer almaktadır. Matematik öğretim yöntemleri dersi matematik eğitimi alanında doçent unvanına sahip bir öğretim üyesi tarafından her iki dönem için de 14'er hafta boyunca haftada iki kez verilmektedir. Her Pazartesi, ders kitabı olarak kullanılan *İlkokul ve Ortakul Matematiği: Gelişimsel Yaklaşımla Öğretim* (Van de Walle, Karp ve Bay-Williams, 2010) adlı kitaptaki bir bölüm üzerinden ders anlatımı gerçekleştirilmektedir. Öğretmen adaylarından her hafta bu teorik saat öncesinde ilgili bölümü okuyup derse gelmeleri beklenmektedir. Bazı haftalar ders anlatımına başlamadan önce öğretmen adaylarına habersiz sınavlar yapılmaktadır. Yapılan bu küçük sınavlarda konuyla ilgili 2-3 soru yer almaktadır.

İki saat süren bu teorik kısmın ardından, her Çarşamba, öğretmen adaylarının o haftaki konuyla ilgili hazırladıkları etkinlikleri sınıfta uyguladıkları uygulama (lab) saati gerçekleştirilmektedir. Öğretmen adayları 5-6 kişilik gruplar halinde çalışarak matematiksel etkinlikler hazırlamakta ve bu etkinlikleri matematik laboratuvarında diğer arkadaşlarıyla birlikte uygulamaktadır. Uygulamalar sonrası her grubun etkinliği hakkında öğretim üyesi tarafından dönüt verilmektedir. Aynı şekilde, öğretmen adaylarından da arkadaşlarının hazırlayıp sundukları etkinlikler için dönüt vermeleri beklenmektedir. Her dönem ayrıca birer vize ve final sınavları yapılmaktadır.

2.3 Verilerin Toplanması ve Analizi

Çalışmanın verileri temel olarak yarı-yapılandırılmış bireysel görüşmeler aracılığıyla toplanmıştır (görüşme soruları için bkz. EK 3). Her bir katılımcıyla matematik öğretim yöntemleri dersinin ikinci dönemi boyunca (dersin başında, ortasında ve sonunda olmak üzere) üçer kez ayrı ayrı görüşme yapılmış, görüşmeler sırasında ses kaydı alınmıştır. İkincil veri toplama yöntemi olarak sınıfiçi gözlemler gerçekleştirilmiştir. Bu gözlemlerde amaç, katılımcıların sınıf içerisindeki performanslarından ziyade, verdikleri bilgilerin doğruluğunu değerlendirmek, aynı zamanda katılımcıların üzerinde durdukları noktalar hakkında daha detaylı bilgi sahibi olmaya çalışmaktır. Son olarak, gerçekleştirilen gözlem ve görüşmeler sırasında araştırmacı tarafından elde edilen verileri tamamlayıcı notlar alınmıştır.

Verilerin analiz süreci, yapılan görüşmelerin yazıya aktarılmasıyla başlamıştır. Her biri ortalama 30 dakika süren toplam 27 görüşme araştırmacı tarafından bilgisayar ortamında deşifre edilmiştir. Veriler sürekli karşılaştırmalı yöntem kullanılarak üç aşamada analiz edilmiştir. İlk olarak, katılımcıların etkinlik hazırlama ve uygulamaya ilişkin öz-yeterlik algıları kodlanmıştır. Katılımcılar etkinlik hazırlama ve uygulamayla ilgili yeterliklerini ayrı ayrı değerlendirdikleri için öz-yeterlik algıları *etkinlik hazırlama* ve *etkinliği uygulama* kodları kullanılarak analiz edilmiştir. Ardından, katılımcıların yeterlik algıları üzerinde etki yaratan matematik öğretim yöntemleri dersine ait bileşenler kodlanmıştır (kod listesi için bkz. EK 4). Bu kısımda kullanılan kodlar *ders anlatımları, grup çalışması, arkadaşların sunumları, grup çalışmasına ilişkin dönütler, verilen okumalar* ve *sınavlar* şeklinde adlandırılan temalar altında toplanmıştır. Son olarak, katılımcıların öz-yeterliklerini etkileyen her bir faktörün nasıl etki yarattığına dair açıklamaları Bandura'nın (1997) tanımladığı öz-yeterlik kaynakları göz önünde bulundurularak analiz edilmiştir. Diğer bir deyişle, veri analizinin bu kısmında *bireysel deneyimler* (katılımcılar kendi performansları sonucu yeterlik algılarında değişimden bahsettiğinde), *dolaylı deneyimler* (katılımcılar dolaylı gözlem ya da öğrenmeler sonucu yeterlik algılarında değişimden bahsettiğinde), *sözel ikna*

(katılımcılar aldıkları dönütlerin etkisinden bahsettiklerinde) ve *duygusal durum* (katılımcılar hissettikleri duygusal durumun etkisinden bahsettiklerinde) kodları kullanılmıştır. Kodlama güvenirliği İlköğretim Matematik Eğitimi alanından bir doktor ünvanına sahip bir araştırmacı ile yapılmıştır ve %92 güvenirliğe ulaşılmıştır.

