ANALYZING COLLECTIVE EFFICACY OF PRESERVICE SCIENCE TEACHERS IN SCIENCE METHODS COURSE

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Approval of the Graduate School of Social Sciences

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ABSTRACT

ANALYZING COLLECTIVE EFFICACY OF PRESERVICE SCIENCE TEACHERS IN SCIENCE METHODS COURSE

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This study was aimed to examine preservice teachers who work in the same group in terms of collective efficacy. The participants of this study were four preservice science teachers in third year of science teacher education program. This study was conducted in science methods course. In this course, the participants as a group were expected to prepare lesson plans according to newly learned science teaching methods during a semester. Interviews, observation, preservice teachers' critique papers, lesson plans and STEBI-B were used to collect data. Except STEBI-B instruments, the other instruments were analyzed qualitatively. On the other hand, Wilcoxon Signed Rank test was carried out to analyze data from STEBI-B. Results of this study demonstrated that the group conducted collaborative work to prepare lesson plans. Secondly, it was found that the collective efficacy among group members were developed and improved continuously during the semester. Moreover, the group members mentioned that the sources of collective efficacy which are mastery experiences, vicarious experiences, verbal persuasion, and psychological and affective states played important role in the formation of group behavior. Finally, it was revealed that thanks to these sources of collective efficacy, group performance

on preparation of lesson plan, personal science teaching efficacy, and science teaching outcome expectancy were enhanced. In the light of the results, science teacher educators and science teachers should take collective efficacy into consideration to design group work in the science education program or science lessons.

Keywords: collective efficacy, group work, preservice science teachers, science methods course, lesson plan.

ÖZ

ÖZEL ÖĞRETİM YÖNTEMLERİ DERSİNDE FEN ÖĞRETMEN ADAYLARININ KOLEKTİF YETERLİĞİNİN ANALİZİ

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Bu çalışma, aynı grupta çalışan öğretmen adaylarının kolektif yeterlik açısından incelenmesini hedeflemiştir. Katılımcılar, fen bilgisi öğretmenliği programının üçüncü yılında bulunan dört öğrenciden oluşmaktadır. Çalışma özel öğretim yöntemleri dersi kapsamında yürütülmüştür. Bu derste, katılımcılardan grup olarak öğrendikleri fen öğretim metotları doğrultusunda ders planı hazırlamaları beklenmiştir. Görüşme, gözlem, öğretmen adaylarının oluşturduğu değerlendirme kâğıtları, ders planları ve STEBI-B veri kaynağı olarak kullanılmıştır. STEBI-B dışında diğer veri kaynaklarında nitel veri analiz yöntemi kullanılmıştır. STEBI-B'den gelen veriler ise Wilcoxon Signed Rank test ile analiz edilmiştir. Çalışmanın sonucu, katılımcıların ortak çalışmaya dayalı bir grup çalışması gerçekleştirerek ders planları hazırladığını göstermiştir. Ayrıca, bu grupta kolektif yeterlik oluştuğu ve süreç içerisinde geliştiği bulunmuştur. Grubun davranışlarının oluşumunda kolektif yeterliğin kaynakları olan doğrudan yaşantı, dolaylı yaşantı, sözel ikna ve psikolojik, ve duygusal durumun önemli olduğu görülmüştür. Son olarak, bu kaynakların grup performansının, fen öğretim yeterliğinin ve sonuç beklentilerin gelişiminde rol

oynadığı tespit edilmiştir. Bu bulgular ışığında, fen öğretmen eğitimcileri ve fen öğretmenleri derslerindeki grup çalışmalarında kolektif yeterliği göz önüne almalıdırlar.

Anahtar Kelimeler: Kolektif yeterlik, grup çalışması, fen bilgisi öğretmen adayları, özel öğretim yöntemleri dersi, ders planı.

To My Family and Myself

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NRC	The National Research Council
MoNE	Ministry of National Education
NGO	Nongovernmental Organization
METU	Middle East Technical University

CHAPTER I

INTRODUCTION

Group work is a desired skill that employees in business, law, information technology, science, engineering, health discipline should have. More explicitly, the employees in these fields are asked to know working with others, solving problem as a group, communicating easily with each other and making common decision (Litchfield, Frawley, & Nettleton, 2010).

In addition to these disciplines, group work is implemented as a pedagogical mode at all levels in most educational systems, from compulsory education to higher education (Chiriac, 2014). Research on group work pointed out that it had positive influence on cognitive learning as well as pro-social and emotional development (Järvelä, Volet, & Järvenoja 2010). More specifically, the implementation of group work in educational setting had some advantageous such as improvement in students' learning, the level of reasoning, the use of high level of cognitive strategies, the level of critical thinking abilities and achievement, development in social skills like communication, enhancement in motivational outcome like self-esteem and attitude towards other people or subject matter (Johnson & Johnson, 1998, 1999; Johnson, Johnson, & Smith, 1991; Ragan, 1993; Rutherford, Mathur, & Quinn, 1998; Slavin, 1990; Zurita & Nussbaum, 2004). On the other hand, in some studies, it was reported that people found group work ineffective for learning (e.g., Chiriac, 2014; Hansen, 2006; Peterson & Miller, 2004). In line with this idea, Johnson and Johnson (1999) emphasized that every group did not work efficiently. This situation may be related to group members (Blumenfeld, Marx, Soloway, & Krajcik, 1996). Concerning this issue, Ennen, Stark, and Lassiter (2015) asserted that motivation of group members may be responsible factor influencing group work effectiveness. Especially, group members' personal beliefs, values, and attitudes can influence interaction within a group (Goodman & Dabbish, 2011; Harrington & Fine 2006). Moreover, extrinsic and intrinsic motivation also have a positive impact on group performance (Cooper

& Jayatilaka, 2006). In addition to personal-level motivation, there are also group-level motivational factors which have an influence on group work. Of these group-level motivational factors, collective efficacy is seen as one of the most powerful construct (Bandura, 1997) since it is an important predictor regarding group performance (Goddard, 2001; Peterson, Mitchell, Thompson, & Burr, 2000). Bandura (1997) defined collective efficacy construct as "a group's shared belief in its conjoint capabilities to organize and execute the course of action required to produce given levels of attainments" (p.477). These shared beliefs of group members affect on the goals, management of their resources, the plans, strategies, effort, and their persistence (Bandura, 2002; Durham, Knight, & Locke, 1997).

Collective efficacy was developed by Bandura's social cognitive theory (1986). According to this theory, the behavior of an individual was determined in the light of psychological and social processes involved in motivation, self-regulation, choice, and performance (Bandura, 1986). Based on social cognitive theory, Bandura (1997) firstly formulated self-efficacy construct as ''beliefs in one's capabilities to organize and execute the courses of action required to produce to given attainments'' (p.3). More explicitly, self-efficacy is a significant predictor of behavior since it influences cognitive processes (especially goal setting), motivational processes (especially attributions for success and failure), affective processes (especially control of negative feelings), and selection processes in individuals (Bandura, 1993). After the formulation of self-efficacy, Bandura (1998) argued that efficacy construct cannot be only confined to exercise of individual agency since individuals do not work as social isolates, and many human activities need interaction among people. Therefore, people form beliefs about the collective capabilities of the group(s) to which they belong. As a result, collective efficacy was born as a new construct influencing group behavior.

Bandura (1997) also claimed that there were sources of collective efficacy. These sources are relevant for both self-efficacy and collective efficacy because of the fact that they were both derived from the same theory. The sources include mastery experience, vicarious experience, verbal persuasion, and physiological and affective responses (Bandura, 1997). Development of efficacy is not directly related to the sources of efficacy information. Interpretation of the consequences of their

behavior associated with sources of efficacy influences their level of self-efficacy (Junqueira, & Matoti, 2013).

Mastery experience is the most powerful source of efficacy belief. The source is developed from previous authentic experience. If people have the perception that previous experiences are successful, their expectation regarding future performance to be better will be increased. On the other hand, if they interpret previous experience as a failure, their efficacy levels are diminished (Bandura, 1997). In collective efficacy, past group performances provide contribution of development of collective efficacy. Concerning this issue, previous performance appears to be a positive predictor of subsequent collective efficacy within teams (Myers, Feltz, & Short, 2004).

Vicarious experience is the second source for developing efficacy beliefs. It is related to taking such as supervisors, colleagues, mentors, parents or peers as models. If these models are viewed as talented and successful in their task, they reinforced the notion "if they can do it, I can, too.". Therefore, they develop positive beliefs about capability in related tasks (Bandura, 1997). In collective efficacy, vicarious experience refers to taking other group or other people as a model. Observation of performance of other groups or other people who especially have similar goals and familiar opportunities or constraints may lead to development of perception of collective efficacy (Goddard, Hoy, & Woolfolk Hoy, 2004).

Verbal persuasion refers to verbal feedback about task performance from other people such as supervisors, teachers, colleagues, parents, peers, and mentors. When people receive positive feedback about their performances, they will be persuaded about their capabilities about tasks. This leads to development of self-efficacy (Bandura, 1997). In terms of collective efficacy, verbal persuasion refers to verbal feedback from other groups or people about their performances. According to Sorlie and Torsheim (2011), well-reflected arguments and feedback from other groups may increase collective efficacy of members in a group.

Physiological and affective states such as anxiety, fear, stress, arousal, and mood also provide information about efficacy beliefs. While people feel fear, stress, or anxiety about the task they will do, it causes self-efficacy to decrease in the related tasks (Bandura, 1997). Conversely, feeling arousal to do any task can motivate

people to improve their future performance. In collective efficacy, psychological and affective states are related to the present situation of the group, both psychologically and emotionally. Goddard et al. (2004) stated that control pressure, crises and negative situation may have an impact on the development of shared perception of collective efficacy.

1.1 Statement of the Problem

Scientific literacy has been a perennial goal of science education (American Association for the Advancement of Science, 1990). To accomplish this goal, meaningful learning has been regarded as an important factor which provides opportunities with students to analyze, research, explain new knowledge, facts, and ideas by connecting them with existing knowledge, concepts, or principles, and to be aware of their own development in their learning process (Ashburn & Floden, 2006; Biggs & Tang 2007; Chin & Brown 2000). In other words, students are asked to become more active and construct their knowledge in the learning process (Kember 2009; Lammers & Murphy 2002). Key parts of the construction of science knowledge involve collaboration and the situatedness of science in nested social networks (Ford & Forman 2006). Moreover, The National Research Council [NRC] (2008) has pointed out collaboration as a critical variable in identifying an efficient science learner. Therefore, the incorporation of collaboration in classrooms to provide authentic science education, has been called for at all grade levels (Richard & Bader 2010; Windschitl, Thompson, & Braaten, 2008). Likewise, in the Turkish science education curriculum, it was mentioned that working together, which was emphasized as a desired characteristic of students helped students to learn science effectively (Ministry of National Education [MoNE], 2013).

Since students in higher education need to focus on meaningful learning to be prepared for future jobs where they work in groups (Biggs & Tang 2007), group work also has been also a valuable learning strategy in higher education (Slotte, Palonen, & Salminen 2004). The purpose of usage of group work in university students is to promote more interdependent relationships among students, to arouse their interest and to produce better learning outcomes (Cabrera et al., 2002; Summers & Svinicki, 2007; Yi & Luxi, 2012). Therefore, university instructors have started to

use interactive engagement and social/collaborative learning methods in their science classes to achieve better learning outcomes (NRC, 2012).

Putnam and Borko (2000) argued that as undergraduate students, preservice teachers should be in authentic contexts for learning, which are meaningful to teachers' practice. In these contexts, collaboration with peers was required to improve teaching learning (Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Simmie, 2007). In line with this idea, there was few research examining influence of collaboration on preservice teachers' authentic activities in the literature. For example, Soprano and Yang (2013) designed their study to ask preservice science teachers to produce lesson plans with group work in a science methods course. They found that this group work increased science teaching efficacy beliefs of preservice teachers. Likewise, in a similar research design, Watson, Miller, and Patty (2011) reported that this kind of experience led to the improvement of teaching experience. In addition to science teaching efficacy beliefs and teaching experience, Watters and Ginns (2000) demonstrated that preservice science teacher' science content knowledge, and pedagogical skills were increased by preparing lesson plans with group work.

Because there are few studies about group work among preservice science teachers, factors influencing their group work has still not been examined extensively. According to Johnson and Johnson (1999), every group does not work efficiently. The collective motivation of small groups influences group behavior (Klassen & Krawchuk, 2009). Within this scope, as a motivational construct, collective efficacy can be regarded as an important group belief influencing group functioning (Bandura, 1997).

This collective efficacy construct was examined in a number of studies on fields such as schools, organizations, sports and university in some respects. First of all, there were studies regarding sources of collective efficacy. For example, it was found that past performance as mastery experience was an influential factor in collective efficacy (Goddard, 2001; Goddard et al., 2004; Goddard, Logerfo, & Hoy, 2004; Katz-Navon & Erez, 2005; Ross, Hogaboam-Gray, & Gray, 2004). Besides, Bruton, Mellalieu, and Shearer (2014) focused on observing other successful groups; whereas, Baker (2001) stated that verbal feedback should be taken into consideration

to develop collective efficacy. On the other hand, collective efficacy was investigated in terms of relationship between some variables such as burnout, job satisfaction, group size, group cohesion, group performance, and self-efficacy. Among these variables, much emphasis was given to group performance and self-efficacy in the research, and it was found that collective efficacy was strongly associated with group performance (Bandura, 1997; Goddard, 2001; Greenlees, Graydon, & Maynard, 1999; Gully, Beaubien, Incalcaterra, & Joshi, 2002; Hasan & Ali, 2007; Hodges & Carron, 1992; Klassen & Krawchuk, 2009; Lent, Schmidt, & Schmidt, 2006; Myers, et al., 2004; Peterson et al., 2000; Wang, Hsu, Lin, & Hwang, 2014), and self-efficacy of group members (Fernandez-Ballesteros, Diez-Nicolas, Caprara, Barbaranelli, & Bandura, 2002; Fives & Looney, 2009; Goddard & Goddard, 2001; Lent et al., 2006; Lev & Koslowsky, 2009; Skaalvik & Skaalvik, 2010; Viel-Ruma, Houchins, Jolivette, & Benson, 2010).

Based on Bandura's (1997) collective efficacy definition which is the belief about group capabilities to accomplish a task, collective efficacy can be an important construct in group work of preservice teachers as well. To date, limited number of the studies examined collective efficacy in the context of preservice education. One of the research belonged to Webster, Erwin, and Parks (2013). They urged preservice classroom teachers to work as group in a course to produce projects concerning preventing childhood obesity for real classroom. They found that in this process, collective efficacy of preservice classroom teachers increased. Likewise, Wang and Lin (2007) examined groups of preservice mathematic teachers in online environments. They reported that collective efficacy was a significant factor on group discussion and group performance.

Due to limited studies concerning preservice teachers' collective efficacy in the literature, there was lack of information on how collective efficacy took place, what the role of sources of efficacy in group behavior, and how collective efficacy influenced self-efficacy and group performance. Therefore, in order to fill this gap in the literature, current study was conducted with preservice science teachers in a semester-long science methods course to investigate the development of collective efficacy, its sources, and relationship with group performance and self-efficacy.