BULGULAR

Çalışma sonucunda elde edilen bulgular göstermiştir ki, matematik öğretim yöntemleri dersi genel olarak öğretmen adaylarının öz-yeterlik algılarının gelişimine katkı sağlamış, özellikle etkinlik hazırlama konusunda olumlu etki yaratmıştır. Matematik öğretim yöntemleri dersi sonunda 8 katılımcı etkinlik hazırlama konusunda yüksek düzeyde yeterli hissederken, 1 katılımcı kendini orta seviyede yeterli olarak değerlendirmiştir. Genel olarak, dönem başında müfredat bilgilerinde yetersizlik olduğuna inanmaları katılımcıların öz-yeterlikleri arasındaki bu farka neden olmuştur. Ancak matematik öğretim yöntemleri dersini aldıktan sonra bu katılımcıların 6.-8. sınıflara yönelik nitelikli matematiksel etkinlikler hazırlayabileceklerine ilişkin inançları güçlenmiştir. Öte yandan, matematiksel etkinlikleri etkili bir şekilde uygulayabilme açısından katılımcılardan yalnızca 5'i kendilerini yüksek düzeyde öz-yeterlik algısına sahip olduklarını belirtmişlerdir. Diğer 4 katılımcı ise matematik öğretim yöntemleri dersini etkinlik uygulamaya ilişkin orta düzeyde yeterlik algısı ile tamamlamışlardır. Sınıf yönetimi konusunda kaygısı olan bu katılımcılar, etkinlik uygulama konusundaki yeterliklerini daha düşük olarak değerlendirmiştir.

Dönem başında, katılımcılardan bir önceki döneme ait deneyimlerini göz önünde bulundurarak matematik öğretim yöntemleri dersi boyunca yeterlik algılarını etkileyecek en güçlü faktörün ne olacağı hakkında tahminde bulunmaları istenmiştir. Katılımcılardan 4'ü grup çalışmasının, diğerleri ise grup çalışmasına yönelik verilen dönütlerin öz-yeterlikleri üzerinde en güçlü etkiye sahip olacağını öngörmüşlerdir. Dönütlerin etkisinin güçlü olacağını düşünen katılımcılardan biri, aynı zamanda arkadaşların sunumlarının da çok etkili olmasını beklemiştir. Ancak bu katılımcı dönem sonunda arkadaşlarının sunumları hariç diğer üç ana faktörün (ders anlatımı, grup çalışması, dönütler) birlikte en güçlü etkiyi yarattığına inandığını belirtmiştir. Benzer şekilde, dönem sonunda katılımcıların öz-yeterliklerini etkileyen en güçlü faktörün ne

olduğuna bakıldığında, matematik öğretim yöntemleri dersi başında yürüttükleri tahminlerde büyük ölçüde değişiklik olduğu görülmektedir. Buna göre, en çok etkiyi grup çalışmasının ve arkadaşların sunumlarının yarattığını düşünenler 3'er kişiye düşmüştür. Dönem başında hiçbir katılımcı ders anlatımlarının etkili olacağını düşünmezken, bu dersin sonunda 6 katılımcı ders anlatımlarının öz-yeterlik algıları üzerinde en büyük etkiyi yarattığını belirtmiştir. Arkadaşlarının lab uygulamaları da 3 katılımcı için yeterlik inançlarında en güçlü etkiye sahip olmuştur.

Matematik öğretim yöntemleri dersi boyunca katılımcıların yeterlik inançlarına katkıda bulunan farklı birçok faktör olduğu ortaya çıkmıştır. Bulgular göstermiştir ki, ders anlatımları, grup çalışmaları, arkadaşların sunumları, grup çalışması hakkında alınan dönütler, verilen okumalar ve yapılan sınavlar katılımcıların öz-yeterliklerini etkileyen ana faktörlerdir. Bu faktörlerin her biri, öz-yeterlik kaynaklarını nasıl harekete geçirdiği araştırılarak analiz edilmiştir.

3.1 Ders Anlatımları

Matematik öğretim yöntemleri dersi boyunca Pazartesi günleri gerçekleştirilen ders anlatımlarının, katılımcıların öz-yeterlikleri üzerinde önemli etkiye sahip olduğu görülmüştür. Ders anlatımları sırasında dersi veren öğretim üyesinin sahip olduğu bilgi ve becerileri öğretmen adaylarına sözel olarak aktarması, katılımcılar için dolaylı öğrenme fırsatı yaratmış ve öz-yeterliklerinin gelişimine katkıda bulunmuştur. Bu açıdan öğretim üyesi matematiksel etkinlikleri seçme ve kullanma konusundaki bilgi ve tecrübelerini öğretmen adaylarıyla paylaşarak onlara dolaylı deneyim kazanma imkanı sunmuştur.

Ders anlatımı sırasında öğretim üyesi, katılımcıların sahip oldukları kavram yanılgılarının üstesinden gelmelerine yardımcı olarak kendilerini daha yeterli hissetmelerini sağlamıştır. Öğretim üyesi soru-cevap yöntemini kullanarak öğretmen adaylarının kavram yanılgılarını ortaya çıkarmış ve bu kavram yanılgılarını ortadan kaldırılmasını sağlayacak şekilde ders anlatımı yaparak öğretmen adaylarının etkinlik hazırlayacakları matematik konularına ilişkin alan bilgilerinin artmasına yardımcı

olmuştur. Bu açıdan, öğretim üyesinin verdiği düzeltici dönütler sözel ikna kaynağı olarak katılımcıların öz-yeterliklerini güçlendirmiştir.

Bu süreç içerisinde öğretim üyesinin soru-cevap yöntemini kullanmış olması öğretmen adaylarının bireysel deneyim kazanmalarına da yardımcı olmuş ve öz-yeterlik algıları üzerinde olumlu etki yaratmıştır. Öğretim üyesi ders anlatımlarında öğretmen adaylarının ders kitabında yer alan etkinlikleri gelecekteki öğrencileriyle nasıl uygulayacaklarını açıklamalarını ve kitaptaki etkinlik örneklerinin farklı yaş ve öğrenme düzeyindeki öğrenciler için nasıl düzenleyeceklerine dair fikir üretmelerini sağlayacak sorular yönelterek sınıfta tartışma ortamı yaratmıştır. Katılımcılar da bu sürecin kendilerine etkinlik hazırlama ve uygulama konusundaki bilgilerini arttırdığını, bireysel deneyim sağlayarak yeterlik algılarını güçlendirdiğini ifade etmişlerdir.

Öğretim üyesinin soru-cevap yöntemini kullanmış olması katılımcılar için aynı zamanda dolaylı deneyim kazanma imkanı yaratmıştır. Sınıftaki tartışma ortamında arkadaşlarının fikirlerini dinlemek, katılımcılar için etkinlik merkezli matematik öğretimi konusunda dolaylı öğrenme sağlamıştır. Bu açıdan soru-cevap yöntemi yeterlik algısının dolaylı deneyimler kaynağı üzerinden katılımcıların öz-yeterliklerinde olumlu etki yaratmıştır.

Soru-cevap yönteminin etkinleştirdiği bir diğer öz-yeterlik kaynağı ise katılımcıların duygusal durumları olmuştur. Bu yöntemle öğretmen adaylarının derse aktif katılımlarının sağlanması, katılımcıların dersten keyif almalarına ve matematiksel etkinlikler üzerine fikir yürütme ve fikirlerini tartışma konusunda motive olmalarına yardımcı olmuştur. Katılımcıların soru-cevap yöntemi kullanılarak desteklenen duygusal durumları etkinlik hazırlama ve uygulamaya ilişkin yeterlik algılarını da olumlu etkilemiştir.

Matematik öğretim yöntemleri dersi kapsamında öğretmen adaylarından verilen haftalık okumaları tamamlayarak derse katılmaları beklenmiştir. Ders kitabına ek olarak, öğretmen adaylarının müfredata ve matematik öğretimiyle ilgili türkçe kaynaklara da göz atmaları, böylece ders anlatımlarına aktif olarak katılmaları dersi

veren öğretim üyesinin beklentisi olmuştur. Bulgular göstermiştir ki, katılımcılar öğretim üyesinin beklentilerini karşılamak için yeterli çabayı sarf ettiklerinde kendilerini daha yeterli hissetmişlerdir.

Verilen okumalar açısından ders anlatımlarının tamamlayıcı nitelikle olduğu görülmüştür. Katılımcılar, ders anlatımlarını kitaptan öğretimlerini arttıran destekleyici bir etken olduğunu belirtmişlerdir. Pazartesi günleri ders kitabındaki konuyu tartışırken öğretim üyesi öğretmen adaylarının okuyup geldikleri kısımlara ilişkin yanlış anlamaları (örneğin, kitapta geçen etkinlik örneklerini yanlış yorumlamaları) üzerine yoğunlaşarak bu yanlış anlamaları düzeltmelerine yardımcı olacak şekilde ders işlemiştir. Öğretim üyesi tarafından verilen bu düzeltici dönütler, katılımcıların yeterlik inançları için sözel ikna kaynağı sağlamıştır.

Son olarak, ders anlatımları sırasında öğretim üyesi ve öğretmen adayları arasındaki iletişim katılımcıların yeterlik algıları üzerinde etki yaratan bir faktör olmuştur. Bulgular göstermiştir ki, öğretim üyesinin arkadaşcanlısı yaklaşımı ve yarattığı rahat sınıf ortamı katılımcıların öz-yeterliklerini duygusal durum kaynağı aracılığıyla etkilemiştir. Bu sayede katılımcılar düzenli olarak dersi takip etme ve derse aktif olarak katılma açısından motive olmuşlardır. Teorik saatlerde gerçekleşen sınıfiçı tartışmalarda etkinlikler hakkında düşüncelerini açıkça ve yargılanmadan ifade edebilmeleri, etkinlik merkezli matematik öğretimi konusunda kendilerini rahat ve dolayısıyla daha yeterli hissetmelerini sağlamıştır.

3.2 Grup Çalışması

Pazartesi günkü ders anlatımlarının ardından öğretmen adayları grup çalışması yaparak o haftaki konuyla ilgili matematiksel etkinlikler hazırlamış ve bu etkinliklerini lab saatlerinde diğer öğretmen adaylarıyla birlikte sınıfta uygulamışlardır. Yapılan görüşmelerde katılımcılar, bireysel deneyim kaynağı olarak etki yaratan bu sürecin yeterlik algılarına katkıda bulunduğundan bahsetmişlerdir. Ancak matematik öğretim yöntemleri dersi boyunca etkinlik hazırlamaya ilişkin öz-yeterlikleri grup çalışmaları sayesinde gelişirken, etkinlikleri uygulamaya yönelik yeterlik algılarında

aynı derecede olumlu değişim gözlenememiştir. Bunun başlıca sebebi, katılımcıların, bir önceki dönemin aksine, lab saatinde gerçekleşen uygulamaların yetersiz olduğunu düşünmeye başlamalarıdır. Katılımcılar, etkinlikleri gerçek sınıf ortamında öğrencilerle uygulamanın kendilerine daha çok katkı sağlayacağına inandıklarını belirtmişlerdir.