1.2 Significance of this Study

This study is significant in some respects. First of all, collective efficacy has become subject of limited research (Bandura, 1997, Pajares, 1996). Especially, in last five years, collective efficacy was examined slightly. Therefore, the study can make the contribution to development of collective efficacy literature. Moreover, to date, this construct has been examined in the workplace, sport teams, undergraduate work groups, universities and inservice teachers (e.g., Baker, 2001; Goddard & Goddard, 2001; Lee & Farh, 2004; Lizzio & Wilson, 2005; Tasa, Seijts, & Taggar, 2007). On the other hand, a few research was conducted with preservice teachers about collective efficacy. Therefore, there is a need to investigate preservice teachers working in groups in terms of collective efficacy.

Second, Bandura (1997) stated that there were the sources of collective efficacy such as mastery experience, vicarious experience, verbal persuasion, and psychological and affective states. However, the sources of collective efficacy were not given sufficient importance in collective efficacy research. For example, literature had lack of studies investigating all of these sources together (Huh, Reigeluth, & Lee, 2014). Therefore, the current study aims to shed light on how all of the sources influenced group behavior.

Third, up to now collective efficacy has been mostly examined in quantitative research (e.g., Baker, 2001; Goddard & Goddard, 2001; Katz-Navon & Erez, 2005; Ross et al., 2004; Tschannen-Moran & Barr, 2004). On the other hand, this study focuses on qualitative research to analyze collective efficacy deeply because qualitative studies may show more complete picture of efficacy investigation (Aydın & Boz, 2010). Therefore, current study makes another significant contribution to collective efficacy literature by examining this construct using the qualitative data.

Fourth, collective efficacy can help novice teachers adapt to the teaching profession in school environment (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). Therefore, collective efficacy might be encouraged in preservice education so that each preservice science teacher enters her or his first teaching job with a belief that working with other teachers leads to increase learning and achievement (Friend, 2000; Kluth & Straut, 2003; Quinlan, 1998; Webster et al., 2013). As a result, it is

necessary to investigate collective efficacy during teacher education programs with preservice teachers.

Fifth, there is also a practical significance of this study. Collaboration is described as one of the 21st century skill individuals should have (NRC, 2010). In addition, Borko (2004) and Penuel et al. (2007) emphasize that collaboration at all educational level is an important factor to increase lifelong learning and productivity (Chiriac, 2014). Considering this importance of group work in education setting, this study can be an important source for teacher educators or inservice teachers who want to implement, and increase the effectiveness of group work they would implement in the classroom.

Finally, compared to studies conducted with primary, secondary and university students (e.g., Chiriac, 2014; Bouner, Hughes, & Bouner, 2001; Ebrahim, 2012; Hong, 2010; Howe et al., 2007; Opdecam, Everaert, Van Keer, & Buysschaert, 2014; Thurston et al., 2010; Topping et al., 2011; Topsakal, 2010; Yildirim & Girgin, 2012), there is not enough research focusing on preservice teachers who took part in group work. Therefore, this study can contribute to the related literature.

1.3 The purpose of the Study

The main purpose of this study is to explore collective efficacy of preservice science teachers in semester-long science methods course, to investigate the role of sources of efficacy on group behavior, and to examine the influence of collective efficacy on group performance and on self-efficacy of preservice science teachers in the science methods course.

1.4 Research Questions

In the light of the purposes mentioned above, the research questions are formulated as stated below:

1) How do preservice science teachers describe "working in this group" in a semester-long science methods course?

   Rationale for RQ1: Collective efficacy was regarded as group beliefs about performance capability to the group work (Wang & Hwang, 2012). This shows that the core of collective efficacy is group work. Therefore, in the present study, it was necassary to explore how preservice teachers

describe the group work in the course to draw accurate conclusion about development of preservice science teachers' collective efficacy.

2) How is preservice science teachers' collective efficacy developed in the science methods course?

   Rationale for RQ2: Baker (2001) emphasized that that group members' personal traits, attitudes, motivations and beliefs may influence interaction in the group which played essential role in development of collective efficacy. However, there is need more empirical research about development of collective efficacy. Therefore, the current study aimed to examine development of preservice science teachers' collective efficacy in the course.

3) How is preservice science teachers' collective efficacy changes over time in the science methods course?

   Rationale for RQ3: Baker (2001) argued that collective efficacy had a dynamic structure and evolved over time. Therefore, the current study was conducted in a semester-long-science method course to see how preservice science teachers' collective efficacy developed over time to support the finding of Baker's (2001) study.

4) How do the sources of collective efficacy (mastery experience, vicarious experiences, verbal persuasion, and psychological and affective states) in the science methods course contribute to group behavior?

   Rationale for RQ4: There are sources of collective efficacy which are also relevant for self-efficacy (Bandura, 1997). Compared to self-efficacy, collective efficacy sources are investigated slightly in empirical studies (Huh et al., 2014). Therefore, it is necessary to examine how sources of collective efficacy influence group behavior. Consistent with this idea, the present study was conducted to observe how the sources of collective efficacy affect the group of preservice science teachers' behavior.

5) How does preservice science teachers' collective efficacy contribute to group performance in the science methods course?

Rationale for RQ5: In the literature, it was found that collective efficacy was significantly related to group performance (e.g., Goddard, 2001; Greenlees et al., 1999; Gully et al., 2002; Lent et al. 2006; Myers et al., 2004). However, there is a few research investigating nature of this relationship. In order to fill the gap, this study was conducted to examine the relationship between collective efficacy of preservice science teachers and their group performance in the science methods course.

6) How does preservice science teachers' collective efficacy contribute to self-efficacy of group member concerning science teaching in the science methods course?

Rationale for RQ6: Research showed that collective efficacy was associated with self-efficacy of group members(e.g., Fernandez-Ballestero et al., 2002; Lev & Koslowsky, 2009; Skaalvik & Skaalvik, 2010; Viel-Ruma et al., 2010). Similar to previous research question, much emphasis was not given to understand the relationship between collective efficacy and self-efficacy. In order to shed light on this relationship, how preservice science teachers' collective efficacy influenced their self-efficacy concerning science teaching was examined in the present study.

1.5 Definitions of Important Terms

Preservice science teachers: Students who are junior level in Elementary Science Teacher Education Program.

Science methods course: A course is given in sixth semester and third year of Turkish science teacher education program. The aim of the course is to explain and discuss science teaching methods, and to help preservice science teachers utilize the methods in planning effective science lesson.

Collective efficacy: It refers to "a group's shared belief in its conjoint capabilities to organize and execute the course of action required to produce given levels of attainments" (Bandura, 1997, p. 477).

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

Group performance: it refers to performance of preservice science teacher as a group regarding preparing lesson plans.

CHAPTER II

LITERATURE REVIEW

In this chapter, firstly a review of theoretical knowledge about self-efficacy, teaching efficacy, science teaching efficacy, and empirical research about preservice science teachers' efficacy were presented. Second, collective efficacy and group work were discussed with empirical research in detail. Finally, summary was provided in the light of given knowledge.

2.1 Self-efficacy Belief

Self-efficacy beliefs are grounded in Bandura's social cognitive theory which is related to how people control over behaviors in their lives (Bandura, 1977). This theory explains acquisition and maintenance of certain behavioral pattern within triadic reciprocal causation including (a) behavior (performance), (b) environmental events (teacher, parents, peer feedback etc.), and (c) personal factors (cognitive, affective, and biological events) (Bandura, 1977). Explicitly, this theory claims that behavior is influenced from personal factors and environmental factors (Hoy & Spero, 2005). When it is examined with respect to personal component, people develop expectation by using existing knowledge and belief to explain events and situations and this expectation lead to predict future behavior (Palmer, 2010). The self-efficacy has gained importance at this point. Bandura (1977) defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p.3). In other words, it can be regarded as driving force to actions (Ahsan, Deppeler, & Sharma, 2013). Therefore, it have positive impact on academic motivation, learning and achievement (Pajares, 1996).

Along with definition of self-efficacy above, Bandura (1997) stated that self-efficacy construct was composed of two dimensions, personal efficacy and outcome expectancy. Personal efficacy was described as "the conviction that one can successfully execute the behavior required to produce outcome (Bandura, 1977, p.79) whereas outcome expectancy meant "a person's estimate that a given behavior will

lead to certain outcomes" (Bandura, 1977, p.79). Both personal efficacy and outcome expectancy are future-oriented decisions. Therefore, the term of "perceived" might be used with constructs such as "perceived personal efficacy" or "perceived outcome expectancy" (Bandura, 1997).

Bandura (1997) postulated four sources of efficacy which were mastery experiences, vicarious experience, verbal persuasion, and physiological and affective states. According to Junqueira and Matoti (2013), self-efficacy was not directly related to the sources of efficacy information. Firstly, people interpreted the consequences of their actions. Then, based on these interpretations, the judgements of competence were shaped.

Mastery experience is the most powerful source of efficacy belief. This source is developed from past personal practical experiences and it provides authentic experiences to accomplish a mission. When people do task or activities, they interpret result of action. Along with these interpretations, they develop beliefs about capability about subsequent task and activities. If people interpret past performance as a successful work, they develop positive beliefs about subsequent tasks whereas they form negative beliefs about subsequent tasks and activities if they think that they fail to perform tasks or activities (Bandura, 1997).

Vicarious experience refers to observation performance of someone else such as supervisors or colleagues, parents, peers, teachers and comparison with these models and themselves. Therefore, people have a chance to evaluate their likelihood of success on similar tasks or activities. In order that this source of self-efficacy influences observer to develop self-efficacy, two conditions should be met. Firstly, because of the fact that models are seen source of aspiration, competencies and motivation, models should have similar characteristic with observer. In addition, the performance of the model about tasks should be successful for observer to believe his/her capabilities to same tasks. Therefore, when people see successful models who have similar characteristic with them, they develop positive belief about capability in related tasks (Bandura, 1997).

Verbal persuasion is the third source of efficacy belief. It refers to verbal feedback about task performance from other people such as supervisors, teacher, colleagues, peers, and parents. Positive verbal feedback encourages people to believe

their capabilities about tasks whereas negative persuasion decreases self-efficacy of people concerning tasks. Verbal persuasion alone does not create self-efficacy, but rather it should be used with other sources to develop self-efficacy in individuals. In addition, verbal persuasion is more effective when feedbacks are made from highly competent people in related field (Bandura, 1997; Palmer, 2010).

Physiological and affective states are the other source which influences self-efficacy. This source presents indirect information about individuals' capability of task. Physiological and affective states are related to individuals' anxiety, fear, stress, arousal, and mood which affect people's feeling about their abilities in particular situation. While people with positive physiological and emotional states are more likely to be successful in tasks, negative physiological and affective states- high stress, fear, anxiety- cause people to show poor performance and decrease self-efficacy about related tasks (Bandura, 1997). In addition, what is important is how people perceive and interpret these physiological and affective reactions than its intensity of them. Therefore, challenging situation is viewed as challenge to be overcome by people with high self-efficacy while the same situation is considered as an obstacle by people with low self-efficacy (Bandura, 1977).

2.1.1 Teaching Efficacy Belief

After becoming popular in worldwide, self-efficacy has been applied in educational settings. As an important element of educational system, teachers have been examined with respect to their self-efficacy beliefs. Therefore, new construct called as teacher efficacy beliefs has been formed. Tschannen-Moran et al. (1998) defined teacher efficacy beliefs as "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific task in a particular context" (p.233). It was seen that it was one of the important sources of motivation to teach (Tschannen-Moran & Hoy, 2001).

Teacher efficacy beliefs have been reported as a significant predictor of teacher performance in classroom (Richardson, 1996; Tschannen-Moran et al., 1998). In other words, teacher efficacy beliefs were closely related to teacher behaviors in classroom (Milner, 2002; Napoles & MacLeod, 2013); teaching practices and qualities (Guskey, 1988; Schoon & Boone, 1998); teacher motivation, and effectiveness (Klassen & Tze, 2014); enthusiasm for teaching (Allinder, 1994);

burnout (Friedman, 2003; Oakes, Lane, Jenkins, & Booker, 2013; Telef, 2011); job satisfaction (Caprara, Barbaranelli, Borgogni, & Steca, 2003; Caprara, Barbaranelli, Steca, & Malone, 2006; Telef, 2011). What is more, teachers' sense of efficacy was closely associated with student outcomes such as students' self-efficacy beliefs, engagement, motivation, and achievement (Anderson, Greene, & Loewen, 1988; Ross, 1992; 2001; Tschannen-Moran et al., 1998; Woolfolk Hoy & Burke-Spero, 2005; Woolfolk Hoy, Hoy, & Davis, 2009).

Teacher efficacy beliefs have two components; one of which is "personal teaching efficacy" related to a person's belief in his or her ability to teach effectively. In other words, because of the fact that teachers with high personal efficacy are confident concerning their ability, training and experience, they teach effectively (Cantrell, Young, & Moore, 2003). In addition, in order to reach goals, these teachers show more great effort and persist longer in difficult tasks (Bandura, 1997). Another component of teacher efficacy belief is "outcome expectancy". It refers to a teacher's belief about the teaching will cause positive effect on student learning (Cakiroglu, Cakiroglu, & Boone, 2005). In other words, teacher with high outcome expectancy believed that they had an influence on student achievement and motivation (Cantrell et al., 2003). Gibson and Dembo (1984) stated that "teacher who have personal teaching efficacy and outcome expectancy should persist longer, provide a greater academic focus in the classroom, and exhibit different types of feedback than teachers who have lower expectations concerning their ability to influence student learning"(p.570).

2.1.2 Science Teaching Efficacy Beliefs

Teacher efficacy beliefs are context and subject matter specific (Bandura, 1986). For example, while a teacher has high efficacy towards teaching mathematics, he/she might feel low efficacious towards teaching social science (Roberts, Henson, Tharp, & Moreno, 2001). In this respect, teacher efficacy beliefs can be extended to specific subject areas. As extension of teacher efficacy into subject matter became a popular in most educational areas, a similar trend was also seen in science teaching (Bursal, 2012). Enochs and Riggs (1990) pointed out that teacher efficacy beliefs played an important role in science teaching. Therefore, they stated that science teaching efficacy belief was comprised of two components which were personal

science teaching efficacy beliefs (PSTE) and science teaching outcome expectancy (STOE). Ritter, Boone, and Rubba (2001) explained that while PSTE referred to the belief in ability toward teaching science effectively, STOE was related to the belief that science teaching would lead to positive outcome in student learning. Ashton and Webb (1986) claimed that PSTE and STOE worked independently; therefore there could be some teachers with high PSTE but low STOE or vice versa (Cantrell et al., 2003; Moore & Watson, 1999). Concerning this issue, Riggs (1991) reported that although some teachers had high outcome expectancy towards science teaching, they avoided teaching science because of lack of personal efficacy belief. Therefore, there were some studies focusing on producing changes in only PSTE (e.g., Schoon & Boone 1998; Tosun, 2000), or only STOE (e.g., Ginns et al. 1995), and sometimes in both of them (e.g., Bleicher & Lindgren 2005).

Concerning the assessment of science teaching efficacy, some instruments were developed. One of the most widely known and used of these instruments is the Science Teaching Efficacy Belief Instrument (STEBI) which was originally developed for inservice teachers (Enochs & Riggs, 1990), the STEBI-A, and subsequently revised for preservice teachers (Enochs & Riggs, 1990), the STEBI-B. Both versions of STEBI include the two sub-scales (PSTE) and (STOE). While these instruments gave quantitative data for researchers, Bandura (1997) suggested for qualitative research in which both an affirmation of belief in one's capabilities to accomplish a task and the strength of that belief were examined.

Science teaching efficacy beliefs are one of the best predictors regarding quality of science teachers (Schoeneberger & Russell, 1986). In line with this idea, a number of research have been implemented to demonstrate the role of science teacher efficacy in teachers' behaviors and practices. Firstly, some of these research showed that science teachers with low science teaching efficacy saw science as a difficult subject to teach (Appleton, 2003); disliked, feared, and failed to understand science (Davis & Smithey, 2009; Tosun, 2000); did not have confidence their ability to teach science (Mulholland, Dorman, & Odgers, 2004; Van Zee, Lay, & Roberts, 2003); spent less time teaching science (Harlen & Holroyd, 1997; Ramey-Gassert & Schroyer, 1992); held negative attitudes toward science and teaching science (Ramey-Gassert & Schroyer, 1992); and passed their negative attitudes on their

students (Czerniak & Chiarelott, 1990). Moreover, it was found that low efficacious teachers taught poorly, even avoiding teaching (Appleton & Kindt, 1999; Bencze & Hodson, 1999; Bursal, 2008), used teacher centered methods such as lecturing (Anderson & Roth, 1989; Harlen & Holroyd, 1997), adopted didactic approaches instead of strategies that promote conceptual understanding (Enochs, Scharmann, & Riggs, 1995; Appleton & Kindt, 1999), and performed strict controlling of students (Enochs et al., 1995). On the contrary, high-efficacious teachers showed desirable teacher characteristics, such as spending more time in teaching, and developing more positive attitudes toward science (Brigido, Borrachero, Bermejo, & Mellado, 2013; Cantrell et al., 2003; Ramey-Gassert & Schroyer, 1992; Riggs, 1991), and applying more humanistic classroom management (Enochs et al., 1995; Ross, 1994; Soodak & Podell, 1994; Yilmaz & Cavas, 2008). Furthermore, it was reported that teachers with high science teaching efficacy utilized student-centered teaching strategies (Anderson & Roth, 1989; Enochs et al., 1995; Marshall, Horton, Igo, & Switzer, 2009; Mulholland & Wallace, 2001; Palmer, 2001), improved quality of teaching science (Richardson & Liang, 2008; Utley, Moseley, & Bryant, 2005).

2.1.3 Preservice Science Teachers' Teaching Efficacy Beliefs

Bandura (1997); Woolfolk Hoy and Burke-Spero (2005) expressed that once self-efficacy beliefs became established, they were somewhat resistant to change. Based on this notion, it was claimed that preservice teachers' efficacy beliefs had an important implication for future teacher practices and teaching efficacy (Fives, Hamman, & Olivarez, 2007; Woolfolk & Hoy, 1990). In the line with this idea, Carter and Sottile (2002) argued that improvement of self-efficacy of preservice science teachers helped them to be better inservice science teacher. Therefore, considerable amount of research has been conducted with preservice teachers to examine science teaching efficacy beliefs.

The study of Ramey-Gassert, Shroyer, and Staver (1996) on elementary teachers demonstrated that antecedent factors such as participating in science activities in and out of school, the number of science and science teaching methods courses taken, teacher preparation and science teaching experiences influence science teaching efficacy. Therefore, teacher education program has become focus point for researchers to develop preservice teachers' sense of science teaching

efficacy (Kim & Cho, 2014). For instance, Bayraktar (2011) conducted a study to evaluate the effectiveness of a primary teacher education program on preservice primary school teachers' efficacy. Data were collected twice (before and after implementation of program) from 282 preservice primary science teachers. Analysis demonstrated that while teacher education program had moderate effect on preservice science teachers' PSTE beliefs, there was no significant difference with respect to STOE. It was concluded that teacher education program had influence on preservice science teacher to develop PSTE beliefs; however, there was need to investigate the components of teacher education program such as science methods course to determine which part of teacher education program help improve preservice teachers' science teaching efficacy. In parallel to this conclusion, Bleicher and Lindgren (2005) conducted a study with 49 preservice teachers in a science methods course. In their study, they tried to examine the role of constructivist-oriented methods course. For this purpose, the researchers redesigned the science methods course in the light of constructivist approach. They included hands-on activities, discussion, demonstrations, discrepant events, and cooperative group work. During this process, quantitative and qualitative data were collected. Quantitative data showed that there was significantly increase in score of PSTE and STOE at the end of implementation of these science methods course. Moreover, qualitative data supported the findings above and all participants declared that there was increase in confidence about teaching science. Moreover, Palmer (2006b) developed the previous study. Durability of changes of self-efficacy of preservice primary teachers in science methods course was investigated. Science teaching efficacy of the preservice teachers was measured four times; at the beginning of, at the end of the course, after a delay period of 9 months, and one year after the end of the course. It was found that the increase in science teaching efficacy beliefs was maintained despite passing time. Therefore, it was concluded that well-designed science methods course can cause not only increase preservice teachers' STOE and PSTE but also maintenance of these efficacy belief over time.

After discovering the role of science methods course in teacher efficacy, researchers conducted some studies by adding the sources of efficacy in method courses. For this purpose, Palmer (2006a) made investigations with 190 primary

teacher education students. A science methods course was designed to provide them with the sources of efficacy (mastery experience, vicarious experience, verbal persuasion and psychological and affective state) and additional sources which were derived from these sources (cognitive content mastery - i.e., success in understanding science -, cognitive pedagogical mastery - i.e., success in understanding how to teach science - and simulated modeling - i.e., tutor and the students simulating the conditions of a primary classroom by a type of role playing - etc.). This science methods course was implemented during 13 weeks. Quantitative and qualitative designs were used to collect data. After analysis, it was found that these preservice teachers had significantly higher STOE and PSTE at the end of the implementation when compared to pretest score scores, and cognitive pedagogical mastery (i.e., a successful learning experience involving the understanding of science teaching techniques) was main powerful source in increase of STOE and PSTE. Similar to Palmer's study (2006a), Bautista (2011) conducted a study investigating only influence of mastery and vicarious experiences in methods course during a semester. It was reported that PSTE and STOE of preservice elementary teachers were improved after this intervention, and enactive mastery, cognitive pedagogical mastery, symbolic modeling (watching others' performance from videos or television) and cognitive self-modeling (imagining themselves performing a classroom practice successfully) made contribution to this improvement of self-efficacy of the participants. Likewise, Gunning and Mensah (2010) conducted similar study with preservice elementary teachers. A total of 23 preservice elementary science teachers enrolled in the elementary science methods course were participated. Open-ended survey, field notes, reflective journal were used collect data to measure changes in efficacy beliefs. In addition, one participant was interviewed. Data analysis demonstrated that mastery experience, vicarious experience, verbal persuasion and psychological and affective state had an effect on the development of efficacy beliefs. As a result, they enhanced PSTE and STOE towards teaching science at the end of methods course. In addition, interview with the participant showed that vicarious experiences were seen to be most effective source in development of PSTE and STOE. Although previous studies (e.g., Gunning & Mensah, 2010; Palmer, 2006a, 2010) demonstrated that the sources of efficacy

played an important role in enhancing science teacher efficacy belief, there have been different findings concerning main sources which are responsible for this improvement such as cognitive pedagogical mastery (Palmer, 2006a); cognitive mastery (i.e., perceived success in understanding how to teach science), and in situ feedback (verbal persuasion given after observation of the teacher teaching his/her own class (Palmer, 2010); vicarious experiences (Gunning & Mensah, 2010); enactive mastery, cognitive pedagogical mastery, symbolic modeling and cognitive self-modeling (Bautista, 2011).

In short, the one of most influential factors in science teachers' behaviors is science teaching efficacy beliefs (Hoy & Spero, 2005). Therefore, teacher efficacy towards science should be improved to help preservice teachers to be effective inservice teachers (Hechter, 2011). To improve preservice teachers' science teaching efficacy belief, science methods courses are seen as suitable contexts (Cantrell et al., 2003; Cone, 2009; Ebrahim, 2012; Ross & Bruce, 2007; Settlage, 2000). Accordingly, some researchers have considered science methods courses as the context of their study in which Bandura's (1997) sources of efficacy were integrated (e.g., Bautista, 2011; Gunning & Mensah, 2010; Palmer, 2006a, 2010). Results of these studies indicated that the some sources of efficacy played an important role in development of science teaching efficacy belief compared to other sources.

2.2 Collective Efficacy Belief

Bandura (1997) extended social cognitive theory to group agency. According to this theory, people must interact with others to work and live together; therefore, people in a group develop beliefs about collective action they will do (Bandura, 1997). Congruent with this idea, "collective efficacy" was formulated. Bandura (1997) defined perceived collective efficacy as "a group's shared belief in its joint capabilities to organize and execute the courses of action required to produce given levels of attainment" (p.477). Perceived collective efficacy influenced "the sense of mission and purpose of a system, the strength of common commitment to what it seeks to achieve, how well its members work together to produce results, and the group's resiliency in the face of difficulties" (Bandura, 1997, p.469).

Concerning development of collective efficacy, Baker (2001) pointed out that group members played active role in formation of collective efficacy in the group

work. More specifically, group members bring their personal attitudes, beliefs, traits, and history into group, and these will have an impact on how they interact with other group members. However, interaction between group members is low when a group is formed. Over time, when they begin to know each other, they share their perception, knowledge about task, attitudes and beliefs with each other. Therefore, interaction is improved and this helps form collective efficacy in group. In other words, collective efficacy beliefs are dynamic quality and evolve with the development of the group. In addition, this shared collective efficacy cannot be evaluated as separate entity from social context in which collective efficacy developed (Lindsley, Brass, & Thomas, 1995). Therefore, Bandura (1997) stated that collective efficacy may change according to domains and tasks.

Bandura (1997) argued that there were some sources to enhance collective efficacy. The sources which are also relevant for self-efficacy are mastery experience, vicarious experience, verbal experience, and psychological and affective states. For mastery experience, previous performance in groups plays essential role in development of subsequent collective efficacy (Myers et al., 2004). Regarding vicarious experience, collective efficacy can be improved when groups take other groups or other peoples who have similar goals or constraints as a model in their performances or products (Goddard et al., 2004). Moreover, verbal feedback of other groups or other people may persuade groups about their ability to do tasks. This refers to effect of verbal persuasion source on collective efficacy (Sorlie & Torsheim, 2011). Final source is related to psychological and affective states. While positive feelings in the group enhance collective efficacy, negative situations lead to decrease collective efficacy (Bandura, 1997). Concerning this issue, Goddard et al. (2004) claimed that stress, crises and pressure might influence negatively on improvement of collective efficacy in groups.

Lent et al. (2006) emphasized that collective efficacy was aggregation of group members belief concerning how they perform as a unit. Therefore, collective efficacy does not mean the sum of personal belief of group members. What is important is the presence of shared perception of collective efficacy among group members (Katz-Navon & Erez, 2005). Because of the conflict on the definition of collective efficacy, there were some approaches to measure it. First approach is

related to gathering each group member's perception about their capabilities to execute work in a group. In other words, it means collecting group members' self-efficacy. Second approach refers to accumulation each group members' perception about capabilities of the group as whole. When compared to two approaches, second approach is more appropriate to measure collective efficacy in a group since this measuring method fits in the definition of Bandura (1997); Huh et al. (2014); and Lent et al. (2006) that collective efficacy is group level trait; therefore, is not a simply sum of individual self-efficacy. Apart from these two approaches, some researchers proposed another alternative assessment approach in which group members were asked to discuss and reach consensus regarding collective efficacy of the group. However, this approach led to decrease validity of the assessment because group members can give answers in parallel to other group members to provide social desirability (Stajkovic et al., 2009).

As an another collective motivation construct, group cohesion was confused with collective efficacy. Although there are some studies that collective efficacy is significantly related to group cohesion (Lee & Farh, 2004; Paskevich, Brawley, Dorsch, & Widmeyer, 1999), they were different from each other. Collective efficacy referred to cognitive judgments about a group's capabilities whereas group cohesion was perceived as force to bind group members to commit to group goals (González, Burke, Santuzzi, & Bradley, 2003). Group cohesion was investigated mostly in groups including families, sports teams, the military, workplace groups, nations, and political groups (Lee & Farh, 2004), and it was related to the cooperation of group, planning, communication, quality of work, quantity of work, and group performance (Liden, Wayne, Jaworski, & Bennett, 2004). In short, group cohesion was regarded as one of dimension of group work which facilitates effective interaction among group members (Kreijns, Kirschner, & Jochems, 2003) as well as contributes cognition of group members such as adherence, effort and intention (Burke, Carron, Eys, Ntoumanis, & Estabrooks, 2006; Carron, Hausenblas, & Mack, 1996).

There are two kinds of cohesion in the literature, task cohesion and social cohesion. According to Zaccoro and Lowe (1988), social cohesion, is related to the degree of positive relationships among group members, causes more frequent interactions whereas task cohesion means group members' commitment to the group

task which improves group productivity. Research on these two kinds of cohesion demonstrated that task cohesion had positive relationship with group performance although these two constructs were seen important in group work (González et al., 2003). Similarly, Lent et al. (2006) reported that task cohesion was asignificant predictor of collective efficacy. On the other hand, Lee and Farh (2004) claimed that collective efficacy influenced the development of group cohesion. In addition, Wang and Hwang (2012) found that reciprocal relationship between cohesion and collective efficacy existed. In other words, while collective efficacy predicted task cohesion, task cohesion predicted subsequent collective efficacy.

2.2.1 Research related to Collective Efficacy Belief

Compared to self-efficacy, there is limited number of studies examining collective efficacy. These studies have been conducted with school setting, organization and sports (Bandura, 1997). After it was formulated, collective efficacy was investigated as important variable in sports at first. More specifically, Greenlees et al. (1999) investigated the influence of collective efficacy beliefs on effort and persistence in a group. For this, 22 students studying sports studies in a faculty of higher education in United Kingdom were participated. These students were divided into groups of three individuals. They were given a task to do as a group. It was found that individuals in high collective efficacious groups showed more effort and persistence to their goals than those in low collective efficacious groups. In addition, the researchers stated that there was relationship between collective efficacy and group performance since it was seen that there was significant decline in team performance of low collective efficacious groups. Although Myers et al. (2004) did a research in the same line of study of Greenless et al. (1999), they conducted longitudinal study to examine the relationship between collective efficacy and group performance during a season of competition in American football. A total of 10 groups that participated in this study were evaluated for this purpose. It was reported that within groups, collective efficacy was positive predictor of subsequent performance. Moreover, across weeks, it was seen that collective efficacy had a positive influence on subsequent performance of the groups.

In addition to studies related to sports, there were studies examining students in terms of collective efficacy. For example, Klassen and Krawchuk (2009)

conducted an investigation with early adolescents (grades 6 and 7 in elementary schools, grades 8 and 9 in junior high schools). For this, 413 students participated in the study, and they were asked to work with three or four same grade students in 40-50 min to solve puzzle and mathematical problems. It was found that collective efficacy and group cohesion significantly predicted group performance for older adolescents but not younger adolescents. They argued that the development of collective efficacy and group cohesion for younger adolescents requires extended time or more familiar group task. Similar research was conducted by Putney and Broughten (2011). They examined classroom environment of fifth grade students over four years. During this process, events were recorded in camera regularly: daily for the first three weeks of the school year then at least twice monthly. In addition, interviews were done to collect data. As a result, it was found that collective efficacy between students were developed when teacher acted as a community organizer which provided student with opportunities to solve problems for developing their capabilities.