Etkinlik hazırlama ve uygulama sürecinde grup olarak çalışıyor olmanın da katılımcıların yeterlik algılarında olumlu etki yarattığı görülmüştür. Grup çalışması, bireysel deneyime ek olarak, grup elemanlarının birbirlerinden öğrenmelerini sağlamış ve dolaylı deneyim kaynağı aracılığıyla öz-yeterliklerinin gelişimine katkıda bulunmuştur. Buna ek olarak, grup arkadaşlarının birbirlerinin öğrenmelerini geliştiren düzeltici dönütler ve grup çalışması sırasındaki başarılarına ilişkin performans dönütleri vermeleri katılımcıların öz-yeterlik inançlarını sözel ikna yoluyla etkilemiştir. Katılımcılar ayrıca grup çalışması yapıyor olmanın bireysel çalışmaktan daha eğlenceli olduğunu, dolayısıyla etkinlik hazırlama ve uygulamaktan keyif aldıklarını belirtmişlerdir. Bu açıdan grup çalışması öz-yeterliğin duygusal durum kaynağını harekete geçirerek etki yaratmıştır.

3.3 Arkadaşların Sunumları

Lab saatlerinin bir parçası olarak, her grup, hazırladığı etkinliği sınıfta arkadaşlarına sunmuş ve onlarla birlikte uygulamıştır. Bulgulara göre katılımcılar, arkadaşlarının sunumlarını öz-yeterliklerine katkıda bulunan bir dolaylı deneyim kaynağı olarak görmüşlerdir. Katılımcılar arkadaşlarını model olarak almış, onların performanslarını kendi yeterliklerini değerlendirirken göz önünde bulundurmuşlardır. Bu bakımdan lab saatleri, katılımcılara sosyal karşılaştırma imkanı vermiştir. Katılımcılar kendilerini arkadaşlarıyla karşılaştırırken genel olarak başarılı örneklere odaklanmış, diğerlerini göz ardı ettiklerini belirtmişlerdir. Arkadaşlarının başarılı performansları, katılımcıları daha iyisini yapma konusunda motive etmiştir. Arkadaşlarının hatalarıysa etkinlik oluşturma ve uygulama açısından dolaylı öğrenme sağlamıştır.

Arkadaşların sunumlarına ilişkin bulgular göstermiştir ki, katılımcıların arkadaşlarının hazırladıkları etkinlikler üzerinde çalışırken veya onları gözlemlerken

içinde bulundukları duygusal durum yeterlik algıları için bir kaynak olmuştur. Diğer grupların hazırladıkları nitelikli etkinlikler üzerinde çalışırken keyif alma, eğlenme gibi olumlu duygular hissettiklerini belirtirken, düşük kaliteli etkinlikler sunulduğunda sıkıldıklarını, bu tür etkinlikler üzerinde çalışmak istemediklerini açıklamışlardır. Bandura'ya (1997) göre olumlu duygular öz-yeterliği beşlerken, olumsuz duygular yeterlik algısını düşürmektedir. Ancak katılımcılar stres, kaygı, kızgınlık gibi güçlü olumsuz duygusal uyarımlara maruz kalmadıkları için, arkadaşların sunumlarının genel olarak yeterlik inançlarında olumlu etki yarattığı söylenebilir.

3.4 Grup Çalışmasına İlişkin Dönütler

Lab saatlerinde her grubun sunumundan sonra öğretim üyesi ve öğretmen adayları grupların çalışmalarına ilişkin dönüt vermişlerdir. Bu dönütler katılımcıların performansları hakkında bilgi sağladığı için sözel ikna kaynağı aracılığıyla etki yaratmıştır. Öğretim üyesi ve arkadaşlarının verdikleri dönütler karşılaştırıldığında, katılımcıların öğretim üyesinin dönütlerine daha çok önem verdikleri görülmüştür. Öğretim üyesinin bilgi ve tecrübesi arkadaşlarından fazla olduğu için katılımcılar onu daha güvenilir bir geri bildirim kaynağı olarak görmüşlerdir. Genel olarak öğretim üyesinin dönütleri olumlu etki yaratırken, matematik öğretim yöntemleri dersi sırasında katılımcılar öğretim üyesinin çok fazla eleştirel davrandığını düşünmeye başlamış ve bu durumdan olumsuz etkilendiklerini ifade etmişlerdir. Ancak katılımcılardan bazıları bu eleştirel yaklaşımı kendileri için meydan okuma olarak görüp daha başarılı olmaya çalışırken, özellikle bir katılımcı eleştirilerin yanlış olduğuna inanıp kendini geri çekmiş, derse katılmaya yönelik motivasyonunda düşüş yaşadığını belirtmiştir.