Collective efficacy has become popular topic in university contexts as well. For instance, Hasan and Ali (2007) did research about developing project about information system to understand how collective efficacy and group performance were related. A total of 76 undergraduate and 28 graduate students were involved in this study. They found that collective efficacy had a significant influence on project success. In parallel to this study, Peterson et al. (2000) carried out a research in which 44 psychology undergraduates at an American university and 99 MBA students at an Australian university enrolled in research method courses were participated. They were divided into groups to work in research projects during a semester. Their collective efficacy was measured twice at the beginning of the semester and at the end of the semester. Moreover, group projects were assessed by detailed grading criteria to minimize any chance of bias in performance evaluation. It was found that groups with high collective efficacy at the beginning of the semester received higher grades. Furthermore, it was reported that groups with collective efficacy at the end of the semester also produced qualified projects. Similar study was also conducted by Wang et al. (2014). In their study, 35 university students worked together in the form of small groups in computer-supported collaborative

environment. While the researchers reported that group interaction functioned as mediator in development of collective efficacy, it was found that the performance of group with high collective efficacy was superior than that of group with low collective efficacy. Lent et al. (2006) extended previous research to assess relationship collective efficacy and group performance as well as self-efficacy. For this, the researchers worked with engineering students which were divided into groups to develop common projects. It was expected to work together and use all talents to produce these projects. They implemented questionnaires related to variables stated above. After that, it was seen that collective efficacy was a good predictor of group performances and self-efficacy of group members was positively related to collective efficacy of groups.

As a different point from studies mentioned above, Alavi and McCormick (2008) carried out an investigation concerning development of collective efficacy in small university group. For this purpose, 145 university students in 40 work-groups participated in this study. Students were asked to work interdependently in groups to carry out-group assignments or projects related to problem solving, developing strategies, and conducting experiments. Two-phase longitudinal design was used to collect data. In phase 1, groups' developing belief about themselves in relation to other group members was measured in the third week of the courses. Then, phase 2 was conducted in the seventh week in which students filled out instruments related to the perception of collective cognition activities (exchanging, interpreting and evaluation), task interdependence (the extent to which group members are required to work their tasks interdependently about group work), and reported their beliefs about collective efficacy. Multiple regression analysis showed that if group members perceived themselves to be interdependent in the early stages of group work, they developed high collective efficacy in final stage of group work. Likewise, Katz-Navon and Erez (2005) carried out a study to investigate role of task interdependence on collective efficacy and self-efficacy. They designed their study to measure self-efficacy and collective efficacy for performance on the individual and team levels in two parallel situations of high and low task interdependence. It was found that under high task interdependence, collective efficacy was an important factor which influenced team performance whereas self-efficacy was shown up as the predictor of

individual performance in groups under low task interdependence. In addition, it was indicated that under high task interdependence, members in groups built almost same understanding of collective efficacy called the homogeneity of perceptions of collective-efficacy. In addition, past group performances were stated as more important factor in collective efficacy development in the study over time. In parallel to last finding of Katz-Navon and Erez (2005), there was a study conducted by Baker (2001) to evaluate how collective efficacy changed over time. The participants of this study were comprised of juniors and senior in principles of management course. In the beginning of semester, they were divided into groups which included 5-7 individuals. They were remained intact during a semester approximately four months to work on tests, group projects, and/or experiential exercises during each class meeting. Their performance, collective efficacy, and self-efficacy were measured six times during this study. After analysis of data, it was found that collective efficacy changed over time but this change was different across groups. Moreover, it was reported that there were relationship between self-efficacy of group members and collective efficacy at all six times. However, the degree of relationship was decreased over time because group success depended less on best individual member, and all members in group made valuable contributions to be successful. Another significant finding was that the most influential factor of development of collective efficacy was reported to giving feedback to group performance. In addition, it was mentioned that the success or failure of other groups which works on similar problems had impact on confidence in group. Regarding sources of collective efficacy, Lee and Farh (2004) conducted a study in which 260 undergraduate students participated. In total, they produced 45 in-class projects as groups. It was found that past performance was positively related to group efficacy. Similarly, Goddard (2001); Goddard et al. (2004) reported that past mastery performance had a significant effect on development of collective efficacy. On the other hand, Bruton et al. (2014) investigated 133 undergraduate students who reported that observing any other groups' positive behaviors influenced their collective efficacy.

As undergraduate students, preservice teachers have been examined with respect to collective efficacy but these studies are limited. For instance, Wang and Lin (2007) did a research with 72 preservice teachers enrolled in introductory

educational psychological course. First, they were divided into groups. Then, these groups were asked to select one of cases related to sixth grade students' math problem. After that, students as group discussed solving processes of these problem in online environment, and associated it with three major educational theories they had just learned (e.g., behaviorism, the attribution theory of motivation, and Piaget's cognitive development theory) to teach students. Groups' conversation in online environment was analyzed with content analysis method. In this analysis, the ideas of group members in each paragraph were counted, and group performance was assessed by the teacher of this course. Moreover, at the end of this group work, collective efficacy scale developed by the researchers was implemented. After analysis of data, it was found that collective efficacy had a positive influence on discussion behaviors in group discussion and group performance. Moreover, it was reported that in their group discussion, groups with higher collective efficacy used more high level cognitive skills, and showed high academic performance in online learning environment. In another study, Webster et al. (2013) examined 103 preservice classroom teachers in a course called "comprehensive school physical activity promotion" which was related to prevention childhood obesity. This course was implemented during a semester, 16 week. As small groups, students were asked to work together in this course about integration of their learning in real classroom such as collaboratively practice planning, teaching, and evaluating classroom lessons. Then, by pre-post measurement, it was found that collective efficacy of preservice classroom teachers increased.

Meanwhile, from Bandura's (1997) collective efficacy definition, some researchers have begun to implement this construct with inservice teachers. Inservice teachers were seen as a group to work together to reach goals related to student achievement and school effectiveness. Collective teacher efficacy was defined as ''the perceptions of teachers in a school that the efforts of the faculty as a whole will have a positive effect on students'' (Goddard et al., 2000, p.480). Therefore, from this perspective, there were some studies associated with collective teacher efficacy in the literature (e.g., Akinbobola & Adeleke, 2012; Cybulski, Hoy, & Sweetland, 2005; Fancera & Bliss, 2012; Kurt, Duyar, & Calik, 2011; Kurz & Knight, 2004; McCoach & Colbert, 2010; Schechter & Tschannen-Moran, 2006). For example,

Viel-Ruma et al. (2010) conducted a study to explore relationship between teacher efficacy and collective teacher efficacy. They designed their study in which 104 educators (34% were elementary school teachers, 22% were middle school teachers, and 44% were high school teachers) were participated. They were asked to complete surveys via internet. They found that there was significant relationship between teacher self-efficacy and collective efficacy (r = .35, p = .00). Likewise, Goddard and Goddard (2001) extended previous study. A total of 438 teachers in 47 urban schools was examined in the light of collective teacher efficacy and teacher efficacy. For this, five-item personal teacher efficacy scale of Gibson and Dembo (1984) and 21-item collective efficacy scale developed by Goddard, Hoy, and Woolfolk Hoy (2001) were used to collect data. They found that collective efficacy was significantly direct proportional to teacher efficacy. Skaalvik and Skaalvik (2010) made a similar investigation in Norwegian school context. While they reached the same result, they added that teachers' relationship to parents influenced teacher efficacy whereas relationship between school principals and other teachers had an impact on collective efficacy. Another similar study was conducted by Fives and Looney (2009) with college instructors (75 graduate students, 24 nontenured faculty, and 18 tenured faculty members). Although they reported that there was a significant relationship between teacher efficacy and collective teacher efficacy, there were no differences between collective teacher efficacy, and such variables: departments, experience level, professional level.

In addition to these studies, Tschannen-Moran and Barr (2004) conducted a study to investigate relationship between collective efficacy and achievement. The participants were composed of students and their teachers in 66 middle schools in Virginia, USA. Two instruments were used to collect data. It was found that there was significant positive relationships between collective teacher efficacy and student achievement on math, writing, and English tests (r = .41, r = 50 and r =.37, p < .01). Similarly, Cybulski et al. (2005) reached same result that collective teacher efficacy influenced reading and mathematics achievement. In the study of Moolenaar, Sleegers, and Daly (2012) with 53 Dutch elementary school, they found that effective collaborative work between teachers were related to high collective teacher efficacy which influenced students achievements.

Goddard et al. (2004) extended Moolenaar et al.'s (2012) study. They investigated 96 high schools in terms of relationship between collective teacher efficacy and student achievements. They found that collective efficacy was significant predictor of student achievement, and past experience had an impact on the development of collective teacher efficacy. Moreover, Ross, Hogaboam-Gray, and Gray (2004) in their study stated that this relationship is reciprocal. In other words, while collective teacher efficacy made contribution to student achievements, prior students' achievement worked as mastery experience which provided development of teacher collective efficacy. Moreover, they stated that school processes that promoted teacher ownership of school directions (shared school goals, school-wide decision making, fit of plans with school needs, and empowering principal leadership) were responsible in the development of teacher collective efficacy in their study. Apart from student achievement, Gibbs and Powell (2012) investigated relationship between student behaviors and collective teacher efficacy. They found that if teachers had higher collective efficacy, numbers of children excluded from school decreased.

In brief, collective efficacy is regarded as neglected construct in group work studies (Bandura, 1997). Therefore, there is limited number of studies about collective efficacy in the literature. In general, it was investigated in teams in sports, university group work, and school environment especially with teachers. This research revealed out that collective efficacy was significantly related to group performance and self-efficacy of group members (e.g., Katz-Navon & Erez, 2005; Lent et al., 2006; Skaalvik & Skaalvik, 2010; Viel-Ruma et al., 2010). In addition, the sources of collective efficacy influenced development of collective efficacy (Goddard, 2001; Goddard et al., 2004; Lee & Farh, 2004). On the other hand, as undergraduate students, preservice teachers were examined in terms of collective efficacy in few studies. In these studies, although it was found that collective efficacy among preservice teachers was formed and affected group performance (Wang & Lin, 2007; Webster et al., 2013), there was need to detailed investigation of how collective efficacy was developed, how the sources of collective efficacy influenced group behavior, how collective efficacy contributed to self-efficacy and group performance.

2.3 Group Work

Collective efficacy refers to shared belief of a group concerning group's capability to perform in specific tasks (Bandura, 1997). From this perspective, collective efficacy has been examined in group work. Group work means that two or more people worked together to make common assignment (Zhou, Kim, & Kerekes, 2011). Successful group work has such important benefits to individuals such as scheduling activities, sharing responsibilities, exchanging opinions, using higher order thinking skills, providing active learning with longer retention of information, using better problem solving skills, developing social and team skills, increasing self-confidence, enhancing about intellectual development, and appreciating multicultural democracy (Koppenhaver & Shrader, 2003; Matthews, Cooper, Davidson, & Hawkes, 1995; Millis & Cottell, 1998; Nesbit & Rogers, 1997).

More importantly, learning is the most significant product of group work (Gillies & Boyle, 2011). There are two approaches regarding learning in group, which are cooperative learning and collaborative learning. Although these terms are used synonymously with each other in some studies (e.g., Gunderson & Moore, 2008; Timpson & Bendel-Simso, 1996), they are two different concepts (Chiriac, 2014; Tolmie et al., 2010). Cooperative learning is related to any group work without any interaction in a group between individuals (Bennet & Dunne, 1992). In collaborative learning, individuals in a group interact always to produce common product (Webb & Palincsar, 1996). In order to differentiate these terms easily, Chiriac and Granström (2012) used "working in a group" as cooperation and "working as a group" as collaboration. In "working in a group", although individuals were present in a group, they divided group assignment into parts, and these parts were done individually. At last stage, these parts were joined as a group product (Chiriac, 2010). On the other hand, "working as group" meant that all group members were involved to work together in every part of group assignment (Bennet & Dunne, 1992). Therefore, this type of group work was seen as real and meaningful group work (Chiriac, 2014). From different perspectives, Panitz (1996) emphasized that in collaboration learning group members shared authority and accepted responsibility to do group task. In addition, consensus among group members was the underlying premise of collaborative learning whereas in cooperative learning

people worked together in order to accomplish a specific goal or design an end product which was usually content specific. It was more directive than a collaborative system of governance and closely controlled by the teacher.

Although these are different concepts, some factors are identified for both type of learning to be considered in designing and implementing a group work activity. These factors are shown in the following (Johnson et al., 1991):

(1) Positive interdependence: Each group member depends on other members to become successful in group work. In other words, group members need each other to accomplish the group's mission. Therefore, success of group is shared by all group members. This aspect is seen as "sink or swim together".

(2) Individual and group accountability: Individual accountability means that each individual is accountable for his/her learning whereas group accountability is related that each member in a group should make contribution in group work. In other words, all group members should take responsibility for making group assignment.

(3) Face-to-face interaction: Group members should interact physically each other in environment to make group assignment by helping, encouraging each other, and discussing, exchanging ideas. Group interaction plays significant role in increasing group members' motivation (Markett, Arnedillo Sánchez, Weber, & Tangney, 2006), group motivation (Johnson & Johnson, 1998), and collective efficacy (Bandura, 1997)

(4) Psychological safety: They should work together in psychologically comfortable environment which is easy to express their ideas to each other, to listen to other members, and to participate in group meetings. This helps group members to make common decision, communicate with each other easily, build trust among group members, solve problems, and get motivated to carry out group work.

(5) Group processing: Groups should be included in a process to discuss how the work of the group is, what has been successful, and what need to be improved (Johnson & Johnson, 2009). According to Hinsz, Tindale, and Vollrath (1997), each group has information processing system. The purpose of group processing is to enhance continuously the quality of group work by strengthening effectiveness of group members (Johnson, Johnson, & Holubec, 2008). Gibson (2001) specified four

stages in group processing. The first stage called accumulation, knowledge was acquired from environment. By filtering this knowledge, important information was stored. Then, in the second stage called interaction, when necessary, this information was retrieved. They were shared with group members. After that, in examination stage, group members worked together to examine this knowledge. By negotiation, group members tried to interpret each knowledge. Finally, group members' perceptions, judgments, knowledge and opinions were integrated to produce decisions and actions. There were few studies on group processing. One of them was related to effectiveness of group processing on achievement, perception of social and academic support (Bertucci, Johnson, Johnson, & Conte, 2012). They made experimental study with 61 elementary students in which the half students conducted group work with group processing whereas the other half studies did group work without group processing. All of students participated 5 instructional sessions over 3 weeks. In these sessions, students worked together in the subjects of science, history, and Italian (literature and grammar). As a result, it was reported that students in class with group processing performed better than those in class without group processing. However, it was found that group processing did not have impact on perception of students on academic and social support.

2.3.1 Theoretical Framework of Group Work

There were two major theories which provided theoretical rationale for group work in educational settings. First theory belonged to Vygosty (1978). According to his socio-cultural learning theory, learning was constructed as a result of social interaction. In order to explain clearly how this interaction provides learning, he proposed zone of proximal development which meant that children learned better with adult guidance or in collaboration with more capable peers. In the same vein, at education settings, when students worked together in group, group members often provided information, prompts and cues, reminders, and encouragement to other students in the group (Gillies, 2003).

Another theory was Bandura’s social learning theory (1997). According to this theory, learning was occurred by observing other people behaviors or the consequences of the behavior. Social learning theory explained human behavior in terms of continuous reciprocal interaction between cognitive, behavioral, and

environmental influences. In order to occur effective learning by observing, certain steps must be followed. Firstly, attention to certain behavior should be required. Then, this behavior should be remembered by extracting this knowledge from memory. Then, this behavior should be performed. Finally, reinforcement from the other people should be provided to motivate (Bandura, 1997). Considering this theory in the light of group work, social skill such as communication, persuasion, active listening can be learned by observing other members in group.