3.5 Dersin Okumaları

Bulgular göstermiştir ki, matematik öğretim yöntemleri dersi kapsamında ana ders kitabı olarak kullanılan *İlkokul ve Ortakul Matematiği: Gelişimsel Yaklaşımla Öğretim* (Van de Walle, Karp ve Bay-Williams, 2010) katılımcılar için sembolik öğrenme kaynağı sağlamış ve öz-yeterlik algılarının gelişimine dolaylı deneyimler üzerinden katkıda bulunmuştur. Ancak kitabın dilinin ingilizce olması katılımcıların

okuduklarını anlamaları üzerinde olmsuz etkiye de sebep olabildiği görülmüştür. Ayrıca katılımcılar, matematik öğretim yöntemleri dersinin ikinci dönemine ait okumaların daha uzun olduğunu belirtmiş, bazen ilgili konuyu detaylı şekilde okuyacak vakitleri olmadığını açıklamışlardır.

Başka bir sembolik öğrenme, yani dolaylı deneyim, kaynağı da Matematik Öğretim Müfredatı ve matematik öğretimine yönelik yazılmış olan Türkçe kaynaklar olmuştur. Öğretmen adaylarının bu kaynaklara da çalışıyor olmaları Türkiye şartlarına uygun şekilde etkinlik hazırlama uygulamayı öğrenmelerine ve kendilerini daha yeterli hissetmelerine yardımcı olmuştur.

3.6 Sınavlar

Habersiz yapılan küçük sınavlar matematik öğretim yöntemleri dersinin bir parçası olarak Pazartesi günleri ders anlatımlarından hemen önce uygulanmıştır. Her ne kadar bu sınavlar derse hazırlanma ve dolayısıyla derse katılma açısından katılımcılar için motive edici bir faktör olsa da, katılımcılar için strese yol açtığı görülmüştür. Katılımcılar verilen okumaları tamamlayacak zamanları olmadığında veya okudukları kısımlarda anlamadıkları yerler olduğunda, mesela kitaptaki etkinlik örneklerini anlamlandıramadıklarında, bu küçük sınavların onlar için stres yarattığını belirtmişlerdir. Ancak bu olumsuz duygusal durum yeterlik algıları üzerinde doğrudan değil dolaylı bir etki yaratmıştır. Çünkü görüşmeler sırasında katılımcılar bu duygusal durumun etkinlik hazırlama veya uygulama konusundaki yeterliliklerini değil, derse hazırlanma sürecindeki performanslarını etkilediğini açıklamışlardır. Öte yandan, vize sınavının bireysel deneyim kaynağını etkinleştiren bir faktör olduğu ortaya çıkarılmıştır. Katılımcılar, vize sınavındaki performanslarının etkinlik hazırlama ve uygulamaya yönelik yeterliklerine ilişkin bilgi sağladığını belirtmişlerdir.

TARTIŞMA VE ÖNERİLER

Bu çalışmada ilköğretim matematik öğretmeni adaylarının öğrencilerin üst-düzey matematiksel becerilerini geliştirecek matematiksel etkinlikleri hazırlama ve matematik öğretimlerinde etkili bir şekilde kullanmaya ilişkin öz-yeterlik algı düzeylerini belirleyerek, matematik öğretim yöntemleri dersi boyunca öğretmen adaylarının söz konusu inançlarını etkileyen faktörleri ortaya çıkarmak hedeflenmiştir. Bu derse ait bileşenlerden öğretmen adaylarının yeterlik inançları üzerinde etkileyen her bir faktör de Bandura'nın (1997) ortaya koyduğu öz-yeterlik kaynakları göz önünde bulundurarak nasıl etki yarattıkları detaylı bir şekilde incelenmiştir. Elde edilen bulgulara göre, matematik öğretim yöntemleri dersi öğretmen adaylarının öz-yeterlikleri üzerinde olumlu etkiye sahipken, etkinlik hazırlama konusunda yeterlik algılarının gelişimine etkinlikleri etkili bir şekilde uygulamaya yönelik öz-yeterliklerinden daha çok katkıda bulunmuştur. Bunun en önemli sebebinin ise öğretmen adaylarının sınıf yönetimi becerilerine ilişkin kaygıları olduğu görülmüştür. Öz-yeterliğin en güçlü kaynağı bireysel deneyimler olduğu için öğretmen adaylarına hazırladıkları etkinlikleri gerçek sınıf ortamında uygulama imkanının sağlaması matematik öğretim yöntemleri dersinin öz-yeterlik algıları üzerindeki etkisini güçlendirebilir. Etkinlik hazırlama konusunda ise bu dersin öğretmen adaylarının yüksek öz-yeterlik inancı geliştirmelerini sağlamada başarılı olduğu söylenebilir.

Araştırmaya katılan öğretmen adaylarının öz-yeterliklerini etkileyen faktörlere bakıldığındaysa ders anlatımları, grup çalışmaları, arkadaşların sunumları, grup çalışmasına ilişkin dönütler, dersin okumaları ve sınavların en az bir öz-yeterlik kaynağını harekete geçirerek etki yarattığı görülmüştür. Genel olarak, matematik öğretim yöntemleri dersinin en çok dolaylı gözlem kaynağı aracılığıyla öğretmen adaylarının öz-yeterlik inançlarını etkilediği görülmüştür. Öz-yeterliğin en güçlü kaynağı bireysel deneyimler olduğu halde, matematik öğretim yöntemleri dersinin sağladığı

bireysel deneyimler sınırlı olduğu için öğretmen adayları daha çok dolaylı deneyimlere dayanarak yeterliklerini değerlendirmiş olabilirler. Öz-yeterliklerindeki gelişmeye bakıldığındaysa, dersin çoğunlukla dolaylı deneyim sağlıyor olmasının öğretmen adaylarının matematiksel etkinlikleri uygulama konusundaki kapasitelerine olan inançlarının yükselmesi için yeterli olmadığı söylenebilir. Bu açıdan daha çok bireysel tecrübe kazanacakları (sınıf deneyimi gibi) fırsatlar yaratılması öğretmen adaylarının yeterlik inançlarını güçlendirmeye yarayabilir.

Matematik öğretim yöntemleri dersinin bileşenleri incelendiğindeyse, öğretmen adaylarının yeterlik algılarını etkileyen en güçlü faktörün öğretim üyesinin ders anlatımları olduğu görülmüştür. Bu dersin öncesinde, öğretmen adayları grup çalışmasının öz-yeterliklerini etkileyecek en güçlü faktör olacağını düşündüklerini belirttikleri halde, dönem sonunda fikirlerinde bu yönde değişim olması, derse ilişkin faktörlerin niteliğinin öz-yeterlik algısında yarattığı etki üzerinde belirleyici rol oynadığını göstermesi açısından önemlidir. Genel olarak bakıldığında grup çalışmasının etkisinin dönem sonunda azalmasının sebebi lab uygulamalarının yetersiz kalmaya başladığının düşünülmesi, ders anlatımlarının etkisinin artmasının sebebi ise öğretmen adaylarının etkinlik hazırlama ve uygulama konusunda donanımlı hissetmelerine en çok katkı sağlayan faktör olduğuna inanmaları olduğu görülmektedir. Bu nedenle, öğretmen eğitimi programları tasarlanırken öğretmen adaylarının ihtiyaçları göz önünde bulundurularak eğitimleri süresince artan veya değişen ihtiyaçlarına karşılık verecek imkanların sağlanması verilen eğitimin etkisinin arttırılması ve öz-yeterlik algıları kuvvetli öğretmenler yetiştirilmesi için gereklidir.

Dersi veren öğretim üyesinin ders anlatımları, önceki çalışmalara paralel olarak, bilgi aktarımını yoluyla öğretmen adaylarının öz-yeterlik gelişimine katkı sağlayan olumlu bir etken olmuştur. Öğretmen adaylarına etkinlikleri hazırlarken veya farklı ekonomik düzeydeki okullarda ya da farklı seviyelerdeki öğrencilerle etkinlikleri uygularken karşılaşabilecekleri zorlukların ve bunların üstesinden gelme yöntemlerinin bilgi aktarımı yoluyla öğretilmesi onların kendilerini daha yeterli hissetmelerine

yardımcı olmuştur. Bu açıdan, matematik öğretim yöntemleri dersinde kitapta verilen bilgilerle sınırlı kalmayarak ders anlatımı yapılmasının önemli olduğu söylenebilir.

Çalışmanın önemli bulgularından biri de ders anlatımları sayesinde öğretmen adaylarına bireysel deneyim kazandırılabileceğidir. Ders anlatımı sırasında soru-cevap yöntemini kullanarak öğretmen eğitimciler, öğretmen adaylarının etkinlik hazırlama ve uygulama konusunda fikir üretmelerini, dolayısıyla daha donanımlı hale gelerek kendilerini yeterli hissetmelerine katkı sağlayabilir. Bu yöntem sayesinde öğretmen adayları kendi görüşlerini sınıf ortamında tartışarak birbirlerinin öğrenmelerine katkıda bulunabilirler. Ayrıca soru-cevap yöntemiyle öğretmen adaylarının sahip oldukları kavran yanılgıları belirlenerek bunların üstesinden gelmelerine yardımcı olunabilir, bu sayede onların etkinlik hazırlama uygulama konusundaki yetkinlikleri de arttırılabilir. Soru-cevap yönteminin bir diğer katkısı da öğretmen adaylarının derse katılımlarını ve bundan keyif almalarını sağlaması olduğu görülmüştür. Öğretim üyesinin düz anlatım yoluyla ders işlemesine karşın soru-cevap yöntemiyle öğretmen adaylarını aktif hale getirilmesinin öz-yeterlik inançlarının gelişimine daha çok olumlu etki edeceği savunulabilir.

Öğretim üyesinin öğretmen adaylarından beklentilerinin de öz-yeterlik inancı üzerinde etkili bir faktör olduğu görülmüştür. Öğretmen adayları, öğretim üyesinin beklentilerini karşılamak için harcadıkları çabayı göz önünde bulundurarak yeterliklerini değerlendirmiş ve daha çok çaba harcadıklarında daha çok geliştiklerine inandıklarını belirtmişlerdir. Öte yandan, öğretim üyesinin beklentilerinin çok yüksek olduğunu düşünen bir öğretmen adayının çaba harcamaktan kaçındığı, derse katılımının azaldığı görülmüştür. Ancak bu konuda öğretmen adaylarının öz-düzenleme becerilerinin etkili olduğu düşünülmektedir. Çünkü öz-yeterliği orta seviyede olan bu katılımcı, ders yükünün fazla olduğunu ileri sürerek matematik öğretim yöntemleri dersinde kendisinden beklenenlerin fazla olduğunu belirtmişken, beklentileri karşılamaya yönelik çalışmalar yapan katılımcılar bu dersin kendilerine "çalışma disiplini" verdiğini ve sarfettikleri çabanın karşılığında kendilerini daha yeterli hissettiklerini dile

getirmişlerdir. Bu açıdan, gelecek çalışmalarda öğretmen adaylarının öz-yeterlik algıları ve öz-düzenleme becerileri arasındaki ilişkinin incelenmesi bu konuda daha net fikir verebilir.