2.3.2 Research related to Group Work

Group work has been the subject of much research in educational setting including all levels from compulsory education to higher education. In compulsory education, research about group work was usually related to effectiveness of group work to understand specific topic when compared to traditional teaching methods such as lecturing. In the literature, there were some studies with elementary students (e.g., Demirci, 2010, Ebrahim, 2012; Howe et al., 2007, Lehraus, 2015; Lewis, Treagust & Chandrasegaran, 2012; Marinopoulos & Stavridou, 2002; Qualter & Abu-Hola, 2000). For example, Howe et al. (2007) conducted a research with 24 primary classes located rural and urban areas of United Kingdom. In this project, these classes were examined in terms of learning of two science topics; evaporation and condensation, and force and motion. Pre-, post-test, rating scale and observation instruments were used to evaluate students' outcomes. In the analysis, it was reported that group work played a critical role in improvement of students' learning on these two science topics in rural and urban areas. Likewise, Ebrahim (2012) found that cooperative learning in science has positive influence on both students' achievement and social skills when compared to direct teaching method.

In addition to studies conducted with elementary students, group work in middle school students was examined as well. Similar to studies examining elementary students, Yildirim and Girgin (2012) investigated the effects of cooperative learning method on achievements and permanence of knowledge in genetics unit at 8^{th} grade. Two classes were used, one of which was experimental group taught by cooperative learning method, another group was taught by lecturing. After implementation of ANOVA to analyze data, they found that cooperative learning was effective method to increase students' academic achievement.

Moreover, they indicated that knowledge learned in cooperative learning class was more permanent than knowledge in lecturing class. Similarly, Zinicola (2009) revealed out that collaborative work in middle school students provided enhancement of leaning although there were some factors influencing learning such as, task difficulty, quality of talk, participation levels, frequency of talk and cognitive levels of learner. On the contrary, in the study of Dollard and Mahoney (2010) with 64 middle school students, it was found that there were no significant differences between direct teaching classes and cooperative learning classes in term of achievement. Moreover, it was observed that in direct teaching classes, students gained more positive attitude towards learning science. Topsakal (2010) did research in parallel to Dollard and Mahoney's (2010) study. He examined effectiveness of cooperative learning on teaching 8^{th} grade unit which was substance and energy for living things, and changes in attitude of students towards science lessons. Achievement test and attitude survey were used twice at the beginning and at the end of implementation. In addition to them, interviews and observation were used to specify changes in students' attitude. After analysis of data, the finding showed that there was no statistically significant difference in these groups in terms of achievement. Besides, it was found that students got positive attitude toward science lessons in cooperative learning class according to quantitative and qualitative data. Hong (2010) extended the studies of Topsakal (2010), and Yildirim and Girgin (2012). Both students' learning anxiety and attitudes toward science was examined in high achieving middle school students. Finding demonstrated that students in experiment group developed more positive attitude towards science and declined in anxiety level of learning science. Contrary to this study, Topping et al. (2011) revealed out in their study that middle school students did not show effective gain in terms of learning, attitude towards science, attitude towards collaborative learning, and self-esteem.

There were also many studies investigating group work among high school students (e.g., Bennett, Hogarth, Lubben, Campbell, & Robinson, 2010; Ding & Harskamp, 2011; Heng, Surif, & Seng, 2015; Oludipe & Awokoy, 2010; Rozenszyan & Assaraf, 2011). For instance, Rozenszyan and Assaraf (2011) used collaborative learning in high school students' ecology inquiry based projects which was the part

of the biology matriculation examination of Israeli education. For this, groups which included three students were asked to do research about ecology problem of Israel. After examination of these groups, it was reported that groups which include similar learning abilities found collaborative learning as meaningful and effective way to understand ecological systems. In addition, Oludipe and Awokoy (2010) conducted an investigation about high school students' anxiety for learning chemistry. Based on the finding of their study, they concluded that cooperative learning was effective method to reduce students' chemistry learning anxiety. In addition, Bryan, Glynn and Kittleson (2011) emphasized that collaborative learning activities were strong motivators for high school students to learn science. They suggested that there should be increase in such kind of activities which lead to enhancement in students' motivation as well as interest and achievement.

Group work was examined in different context. For example, Sampson and Clark (2008) conducted a study to observe the effect of group work in scientific argumentation. For the study, 168 high school students were asked randomly to be included in collaborative or individual argumentation. Two cases related to energy transfer, thermal equilibrium, and thermal conductivity were selected for the context of study. One of these cases was assigned to groups or individuals randomly. It was found that although groups could not construct better arguments than individuals, students in groups learned more from experiences than students who worked alone. Similarly, Day and Bryce (2013) examined the role of cooperative learning on socio-scientific discussion in secondary school science. It was found that cooperative learning was one way to facilitate discourse in socio scientific issues.

In some studies, students were investigated from elementary to high schools together in terms of cooperative learning. For instance, Thurston et al. (2010) made a longitudinal study in order to examine the effects of cooperative learning on science attainment, attitudes towards science, and social connectedness during transition from primary to high school. A total of 204 students involved in transition from 24 primary schools to 16 high schools, and 440 comparison students were included in this study. It was found that using cooperative learning not only facilitated transfer knowledge and social skills to new context but also helped students develop more positive attitudes towards science in new context than comparator students.

Even though there were studies which conducted on students in elementary, middle and high school students like stated above, group work was also used as a pedagogical technique in higher education (e.g., Chace, 2014; Gupta, 2004; Monteiro & Morrison, 2014; Rafferty, 2013; Retna, 2015; Tully, 2015). In addition, it was stated that group work was "core model of pedagogy" in the university of the twenty first century (Tapscott & Williams, 2010). Therefore, students in higher education were used as subject in group work studies. For example, Chiriac (2014) investigated experiences about group work of undergraduate students in two universities in Sweden. In order to learn their experience, a questionnaire which included multiple choice and open-ended questions were asked. The answers of students were analyzed by content analysis method. The result of the analysis showed that students focused on three themes which were learning, study-social function and organization and they stated that there were positive and negative ways of each of these theme. For example, most students expressed that group work facilitated gaining academic learning. In addition to these benefits, some of students stated that group work led to decrease learning because of loss of focus and presence of conflict in group. In study-social function of group work, they stated that they felt belongings in a group and their friendship became stronger. Some of them indicated that bad temper of some members and insufficient communication were negative side of the social function of group work. Moreover, they specified negative and positive opinion about aspects organization of group which were group composition, group structure, way of working and contributions. For example, some of them liked homogeneous group composition whereas they found homogenous ineffective due to forming similar ideas about group assignments. Similar to Chirac's (2014) study, Bourner et al. (2001) reported that group work made first year undergraduate students gain positive experiences such as working with others in a group, action planning and organizing, and negative experiences such as time management, communication.

In a different study, Thomas (2014) investigated whether collaborative work developed group skills among undergraduate students. In order to conduct the research, writing assignment was given to seven groups which were composed of four or five people. Because the author examined changes in development of group skills, action research with two cycles was implemented. At the end of second cycle

of this research, a scale which was composed of Likert type of question and open-ended questions was administered. As a result, it was declared that the students had positive experiences about group work and they developed group skills such as creating team cohesion, organization and communication.

Different from previous studies, Summers and Svinicki (2007) examined the effectiveness of cooperative learning on achievement motivation of undergraduate students. For this purpose, they developed their own achievement motivation scale. A total of 483 undergraduate students were surveyed, and these students were separated according to type of methods used in classroom (cooperative learning or no cooperative learning). Structural equation modeling technique was used to analyze data. After analysis, the findings demonstrated that although students in cooperative learning classroom environment were more motivated to learn to attain success, students in traditional classroom were more motivated to learn to compete with other students.

Apart from these studies, Opdecam et al. (2014) investigated cooperative learning from different perspective. University students' preference about cooperative learning or lecture-based learning in relation to their gender, ability, motivation, and learning strategy was the main focus of this research. It was found that students who chose cooperative leaning had lower ability level, got more motivated to learn, sought help from others in learning process, and shared knowledge with others easily. In addition, cooperative learning was found more effective in learning outcomes than lecture-based learning when controlling gender and ability. Differently, Basili and Sanford (1991) conducted a study with undergraduate students to observe influence of group work on conceptual change in some chemistry topics such as the laws of conservation of matter and energy and nature of gases, liquids, and solids. A group of students was asked to form the group to discuss these scientific concepts whereas another group of students were taught by direct instruction. After analysis of these students, they found that students did group work had fewer misconception than students were taught by direct instruction.

Undergraduate students' group work was examined in different context. For example, There were some studies which integrated science, technology, engineering and mathematics (STEM) with group work (e.g., Karacop & Doymus, 2013; Maree,

Bruggen, & Jochems, 2013; Nadolski & Smith, 2010). More specifically, Maree et al. (2013) designed a study in which students as a group constructed concept maps related to biomolecules by using a specific computer program. It was seen that this collaborative work not only led to meaningful learning of science concepts but also increased retention of them in students mind. In addition, collaborative learning of undergraduate students in online environment was investigated. For instance, Lan, Lin, and Hung (2012) conducted a study with 2nd-year undergraduate students in the Department of Information Management. They found that although collaborative learning in online environment needed feedback from the teacher, it helped enhance learning and evaluation of students.

As undergraduate students, there was also research related to preservice teachers regarding group work in the literature. Similar to previous research stated above which was conducted with students and undergraduate students (Chiriac, 2014; Erdamar & Demirel, 2010; Gillies & Boyle, 2010; Thomas, 2014; Topsakal, 2010; Yildirim & Girgin, 2012), preservice teachers were examined in terms of benefits and difficulties of group work. For instance, Erdamar and Demirel (2010) examined preservice teachers' perceptions of group work they did in university. In this study, a total of 245 preservice teachers responded a questionnaire which was developed by the researchers. Then, among these 245 teachers, 15 preservice teachers were interviewed. Results of the study indicated that there were some benefits of group work in social skill such as talking in front of people and in professional development such as improvement of teaching experience whereas some difficulties were specified such as sharing workload by a few students in the group, not sharing responsibility from all members, lack of communication in group. From different perspective, Oncu and Ozdilek (2013) examined satisfaction level of undergraduate students through group work. Students which were from two departments (Science Education and Computer Education and Instructional technology) were gathered to make collective group activity. After this activity, a scale which included a 10-item Likert-type questions and open-ended questions was implemented. It was found that students from two departments satisfied from this group activity, and the most frequently mentioned positive theme in their satisfaction was "learning in general". However, the most frequently expressed negative opinions

in their satisfaction were formulated around “cohesion” which was related to acting in harmony, motivation in group, and team spirit.

Different from previous studies conducted with preservice teachers, Zhou et al. (2011) designed a multidisciplinary method course which included music, math and science for elementary teacher education. For this study, three instructors of this course were asked to work collaboratively. This method course was conducted during three semesters. In five week of each semester, these instructors gave lesson to a class about integration of these three disciplines into the lesson. Then, after five weeks, they divided this class into three sections and each teacher asked her/his group to prepare lesson plan. These prepared lesson plans were developed in the light of discussion of instructor and students in the group. After that, each group performed these lesson plans in real classroom environments and teachers who were responsible for her/his group observed own group performances. Reflective journals, field notes, meeting notes were used for data collection after each lesson plan presentations and these data were analyzed with content analysis approach. As a result, it was reported that this kind of experiences helped preservice teachers understand how collaboration could take place in teaching.

Ruys, Keer, and Aelterman (2012) asked preservice teachers to prepare lesson plan by integrating cooperative learning technique. In total, 323 lesson plans were examined with respect to strengths and weaknesses of them concerning implementation of cooperative learning. A rubric developed by the researcher in the light of related literature was used for analysis. it was found that while lesson plans included well-designed learning task related to cooperative learnings, adequate material and resources, and evaluation of product in cooperative learning, they had lack of the role of teacher during lesson, monitoring, and evaluation processes. Moreover, many lesson plans did not include social goals and objectives, and rules and agreements for group work.

In the study of Mansfield and Volet (2014), 53 preservice teachers were examined to explore small group work on their beliefs about motivation. For this purpose, seminars were implemented to discuss classroom motivation in which students as a small group were asked to exchange prior experience, identify challenges and propose solution. By collecting data from pre and post questionnaire

and final interview, it was concluded that group work among preservice teachers increased about classroom motivation.

Of studies conducted with preservice teachers, preservice science teachers were examined in group work. For example, Taylor, Lucas, and Watters (1999) investigated two classes of preservice science teachers' understanding physics topics such as states of matter, solubility, chemical and physical change, heat and pressure. While collaborative learning was used in one class, another class was taught by traditional method. The researchers found that students in the collaborative learning class had high level of discussion, and deeper conceptual understanding. On the other hand, Soprano and Yang (2013) investigated the influence of cooperative learning field experience on a preservice teacher's views of inquiry-based science and her science teaching self-efficacy. The context of study was science methods course in which students teachers participated in hands-on, science activities to explore ocean sciences. Then, as groups, they were asked to plan three inquiry-based science lesson plans which were taught to elementary school students. After analysis of output of preservice teacher, it was seen that use of cooperative inquiry-based field experiences was effective in increasing of these teachers' self-efficacy for teaching. In a similar vein, Watters and Ginns (2000) conducted their study in science methods course context. In this course, instructional strategies related to essential dimension of meaningful learning which were the knowledge base, metacognition, motivation, individual differences and context were integrated to help them learning to teach science effectively. It was found that collaborative leaning made contribution to science content knowledge, pedagogical knowledge, and professional practice as well as science teaching efficacy beliefs.

In the line with studies of Zhou et al.'s (2011), and Ruys et al.'s (2012); Kenny (2010) designed a study for preservice science teachers to plan and teach a chosen science topic in front of real classroom environment. For this study, they collaborated with inservice teachers. Both qualitative and quantitative data were collected from 23 preservice teachers by their reflective journals, and lesson plans, discussion forum, and SETL (Student Evaluation of Teaching and Learning). The findings showed that this collaboration between preservice and inservice teachers provided increase in confidence level of preservice teachers to teach science.

Apart from Kenny (2010), Watson, Miller, and Patty (2011) carried out a research with only preservice science teachers. The researchers asked preservice science teachers to work together to develop, design, present and evaluate one-hour lesson for sixth grade students as a group in science methods course. A total of 19 preservice science teachers were participated. They were divided into groups to prepare lesson plans. One week was given for preparation for all groups. After preparation, lesson plans presented in front of the other groups and the instructor of the course in an hour-long time. Then, these lesson plans were discussed. Verbal feedback about positive and negative ways of their lesson plans was given. According to feedback, groups made necessary changes to improve their lesson plans. Then, these lesson plans were implemented to sixth grade students. In order to examine this process, 11 questions were asked about experience they had in the group work. After analysis of answers of these preservice science teachers, it was found that they saw collaboration as key element in improvement in their teaching experience. They suggested that this kind of experiences should be more in teacher training program to reach adequate educational experience.