Ders anlatımlarının öğretmen adaylarının öz-yeterlikleri üzerindeki diğer bir etkisinin de ders kitabı aracılığıyla gerçekleşen öğrenmelerini tamamlayıcı niteliği olduğu görülmüştür. Soru-cevap yöntemiyle öğretmen adaylarının ders kitabından neler öğrendiklerini tespit ederek eksik ya da yanlış anladıkları kısımları tamamlayıcı şekilde ders işliyor olması, öğretim üyesinin ders anlatımlarının etkisini güçlendirmiştir. Daha önce belirtildiği gibi, soru-cevap yöntemini kullanmanın öğretmen adaylarının yeterlik inançlarının gelişimleri açısından düz anlatım yoluyla bilgi aktarımından daha etkili olduğu düşünülmektedir. Bu konuda daha büyük örneklem grubuyla yapılacak olan karşılaştırmalı çalışmalar her iki yöntemin etkisini daha açık bir şekilde ortaya koymaya yardımcı olabilir.

Öte yandan, bulgular grup çalışması yaparak etkinlik hazırlama ve uygulama konusunda öğretmen adaylarının bireysel deneyim kazanma fırsatı yakaladığını ve bu deneyimlerin öz-yeterlik algılarının gelişimlerine katkıda bulunduğunu göstermiştir. Ancak dönem boyunca lab saatindeki etkinlik uygulamalarının öğretmen adaylarının yeterlik algıları üzerinde etkisinin azaldığı görülmüştür. Lab uygulamalarına ayrılan sürenin az olması başlıca etkenlerden biridir. Bulgular ayrıca öğretmen adaylarının gerçek öğrencilerle çalışmadıkları sürece etkinlik uygularken karşılaşabilecekleri sınıf yöntemi sorunları ve bunlarla baş etme yolları hakkında becerilerini geliştiremeyeceklerine inanmışlardır. Her ne kadar özel ders tecrübesinin öz-yeterlik gelişimine katkı sağladığı bulunmuşsa da (Tuchman ve Isaacs, 2011), özel ders verirken matematiksel etkinlikleri kullanmıyor olmak bu deneyimlerin öğretmen adaylarının etkinlik hazırlama ve uygulamaya ilişkin öz-yeterliklerine katkı sağlamadığı söylenebilir. Bu açıdan özel ders tecrübelerinin de niteliği önemlidir. Ancak her öğretmen adayının bu tür uygulama yapma imkanı göz önünde bulundurulduğunda, sınıf

deneyiminin matematik öğretim yöntemleri dersi sırasında sağlanması dersin etkisini kuvvetlendirmek adına faydalı olabilir.

Bireysel olarak etkinlik hazırlamak yerine grup çalışması yapmanın da öğretmen adaylarının öz-yeterlik inançlarının gelişimini olumlu etkilediği görülmüştür. Grup çalışması sırasında birbirlerinin öğrenmelerine katkıda bulunmaları, grup arkadaşlarının performansları hakkında dönüt sağlamaları ve birlikte çalışmanın eğlenceli oluşu sayesinde öğretmen adaylarının güçlü yeterlik inancı geliştirmelerine katkıda bulunulabilir. Bu konuda öğretmen adaylarının birlikte çalışmak istedikleri grup arkadaşlarını seçmelerine izin vermek önemlidir. Aynı zamanda grup çalışması için öğretmen adaylarının toplanmaları, uygun yer ve zamanı ayarlamaları sorun olabileceğinden, matematik öğretim yöntemleri dersi kapsamında öğretmen adaylarına etkinlik hazırlamak için grup çalışması yapacakları bir lab saati verilebilir. Bu sayede öğretmen eğitimciler de grup çalışması sürecinde öğretmen adaylarının performanslarını birebir gözlemle fırsatı yakalayabilir, onlara ihtiyaç duyacakları desteği sağlayabilir.

Öğretmen adaylarıyla yapılan görüşmeler sonucu grup çalışmasının tek başına yeterli olmadığı sonucuna ulaşılmıştır. Grup çalışması sonunda, özellikle dersi veren öğretim üyesi tarafından, hazırlayıp sundukları etkinliklere ilişkin geri bildirim yapılmasının öz-yeterliklerin gelişmesini sağlayıcı bir etken olduğu söylenebilir. Burada önemli olan dönütlerin nasıl ifade edildiğidir. Genel olarak, hazırlanan etkinliğin eksik yönlerinin tespit edildiği ve bu kısımların düzeltilmesine yönelik düzenleyici dönütler verilmesinin etkili olduğu görülmüştür. Ayrıca verilen dönütlerin öğretmen adaylarının kişisel yetersizliklerine değil, etkinlik hazırlama ve uygulamadaki performanslarına ilişkin yetersizliklere odaklanması olumsuz geri bildirimlerin bile olumlu etki yaratmasını sağlayabildiği ortaya çıkarılmıştır. Ancak arkadaşları tarafından verilen dönütlerin bu açılardan yetersiz kaldığı tespit edilmiştir. Öğretmen adaylarına etkinlik değerlendire formu verilerek hangi noktalar üzerinde durmaları gerektiği belirtilebilir, böylece verilen dönütlerin niteliği arttırılabilir. Bu tür formlar aynı zamanda öğretmen adaylarının kendi grup çalışmaları sırasında başvurabilecekleri bir kaynak olabilir.