In conclusion, there were many studies investigating group work in elementary, middle, high school, and university students (e.g., Hong, 2010; Lan et al., 2012; Maree et al., 2013; Oludipe & Awokoy, 2010; Opdecam et al., 2014). Most of them focused on comparison between cooperative learning with traditional learning in many respects including students' science achievement, attitude towards science lesson, anxiety level, students' motivation, retention of knowledge. Similarly, group work of preservice teachers were also investigated (e.g., Erdamar & Demirel, 2010; Oncu & Ozdilek, 2013; Mansfield & Volet, 2014; Ruys et al., 2012; Zhou et al., 2011) In these group works, they were usually asked to work together to make authentic activities of teaching such as lesson planning. Concerning this topic, preservice science teachers become subject of some research which is conducted in the context of science methods course (Kenny, 2010; Soprano & Yang, 2013; Watson et al., 2011; Watters & Ginns, 2000). This research demonstrated that collaborative learning to make lesson plans contributed to preservice teachers' science content knowledge, pedagogical knowledge, and professional practice as well as confidence in science teaching, science teaching efficacy beliefs. Although

the benefits of group work were reported, there was a gap in the literature about the effect of group motivational factors such as collective efficacy on preservice science teachers' group work.

2.4 Summary

According to social cognitive theory, people made decision about their lives as result of triadic relationship among behavior, environmental factor, personal factors (Bandura, 1977). Concerning personal factors, Bandura (1997) formulated self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p.3). There were the sources of efficacy information which were mastery experience, vicarious experience, verbal persuasion, and psychological and affective states (Bandura, 1997). Self-efficacy had important influence on individuals' choice of activities, effort, persistence and academic achievement (Pintrich & Schunk, 2002). Once importance of self-efficacy was discovered, it was started to be implemented in educational setting, especially teachers. Therefore, new construct "teacher efficacy" was derived. Tschannen-Moran et al. (1998) defined teacher efficacy beliefs as "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific task in a particular context" (p.233). Because of the fact that self-efficacy is content and subject specific (Bandura, 1997), teacher efficacy was adapted for science as "science teacher efficacy". Tosun (2000) stated that inservice teacher has low science teacher efficacy. Therefore, it was suggested teacher education are designed to improve these efficacy beliefs (Bayraktar, 2011) Research on science teacher efficacy showed that science methods courses are important contexts for development of preservice science teachers by integrating sources of efficacy information (e.g., Cantrell et al., 2003; Ross & Bruce, 2007; Settlage, 2000).

Bandura (1997) pointed out that people were not isolated creatures, they should move with other people to meet requirements of their lives. Therefore, similar to self-efficacy, people in the group should develop belief about their groups' capabilities. Based on this notion, Bandura (1997) formulated new term named collective efficacy. Collective efficacy meant "a group's shared belief in its conjoint capabilities to organize and execute the course of action required to produce given

levels of attainments" (Bandura, 1997, p.477). Bandura (1997) stressed that sources of self-efficacy were relevant for collective efficacy because they were derived from same theory.

Collective efficacy has been considered an important factor in studies of groups and teams (Bandura, 1997; Goddard, 2002; Goddard & Goddard, 2001). Research on people including sports, organization and educational setting revealed that collective efficacy was related to self-efficacy of group members (e.g., Fernandez-Ballesteros et al., 2002; Viel-Ruma et al., 2010) and group performance (Gibson, 1999; Greenlees et al., 1999; Goddard, 2001; Peterson et al., 2000). Considering difficulty in examining groups, collective efficacy has not been much investigated with groups of preservice teachers and in science education. Therefore, in this study, group work which was related to science lesson plan was examined with respect to collective efficacy in the science methods course. Moreover, the role of sources of collective efficacy on group behavior, the effect of collective efficacy on group performance, and on group members' self-efficacy were also explored. Therefore, this study filled the gap in the literature and could be starting point for further studies.

CHAPTER III

METHOD

This chapter presented research design, research questions, participants, context of this study, data collection tools, data collection process, data analysis process, trustworthiness of study, role of the researcher, and ethical issues.

3.1 Purpose and Research Questions

The aim of this study was to investigate collective efficacy of preservice science teachers in the science methods course, the role of collective efficacy sources on group behavior, the influence of collective efficacy on group performance, and on self-efficacy of preservice science teachers in the course. In the light of its purpose, this study attempted to respond following research questions:

1) How do preservice science teachers describe "working in this group" in a semester-long science methods course?
2) How is preservice science teachers' collective efficacy developed in the science methods course?
3) How is preservice science teachers' collective efficacy changed over time in the science methods course?
4) How do the sources of collective efficacy (mastery experience, vicarious experiences, verbal persuasion, and psychological and affective states) in the science methods course contribute to group behavior?
5) How does preservice science teachers' collective efficacy contribute to group performance in the science methods course?
6) How does preservice science teachers' collective efficacy contribute to self-efficacy of group member regarding science teaching in the science methods course?

3.2 Participants

This study was carried out with a group including four preservice science teachers in a science methods course during spring semester of 2014 in one of the major universities in Turkey. In order to select this group, at the beginning of this course, preservice science teachers enrolled in science methods course were asked to compose groups to work together in order to make requirement of this course. As a result, 10 groups, which include three or four students, were formed. Then, groups were informed about the study without explicitly stating purposes. After that, one group who wanted to work with researcher was selected.

Purposive sampling method was implemented for selection of the group since it can provide rich information about subjects (Frankel & Wallen, 2006). In the study, for selection of the group, researcher paid attention regarding being willingness for each member in a group to participate in this study. Therefore, the researcher tried to minimize the risk of breaking up of the group during the implementation of the study.

Selected group had four preservice science teachers who are at third year and sixth semester of science teacher education program. There are two males and two females. Prior to taking this science methods course, these participants have completed science courses related to physics, chemistry, biology and science laboratory and the other courses such as mathematics, technology, history, English, Turkish as well as educational courses such as introduction to education, measurement and assessment, educational psychology.

More specifically, in order to introduce these participants in detail, pseudonyms were given to them by the researcher. Moreover, these names were used in explaining finding of this study to present a clearer picture of what is happening in this case. These names were not shared with anyone including participants to make sure that identities were kept confidentiality. These pseudonyms were Selin, Ceyda, Mehmet, and Kemal. Background of each participant is given by using these pseudonyms below.

Selin: She was twenty one years old and had 3.46 GPA over four. She had teaching experience for two years. She worked in a Nongovernmental Organization (NGO) as a volunteered teacher for three months. She did long-termed group work

within scope of two courses to fulfill requirements of the courses. She had positive attitude towards group work and group friends.

Ceyda: She was twenty four years old and had 2.38 GPA over four. She had teaching experience as private tutor last year for a month. She taught science to the students in a NGO during a semester. Like Selin, she did long-termed group work during two same courses until this study was conducted. She had positive attitude towards group work. She stated that thanks to group work, everyone in the groups has completed each other's deficiencies. Therefore, she learned easily in a group than working alone and they created more qualified product in group work.

Mehmet: He was twenty three years old and had 1.86 GPA over four. As a private tutor, he had teaching experience for one and half month when he was a freshmen. Like Selin and Ceyda, he did long-termed group works during two same courses until this study was conducted. He had negative attitude towards group work. He said that they could not come together to work due to difficulty in arranging time. Moreover, there were communication problems among group members.

Kemal: He was twenty three years old and had 2.26 GPA over four. He had no teaching experience. He did long-termed group works during two same courses until this study was conducted. In these group works, they worked with different people than this current group. He had negative attitude towards group works. He said that time is a big problem; therefore, they preferred to share group work load. Then, they studied separately and combined their work. Moreover, he claimed that in these group works, there was no efficient interaction among the group members and they did not know what the other members do in their work; therefore, they got low grade from homework and added that they did not strive to become more successful.

3.3 Context of this Study

This study was carried out in a science methods course. This course was selected as main context for this study since in the course group work has been asked for students to fulfill course requirements for many years. Considering purpose of this study related to examining collective efficacy, group work was essential structure to conduct the study. For this reason, the science methods course was chosen as the main context of the present study.

The science methods course was compulsory course offered in spring semester of 2013-2014 academic years in elementary science teacher education program. This course was given at sixth semester and third year of this program. It was three-credit course and lasted thirteen week within this semester. There were one professor and four assistants including the researcher to conduct this course. The professor had Ph.D. degree on curriculum and instruction and has given this course for ten years. All assistants graduated from department of elementary science education. They took science methods course when they were undergraduate students. As this study was conducted, three of them were Ph.D. candidate; the other one has master degree in science education. They had different research areas such as nature of science, motivation, argumentation and technology.

The main aim of this course was to help preservice science teachers learn different science teaching methods, prepare lesson plans by using these teaching methods in middle school science, and make microteaching related to these methods. Moreover, there were secondary aims of this course which were to develop usage of science process skills and aspect of nature of science in their lesson plans and to improve students' attitudes, and skills essential to science and technology literacy. In parallel to the main aim of this course, much of the course was concerned with preparing students prepare lesson plans and performing microteaching regarding to science teaching methods. Table 1 below provided overview of the target science teaching methods addressed each week in this science methods course.

Table 1

Science Teaching Methods Implemented in the Science Methods Course across Weeks

Week	**Science Teaching Methods**
1	Demonstration
2	Inquiry and Teaching Science: Learning Cycle, 5E & 7E Instructional model
3	Argumentation
4	Field Trip
5	Project-based Learning
6	Problem-based Learning
7	Teaching science with analogy
8	Role Playing
9	Laboratory Work

One of purposes of this study was to examine the influence of sources of collective efficacy on group behavior. Therefore, science methods course was designed in parallel to this purpose. For this, some related activities related to Bandura (1997)'s sources of collective efficacy which are mastery experience, vicarious experience, verbal persuasion were integrated into the course in the light of purposes of the study. First of all, the course was planned as four hours in a week. First two hours were called as theoretical part. In the first hour of this part, theoretical knowledge about a teaching method was given by the professor of this course. In the second hour, the assistants presented sample lesson related to the teaching method. These two activities were considered as vicarious experience because Goddard et al. (2004) stated that observing and taking other people such as supervisor, mentor, peer and other groups as a model might act as vicarious experience which develop collective efficacy.

Two other hours of this course were referred as practical part which was occurred after one week from theoretical part of each method. In the practical part, some activities related to Bandura (1997)'s sources of collective efficacy were included as well. Firstly, every week groups delivered lesson plans related to teaching method they have learned in previous week. Myers et al. (2004) expressed that past authentic group performance provided mastery experience which is another source of collective efficacy. Here, lesson planning is regarded as early field experience for preservice science teachers to organize teaching (Cantrell et al., 2003). Therefore, preparing lesson plan with group work during nine weeks can provide mastery experience for preservice teachers.

After they prepared lesson plans, groups performed microteaching in the light of these plans in the front of the classroom. During this microteaching, each group observed the microteaching of other groups in class every week. This activity was also related to Bandura's (1997) vicarious experience because it includes observing other groups' performances and taking model of them.

Finally, after each microteaching was finished, other groups and course assistants were asked to make comment about group performance they have observed. Sorlie and Torsheim (2011) emphasized that verbal persuasion source of collective efficacy is related to verbal feedback about group performance from other

groups or other people such as supervisor, mentor, peer. As a result, this activity above was congruent with Bandura's (1997) verbal persuasion source.

For another source which is physiological and affective state, there was no activity implemented in the course even though it was examined in the light of purposes of the study since this source was related to internal state of group such as stress, mood arousal, anxiety itself (Bandura, 1997). Table 2 provided an overview of the organization of the sources of collective efficacy associated with activities in the science methods course below.

Table 2

Organization of Sources of Collective Efficacy Associated with Activities in Science Methods Course

Sources of Collective Efficacy	**Activities**
Mastery Experience	Each group developed their own lesson plans about teaching method every week they have learned in the theoretical part of the course
Vicarious experience	The professor taught theory of teaching method, showed materials and activities related to method that was taught in that week. The course assistants presented sample lesson related to the teaching method that was taught in that week. Each group observed the other group's or other people's performance every week.
Verbal Persuasion	Each group gave feedback the other groups' performance after they finished. The course assistants gave feedback after groups' performances

3.4 Research Design

A mixed method was selected for the research design of the study since it gave more complete picture of phenomena by including both qualitative and quantitative data (Creswell, 2014). There are three types of mixed method approach. Firstly, in triangulation design, qualitative and quantitative data were collected simultaneously to compare the findings whether they are validated each other. Another type of mixed method approaches is explanatory design in which quantitative data is collected previously, then obtained findings are examined in detail by collecting qualitative data. Lastly, in exploratory design, after qualitative data was collected, quantitative research was conducted to extend qualitative findings (Frankel & Wallen, 2006).

In the present study, triangulation design was conducted. In other words, qualitative and quantitative data were collected at the same time. However, compared to quantitative part, the qualitative part of the study was dominated. Clearly, while qualitative study was conducted to respond all research questions, quantitative study was only carried out for the sixth research question to validate the findings of qualitative study.

For qualitative part of the study, one type of design of qualitative research, which is case study was chosen since it provides in-depth understanding of phenomenon by enabling researcher and readers to give wide description about what happened in a case (Creswell, 2007). More specifically, it can be said that this study was instrumental case study because researcher focuses on an issue, then choose one bounded case to demonstrate this issue (Stake, 1995). Similarly, in this study, the main purpose was to investigate collective efficacy of preservice science teachers which can be defined as an issue in group, and it was assumed that case is a group which is composed of four preservice science teachers to work together in a science methods course. Therefore, instrumental case study was the most suitable case study type for this study.

For quantitative part, experimental design was conducted since it helps researchers to establish cause and effect relationship among variables (Frankel & Wallen, 2006). Concerning the sixth research question, the influence of collective efficacy on participants' self-efficacy regarding science teaching in the science

methods course was examined. In order to understand whether there is significant change on self-efficacy levels of participants, they were measured twice with a scale (STEBI-B) at the beginning and end of the science methods.

3.5 The Case of the Study

As noted before, a group who included four preservice science teachers to work together in the science methods course was selected a case of the study. Mainly, they prepared lesson plan as a group every week. Moreover, this group pursued same procedure like other groups in the course. In general, participants in the group have observed the course professor's presentation about new science teaching method in one hour of theoretical hours each week and in the second hour, they observed the microteaching of course assistants related to newly learned teaching science method. Then, one week was given for the group to prepare their own lesson plan based on this new method. After preparing lesson plans, in practice hours, this group was asked randomly to do four microteachings based on lesson plans for demonstration, fieldtrip, analogy and laboratory work. Regarding their performance on microteaching, they received other groups' and the course assistants' feedback. In addition to their microteachings, they had a chance to observe the others groups' microteaching every week.

3.6 Data Collection

Focusing and examining case in depth, it is required to use more than one data collection to reach rich variety of data (Merriam, 2009). Therefore, in this study, data collection was done through pre-interview, focus group interview, post interviews, observation, critique papers, lesson plans, and STEBI-B.

3.6.1 Data Collection Tools

These data collection tools were prepared in the light of the research questions of the present study. Table 3 demonstrated the usage of data collection tools across research questions below.

Table 3

Research Questions and Instruments

Research Questions	Instruments
How do preservice science teachers describe "working in this group" in a semester-long science methods course?	Focus group interview Personal interview Observation
How is preservice science teachers' collective efficacy developed during science methods course?	Focus group interview Personal interview
How do the sources of collective efficacy (mastery experience, vicarious experiences, verbal persuasion, and psychological and affective states) in the science methods course contribute to group behavior?	Critique paper Observation Personal interview
How does preservice science teachers' collective efficacy contribute to group performance in the science methods course?	Personal interview Focus group interview Lesson plans
How does preservice science teachers' collective efficacy contribute to self-efficacy of group member regarding science teaching in the science methods course?	Personal interview Focus group interview STEBI-B

3.6.1.1 Pre-interview

A semi-structured interview protocol was used to learn demographic information, to describe thought of participants with respect to past teaching experience and group work experience. For this purpose, the first draft of pre-interview was prepared by the researcher. The opinion of two experts in science education and qualitative study helped the researcher to create the final version of this tool. The final pre-interview protocol included seven questions. Three of them were related to demographic questions. The other four questions had 8 sub questions in total which were concerned about reaching the opinion of each group member in some aspect stated above. The pre-interview protocol was given in Appendix A.

This pre-interview was conducted at the beginning of group work. Before the researcher made these interviews with each participant, they signed consent form to

declare that they participated in this study voluntarily. Interviewing lasted almost 10 minutes. These pre-interviews were recorded by using digital audio recorder.

3.6.1.2 Focus Group Interview

Focus group interview has important function in collecting qualitative data when studies are conducted with group since in group, participants are located in interactive environment in which they formed their answer in the light of the other' people in group. This situation leads to development of scope and depth of answer of questions in the interview. Moreover, focus group interview can help researchers to reach richness of data about they investigated (Merriam, 2009). For this purpose, in this study, focus group interview was conducted. For the focus group interview, semi-structured interview questions were prepared in the light of research question of this study. The first draft of focus group interview questions developed by the researcher was given for review to expert who was specialized in science education. After receiving feedback from this expert, the final version of focus group interview questions was formed. In the final version, there were 7 main questions and 7 sub questions. These questions were related to all research questions of this study. Clearly, one question was included to understand how group was worked, three questions were added to investigate the collective efficacy in this group, one question was related to examine relationship between collective efficacy and group performance and last two questions were concerned about understanding relationship between collective efficacy and self-efficacy of each participant in this group. The interview questions were presented in Appendix B.

This focus group interview was carried out twice at the fifth and eighth weeks within the semester. These weeks were selected because considering that there were nine teaching methods proceeded in this semester, the researcher aimed to examine the group after each three lesson plans.

To keep attention to the questions in these focus group interviews, comfortable and silent environment was arranged by the researcher. Moreover, in order to prevent dominance of some members in answering questions, the researcher tried to receive answer of each participant. Therefore, these interviews lasted almost 45-60 minutes. These interviews were recorded by audio recorder and video camera.

3.6.1.3 Post Interviews

Interview is an important method in investigation regarding experience, attitude, belief and opinion of individuals (Briggs, 1996). In this study, the main focus was related to examining experience of participants in a group work, their collective efficacy beliefs and understanding opinions about relationship between collective efficacy belief and their performance and self-efficacy. Therefore, the main data collection tool of this study was personal interviews.

A semi-structured interview protocol was used for this interview. The protocol was designed by the researcher in the light of literature review and the research questions. First draft was reviewed by two experts in science education and qualitative research. Based on their feedbacks regarding clarity, language, complexity structure and ordering problem, the interview protocol was revised. Then, in order to enhance content validity of this interview protocol, it was also conducted by two different individuals who were taking the science methods course. According to their answer and their feedback about questions, the final version of this interview protocol was formed. The final version contained 27 questions and some questions had sub questions which were counted as 31 in whole interview protocol. Of 27 questions, 7 questions were related to understanding their group work, 10 questions were concerned about collective efficacy, 7 questions were placed to realize influence of sources of collective efficacy, 1 question was related to examining relationship collective efficacy and group achievements and 2 questions were formulated in investigation of collective efficacy and self-efficacy of participants. This interview protocol was given in Appendix C.

This interview protocol was conducted at the end of the semester. Date and hour were determined with interviewers together. When determining, it was paid attention that date of interview was set after final examination of their courses. The reason of decision was that stress of their final examination could influence their interview negatively.

Similar to focus group interview, silent and comfortable environment was chosen by the researcher to do interviews. Because there are many questions to ask, interviewers had a break if necessary. Moreover, these interviews lasted almost 90-120 minutes and these interviews were recorded by audio recorder and video camera.

3.6.1.4 Observation

Observation was selected for another data collection tool because it provides researcher to describe a specific behavior or environment in detail (Merriam, 2009). In addition, concerning studies which conducted during long length of time, observation can be fruitful to get total picture of phenomena (Bailey, 1982). In the present study, the researcher was nonparticipant observer. Therefore, what happened in the group work without manipulating, intervening concerning group work, the behaviors of participants were recorded as data.

Before conducting observation, an observation form was designed by the researcher to describe interaction in group work and their relations to each other. The first draft of observation form was reviewed twice by an expert who was specialized on qualitative study. Based on feedbacks of the expert, final version observation form (Appendix D) was developed.

This final observation form was composed of three dimensions a) physical environment, b) process of group work c) relationship and communication. Each dimension had sub-dimensions to allow the researcher to more easily focus on the group work. Dimension and sub-dimensions were shown together below.

1) Physical environment
    a) Sitting position
    b) Equipment they possessed
2) Process of group work
    a) Investigation
    b) Discussion
    c) Negotiation
    d) Making decision
3) Relationship and communication
    a) Conversation
    b) Interaction among each other

This observation was done by the researcher when the group was preparing lesson plans related to teaching method they have learned in the theoretical part of the science methods course. Time of meeting for every week was determined as a result of negotiation between participants in the group at the beginning of semester.

For observation, silent and comfortable place was arranged by the researcher. Observation lasted during nine weeks and ranged from 180 to 210 minutes during weeks. In observation, the researcher took notes on a paper in a corner of selected place to avoid disturbing group performance. Moreover, group work was recorded by the video camera every week to watch it later extensively. In order to minimize influence of camera on group work, they were reminded that records of video camera would not be shared with another third person.

3.6.1.5 Critique Paper

Critique paper was asked for the group to prepare in investigating influencing the sources of collective efficacy. There were nine science teaching methods throughout this course and after every three teaching method; the group was expected to write a critique paper based on the questions developed by the researcher. These questions were prepared in the light of literature review at the beginning of the course. Then, the expert in science education gave feedback about these questions. Therefore, with respect to this feedback, the final version of critique paper included six questions (Appendix E).

3.6.1.6 Lesson Plan

In the present study, lesson plans were one of data collection tools. Lesson plans also have been used for some purposes in science education literature. For example, Bell, Maeng, and Binns (2013) collected data for their study from preservice science teachers' lesson plan. The researchers asked them to include technology use into their science teaching in a course which was given in context of learning and teaching science. Similarly, in order to make decision about preservice science teachers' pedagogical content knowledge (PCK), Bayer and Davis (2011) used lesson plans. Based on these lesson plans, it was found that preservice science teachers had common weaknesses and strengths in implementing science assessment, science curriculum materials, and instructional strategies. Likewise, Forbes and Davis (2010) aimed to investigate the usage of curriculum materials in inquiry-oriented science lesson in their study. For this purpose, a total of 46 preservice elementary teachers' two inquiry-based science lesson was examined. They reported that preservice elementary teachers' adapted themselves to use the materials in their lesson plans, and their PCK was improved over time. Similar to investigation of

PCK, lesson plan were used to examine science content knowledge of preservice science teachers. For example, Zembal-Saul, Krajcik, and Blumenfeld (2002) analyzed lesson plans of preservice science teachers. They found that subject matter was emphasized to develop students' learning science. In the study of Otero and Nathan (2008), preservice science teachers were examined in terms of views of their students' prior knowledge of science. For this purpose, reserachers wanted them to prepare lesson plan, and perform microteaching related to these lesson plans in science methods course As a result, it was reported that preservice science teachers have limited knowledge about views of students prior knowledge of science.

Under the name of lesson study, there were also some studies in which lesson was planned, taught, analyzed and revised by four or five teachers (Isoda, 2010; Makinae, 2010). For instance, Demir, Sutton-Brown, and Czerniak (2012) conducted a lesson study in which six teachers from science and mathematics department worked together form a common lesson. In this process, it was observed that there were some changes regarding the teachers' perceptions and beliefs about teaching and learning, and their perception on lesson plans. In parallel to this study, Mutch-Jones Puttick, and Minner (2012) carried out an experimental study to whether lessons study lead to enhance practice of teachers. They reported that although lesson study improved the teachers' ability on setting instructional context, preparing lesson plan related to science learning goals, and considering students with learning disabilities, the teachers' science content knowledge and learning disabilities were not developed.

In the present study, lesson plans were used to describe group performance over time in the science methods course. Throughout the course, the group prepared lesson plans related to teaching method that covered in the theoretical part of the science methods course every week. In total, nine lesson plans were developed by the group. Before they prepared lesson plans, at the beginning of this course, the format of lesson plan was determined in the light of literature review and the opinion of the expert in science education (Appendix F). Moreover, in order to analyze the lesson plans, rubric for science lesson plan was investigated in the literature. Because detailed rubric was not found, the rubric of this lesson plan was developed by the researcher. This rubric was revised by considering feedback of the same expert and

other three assistants of this course who have assisted the science methods course before. The final form of the rubric had seven parts which are objectives, materials, introduction, teaching procedure, closure, usage of teaching method and assessment (Appendix G). The format and the rubric of lesson plan were introduced at the beginning of course and questions about them were answered.

3.6.1.7 STEBI-B

In this study, STEBI-B was used to examine self-efficacy of preservice science teachers. For this purpose, it was implemented twice, at the beginning and the end of the science methods course. Original STEBI-B was developed by Enochs and Riggs (1990) to measure self-efficacy of preservice science teachers towards teaching science. This instrument was five-point Likert-type scale ranging from strongly agree to strongly disagree. In this study, Turkish version of this instrument adapted by Tekkaya, Cakiroglu, and Ozkan (2004) was used. This instrument was composed of 23 items. These items were divided into two subscales which are personal science teaching efficacy (PSTE) and science teaching outcome expectancy (STOE). PSTE subscale has 13 items whereas STOE subscale includes 10 items.

3.6.2 Data Collection Procedure

Prior to starting data collection, official permission was taken from ethical committees of Middle East Technical University (METU) which was presented in Appendix H. After that, the final versions of the data collection tools which are pre-interview questions, focus group interview questions and post interviews questions, observation protocols, lesson plan rubric, critique papers questions, microteaching rubric were prepared. At the first meeting of science methods course, voluntary group for this study was selected. By organizing a small meeting, details of this study was explained to the participants. In this meeting, participants were informed about content, duration and aim of research without explicitly stating purposes. Moreover, it was declared that video records, audio records and their identities were kept confidentiality and that any physical and psychological harm to anyone would not come.

In the first week of the science methods course, pre-interviews and STEBI-B were carried out one-to-one in silent and comfortable place. Before that, the participants were asked to read and sign consent form (Appendix I). After one week

of the pre-interviews, observation was started. They conducted group work each week to prepare their lesson plan they have just learned in the theoretical part of science methods course. The researcher observed what happened in the group work during nine weeks in total. In this process, the focus group interview was done at the fifth and eighth week of the science methods course. Moreover, they prepared critique papers three times at the sixth week, ninth week and fourteenth week in the science methods course. They prepared nine lesson plans in total as the products of the group work. These lesson plans were examined by the researcher. At the end, the post interviews were conducted after final examination of their courses in the spring semester. In total, data collection lasted sixteen week. Data collection schedule was shown in Table 4 below.

Table 4

Data Collection Schedule

Week	Date	Monday	Tuesday	Wednesday	Thursday	Friday
1	**Feb 17-21**					Pre-interviews and STEBI-B
2	**Feb 24-28**					Observation
3	**Mar 3-7**				Lesson plan 1	Observation
4	**Mar 10-14**				Lesson plan 2	Observation
5	**Mar 17-21**		Focus group interview		Lesson plan 3	Observation
6	**Mar 24-28**	Critique paper 1			Lesson plan 4	Observation
7	**Mar 31-Apr 4**				Lesson plan 5	Observation
8	**Apr 7-11**		Focus group interview		Lesson plan 6	Observation
9	**Apr 14-18**	Critique paper 2			**Midterm**	**No class**
10	**Apr 21-25**				Lesson plan 7	Observation
11	**Apr 28- May2**					
12	**May 5-9**				Lesson plan 8	Observation
13	**May 12-16**				Lesson plan 9	STEBI-B

Table 4 (continued)

14	**May19-23**	Critique paper 3	**Final Exams Week**		
15	**May 26-30**		**Final Exams Week**		
16	**June 2-6**	Post interview	Post interview	Post interview	Post interview

3.7 Data Analysis Procedure

The data were gathered by qualitative research methodologies. For analysis of these data, interpretive data analysis approach was usually implemented (Strauss & Corbin, 1990). In order to carry out this analysis, certain sequence steps were followed. These steps includes transcribing of instruments, making coding, finding themes related codes, sorting and identification of data according to codes and themes and interpreting of data (Merriam, 2009). These steps were shown in Figure 1 in the following:

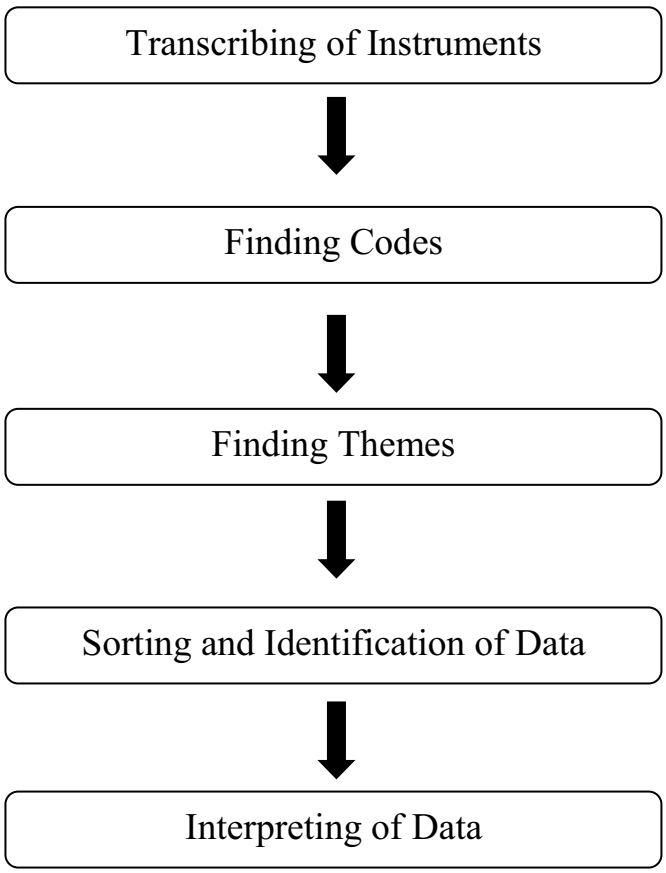

Figure 1.Representation of Data Analysis Process Scheme

Adapted from "Qualitative research: A guide to design and implementation." by S. B Merriam, 2009. Copyright 2009. By CA: Jossey- Bass.

Based on this framework above, firstly, interviews, observation notes and focus group interviews were transcribed from audio records or video records into

paper. Then, the transcription of these instruments as well as critique papers which were given as hardcopy from the group read several times before passing analysis. After finishing all the preliminary preparation for analysis, process of finding codes was started as the second phase of the analysis. For this purpose, any meaningful paragraph, group of sentences, sentence or phrase related to research questions of this study were chosen as codes. After that, as a next phase of this analysis, in the light of similarity and differences among codes, related codes were gathered under themes. During finding codes and themes, related literature was helpful for the researcher. In Tables 5, 6, 7, and 8; these codes and themes were given with explanations from literature below.