Lab ortamında gerçekleşen uygulamalar sayesinde öğretmen adayları diğer grupların sunumlarını izleme, onların etkinlikleri üzerinde çalışma ve onlara gelen dönütleri dinleme imkanı da bulmuşlar, dolayısıyla öz-yeterlik algılarını geliştirecek dolaylı deneyimler kazanabilmişlerdir. Matematik öğretim yöntemleri dersi içeriğinde bu şekilde lab uygulamasının yer alması önemli bir etkendir. Aynı zamanda tüm grupların her hafta etkinliklerini sunuyor olmaları öğretmen adaylarına daha çok ve çeşitli deneyim kazandırması bakımından kendilerini daha yeterli hissetmelerini sağlamıştır. Ancak zamanın kısıtlı olması bu konuda bir dezavantajdır. Gerek sınıfiçi gözlemler, gerek bireysel görüşmeler göstermiştir ki, lab saatlerinde her grubun etkinliklerini detaylı şekilde uygulayabilecekleri süre yoktur. Bir önceki dönemde konuların daha kısa olması nedeniyle öğretmen adayları labdaki uygulamanın daha etkili olduğunu düşünürken, çalışma süresince konuların daha uzun olması lab saatlerinin etkisini azaltmıştır. Bu nedenle, lab saatlerinin süresinin uzatılması dersin geliştirilmesi için faydalı olabilir.

Matematik öğretim yöntemleri dersinin sağladığı dolaylı deneyimlerden biri de dersin okumaları aracılığıyla gerçekleşmiştir. Kullanılan ders kitabının öğretmen adaylarının etkinlik hazırlama uygulama konusundaki yetkinliklerini arttırıcı nitelikte olduğu görülmüştür. Söz konusu ders kitabının diğer üniversitelerdeki özel öğretim yöntemleri derslerinde okutulması önerilebilir. Öğretmen adaylarının Türkiye'de kullanılan matematik öğretim müfredatını da kullanmaya teşvik edilmeleri öz-yeterlik algılarının gelişimlerini olumlu etkilemiştir. Dönem başında müfredata ilişkin bilgilerinin yeterli olmadığına inanan öğretmen adayları, matematik öğretim yöntemleri dersini tamamladıktan sonra müfredat konusunda sıkıntı yaşamadıklarını ve 6.-8. sınıflar yönelik de etkili matematiksel etkinlikler hazırlayıp uygulayabileceklerine inançlarının geliştiğini belirtmişlerdir. Bu nedenle, bu dersin içeriğinde matematik öğretimi müfredatının çalışılmasına de yer verilmesinin önemli olduğu söylenebilir.

Son olarak matematik öğretim yöntemleri dersi kapsamında yapılan sınavlar öğretmen adaylarının yeterlik algılarına ilişkin değerlendirmelerinde etkili olmuştur.

Ders anlatımı öncesi yapılan küçük sınavlar derse hazırlanıp gelmelerini sağlayan bir etken olduğu ve derse hazırlıklı gelmeleri ders anlatımı süresince öğrenmelerini olumlu etkilediği için, bu sınavların öz-yeterlik üzerinde dolaylı katkı sağladığı söylenebilir. Bu sınavların habersiz yapılıyor olması da dolaylı ama olumsuz etki yarattığı görülmüştür. Habersiz yapılan sınavların olumsuz etkisini ortadan kaldırmak için haftalık okumaların miktarını konunun uzunluğuna göre ayarlanabilir. Örneğin, uzun ve detaylı okuma gerektiren konular iki haftaya yayılarak öğretmen adaylarının okumaları tamamlaması ve böylece derse hazır gelmeleri, sınav kaygısı yaşamamaları sağlanabilir. Öte yandan, yapılan vize sınavı öğretmen adaylarının etkinlik merkezli matematik öğretimi konusundaki yeterliklerine ilişkin bilgilendirici özellikte olduğundan, öz-yeterlik algılarını doğrudan etkilemiştir. Sınavda başarılı olan öğretmen adayları kendilerini daha yeterli hissettiklerini belirtmişlerdir. Ancak final sınavına ilişkin elde veri bulunmamaktadır. Bu çalışmanın bir sınırlılığı, dönemin son iki haftasında öğretmen adaylarının başka bir deneysel çalışmaya katılacak olmaları nedeniyle bu araştırmanın dersin 12. haftasında tamamlanmış olmasıdır. Her ne kadar konuların işlenmesi bu süre içinde tamamlanmış olsa da, yapılan diğer çalışmanın yaratacağı etkinin bu çalışma üzerinde herhangi bir sapmaya neden olmaması için veri toplama süreci 12. hafta, yani final sınavı öncesi sonlandırılmıştır.