During finding codes and themes of the study, a second coder was used in order to establish validity about whether correct codes and themes were found (Lincoln & Guba, 1985). The second coder independently found codes and themes and these findings of the researcher and second coder were compared and contrasted. Any differences were compromised through discussion. As a result, the second coder helped the researcher to examine 67 % part of collected data which was suitable according to Neuendorf (2002)'s criterion that at least 10% of collected data should be investigated from second coder to ensure validation. Moreover, in this study the researcher and the second coder reached 97% agreement in assigning codes and themes in their examination while Miles and Huberman (1994) stated that at least 80% agreement was required for validation. Approximately 3% part of coding parts which the researcher and the second coder disagree was not added in this study. Therefore, it was found that there is no issue for validation in this study.

After stating codes and themes, the writing of these findings was started as next phase of this analysis. For this, data were sorted and described under codes and themes. In this phase, under each codes and themes, quotations were used to help readers to understand this study explicitly. Finally, the researcher interpreted data, explained relationship among data, made conclusion based on the findings under each theme.

Table 5

Demonstration of Codes and Themes with Their Explanation (For Research Question 1)

Codes and Themes	Explanation
Collaborative work	"Working as group" which is described as all group members are involved to work together in every part of group assignment (Chiriac, 2014).
Positive interdependence	Each group member depends on other members to prepare group project (Johnson et al.,1991).
Group accountability	Group accountability is related that each member in a group should make contribution in group work (Johnson et al., 1991).
Face-to-face interaction	Group members should work physically each other to make group assignment (Johnson et al., 1991).
Psychological safety	Group members should interact in psychologically comfortable environment in group meetings (Johnson et al., 1991).
Group processing	A process related to mechanism of group work in which group passes from some phases: accumulation, interaction, examination, and accommodation (Gibson, 2001).

Table 6

Demonstration of Codes and Themes with Their Explanation (For Research Question 2)

Codes and Themes	Explanation
Belief about group abilities for preparing lesson plan	"Belief about group capabilities to accomplish a task" (Bandura, 1997, p. 477).
Collaborative work	"Working as group" which is described as all group members are involved to work together in every part of group assignment (Chiriac, 2014).
Shared purpose	Common goal among group members (Chen, 2009).
Attitude towards group work	Positive or negative feelings, ideas, opinions, judgements (Ajzen, 2001).
Group cohesion	Harmonic force to stick group members to commit to group goals (González et al., 2003).

Table 7

Demonstration of Codes and Themes with Their Explanation (For Research Question 3)

Codes and Themes	Explanation
Influence of mastery experience	As mastery experience, previous authentic performances lead to development of collective efficacy (Myers et al., 2004).
Influence of successful mastery experience	Successful previous experiences cause belief about capability about subsequent task and activities (Bandura, 1997).
Influence of unsuccessful mastery experience	Unsuccessful previous experiences lead to negative belief about capability about subsequent task and activities (Bandura, 1997).
Influence of vicarious experience	Observing other groups, mentors, supervisors, peers or parents might influence collective efficacy (Goddard et al., 2004).
Influence of the other groups' performances	Observing other groups might influence collective efficacy (Goddard et al., 2004).
Influence of the professor's presentation	Observing mentors, supervisors might influence collective efficacy (Goddard et al., 2004).
Influence of the course assistants' performances	Observing mentors, supervisors might influence collective efficacy (Goddard et al., 2004)

Table 7 (continued)

Influence of verbal persuasion	Verbal feedback of other groups or other people may increase collective efficacy (Sorlie & Torsheim, 2011).
Influence of the other groups' feedback	Verbal feedback of other groups may increase collective efficacy (Sorlie & Torsheim, 2011).
Influence of the course assistants' feedback	Verbal feedback of other people may increase collective efficacy (Sorlie & Torsheim, 2011).
Influence of psychological and affective state	Moods, stress anxiety level arousal in group may have impact of collective efficacy (Goddard et al., 2004).

Table 8

Demonstration of Codes and Themes with Their Explanation (For Research Question 5)

Codes and Themes	**Explanation**
Development of personal science teaching efficacy	Increase in the personal belief about ability toward teaching science effectively (Enochs & Riggs, 1990).
Development of outcome expectancy regarding teaching science	Increase in belief that science teaching will lead to positive outcome in student learning (Enochs & Riggs, 1990).

As an exceptional situation, lesson plans were analyzed with document analysis approach (Merriam, 2009). They were examined to observe improvement of the group on preparation lesson plan from the first week of the science methods course to the final week of this course. For examination of lesson plan, rubric to use in the study was investigated in the literature. However, detailed rubric for science lesson plan was not found. Therefore, the new rubric (Appendix G) was prepared by the researcher in light of literature and the opinions of four researchers in science education field before starting the study. In this rubric, there were seven parts which are objectives, materials, introduction, teaching procedure, closure, usage of teaching method and assessment. Material part was 1 point, and each of objectives, introduction, teaching procedure, closure and assessment were 2 points. Finally, usage of teaching method was 3 points. In total, lesson plan was graded out of 14 points. Each of these parts was evaluated under four levels of quality which are "excellent", "good", "moderate" and "poor". For each level of qualities, there were some criteria. In evaluation, if the group members made any part as "excellent quality", they would get full point of this part. If the group members made any part as "good quality", they would get 0.75 of full points of this part. If any part of lesson plans was considered as "moderate", they would get 0.5 of full points of related part. If the researcher found any part as "poor", these group members would get 0.25 point of full points of related part. For example, evaluation of introduction part was made like below. In the introduction part, there was criterion for each level of qualities such as:

> ***For excellent quality:***
> *Introduction includes sufficient description of one of instructional strategies for students used in this lesson such as a using strong motivational device, connection to prior learning, and/or and asking essential questions.*
>
> ***For good quality:***
> *Introduction includes the instructional strategies but concerning usage of these strategies, further explanation is needed.*
>
> ***For moderate quality:***
> *The lesson is only introduced by stating the instructional objective or focus.*

For poor quality:
A process for lesson introduction is very limited or missing

Based on these criteria, the group member's introduction part of each lesson plan was evaluated. If the group wrote introduction in the light of criterion for excellent quality above, it was considered as "excellent" and they got full points which is 2 points. If introduction included one of these instructional strategies but concerning usage of these strategies, further explanation was needed, it was considered as "good" and they got 0.75 of full point which were 1.5 points. If the lesson was only introduced by stating the instructional objective or focus, it was considered as "moderate" they got 0.50 of full points which was 1 point. If a process for lesson introduction was limited or missing, it was considered as "poor" they got 0.5.

In order to provide validity in this evaluation of lesson plans, similar process in the finding codes and themes was followed. At this time, a course assistant helped the researcher every week to analyze lesson plans. For this, each lesson plan was graded independently. Then, these two analyses were compared and any disagreement was resolved through discussion. As a result, the researcher and second coder reached nearly 100% agreement in the examination of lesson plan.

Findings from lesson plans were explained from first lesson plans to last lesson plans by comparing improvement in each part of lesson plan. In writing findings, quotations from lesson plans were used to support explanation of the researcher.

Another exceptional situation was related to the analysis of quantitative data which was obtained from STEBI-B. Concerning the sixth research question, the role of collective efficacy on development of preservice teachers' self-efficacy regarding science teaching was examined. Their self-efficacy levels were measured twice at the beginning and end of the science methods course. In order to understand whether there was significant change on their self-efficacy, implementation of paired-samples t-test was considered. Paired-samples t-test was used when data were collected by subjects on different occasions or under two different circumstances (Gravetter & Wallnau, 2009). There are some assumptions to check before this test was conducted. These assumptions are level of measurement, random sampling, independent

observations, and normal distribution (Gravetter & Wallnau, 2009). In parametric test, dependent variable is need to be measured at the interval or ratio level by using continuous scale (Tabachnick & Fidell, 2001). In the study, STEBI-B was continuous scale. Therefore, this level of measurement assumption was satisfied. Moreover, selection of participant in the study was done by purposive sampling method instead random sampling. Ramdom sampling assumption was violated. For the independent observations, the scores are obtained from different individuals, and should be independent of one another (Gravetter & Wallnau, 2009). In the study, this assumption was satisfied since the data were collected from four preservice science teachers independently. Another assumption is related to normal distribution of data. Items on STEBI-B were gathered under two factors which are personal science teaching efficacy (PSTE) and science teaching outcome expectancy (STOE). The difference between the pre and post scores of PSTE and STOE must be distributed normally (Pallant, 2007). In order to see whether the data showed normal distribution, histograms were examined. The histograms were given below.

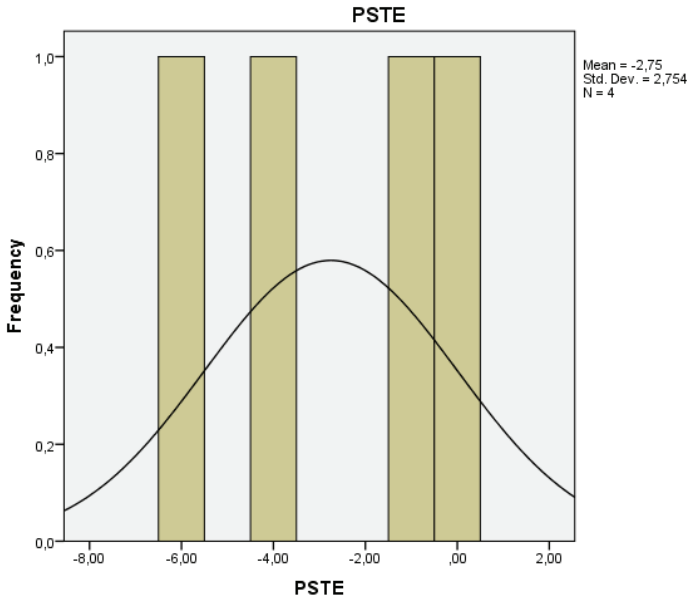

Figure 2. Histogram of Difference between Pre and Post Scores of PSTE

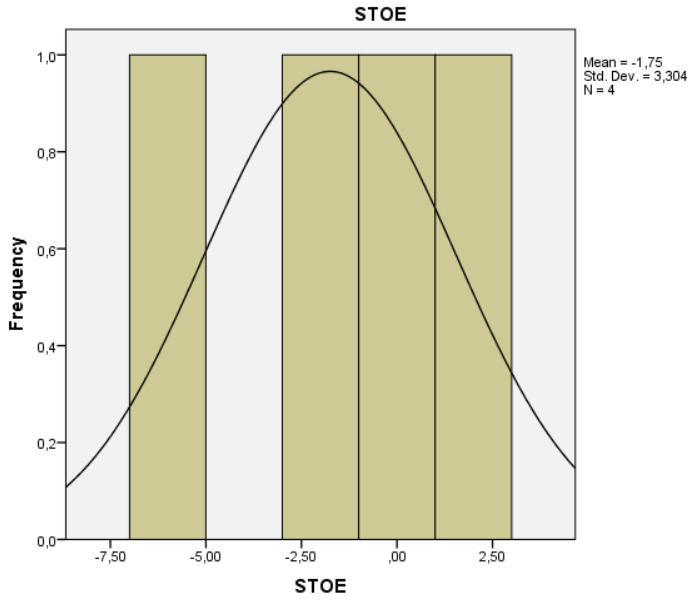

Figure 3.Histogram of Difference between Pre and Post Scores of STOE

As can be seen in Figure 2 and 3, the data were not distributed normally. This was violation of this assumption. Since all assumptions were not satisfied, the paired-samples t-test could not implemented. Instead, the nonparametric alternative of this test which is Wilcoxon Signed Rank Test was conducted since Pallant (2007) stated that nonparametric test is useful when the sample size is small, and sample does not meet assumptions of parametric technique.

3.8 Trustworthiness of the Study

In qualitative studies, reliability and validity of findings are based on trustworthiness of the study (Creswell, 2007). In order to ensure trustworthiness of the study, there are four criteria which are credibility, transferability, dependability, and confirmability (Guba & Lincoln, 1994).

As first criteria trustworthiness of qualitative studies, credibility is related to openness, consistencies and being confirmative from other researcher (Merriam, 2009). Therefore, it refers to interval validity in quantitative research. In this study, credibility issue was provided by using some strategies. Prolonged engagement, which is one of these strategies, was established to build confidence between researcher and participants (Creswell, 2007). For this purpose, sufficient time was spent with the group in this study. For example, the participants gathered as group to make lesson plans during nine weeks. In this process, the researcher took part in

these meetings as observer. In addition, during of the science methods course, the researcher was one of assistants of this course. Therefore, there were several times to talk these participants to develop relationship and rapport with them.

In addition to prolonged engagement, another strategy is persistent observation to provide credibility. Persistent observation helps researchers to obtain in-depth understanding of phenomena (Lincoln & Guba, 1985). In this study, the researcher observed the group during nine weeks to reach accurate and in-depth picture of group work. Therefore, this strategy was used to support credibility of this study.

Triangulation which is another strategy was used to increase credibility (Merriam, 2009). Seven different instruments were used to collect data in this study. Therefore, usage of these all instruments provided wide range findings about case. This helped the researcher draw accurate conclusion.

Peer debriefing technique was used to assure credibility in stage of coding and finding themes. This technique refers to formal or informal discussion about the finding of the study (Lincoln & Guba, 1985). For this respect, the researcher worked with another researcher who was experienced in science education and qualitative studies to check whether codes and themes were appropriate with data. This provided more correct evaluation of finding from instruments.

Second criterion of trustworthiness in qualitative studies is transferability which is related to generalizability (external validity) in quantitative studies (Merriam, 2009). However, generalizability was not main focus in qualitative studies. In this study, participants were composed of only four individuals. Therefore, the result of this study could not be generalized to large population. However, in qualitative studies transferability is related that methodology or findings of current study is transferable to other research. Therefore, in order to make transferability, thick description of research process, especially methodology and findings were given in this study. For this reason, other researchers can use this kind of knowledge in their own studies.

Third criterion of trustworthiness is dependability which refers to reliability in quantitative research (Merriam, 2009). Because current study was done again to show reliability, it should be given by some approaches. For example, the researcher

prepared interview protocols in which questions were ordered specifically to move consistent progression in each participant concerning data collection. Moreover, the researcher worked with another researcher in data analysis process. Codes and themes found in this study were checked by the second researcher. Therefore, consistency was reached concerning this issue.

Last criterion of trustworthiness is confirmability which is associated with objectivity issue in quantitative research (Creswell, 2007). In this study, objectivity was provided by using direct quotation from answer of participants in conclusions the researcher draw. Therefore, it was showed that the conclusions were from the researcher bias. This can make contribution to confirmability of study.

3.9 The Role of the Researcher

A researcher's worldview, belief, theoretical orientation and experience might have negative influence on trustworthiness of the study (Miles & Huberman, 1994). Therefore, it is essential to explain the role of the researcher, and the researcher background in relation to science method course and collective efficacy in the current study.

The researcher of this study held a bachelor's degree in Elementary Science Education and have studied doctorate program in the same field. The researcher has participated in the national and international conferences about science education. The subject of this study which was collective efficacy was found by the researcher when searching literature. It was integrated into the science methods course which the researcher had assisted two times.

The researcher took precaution to prevent any thread or bias related to the process of data collection. For example, the researcher did not make active involvement in conducting science methods course not to influence behavior of participants of this study even though he was one of assistants of this course. Instead, the course instructor and other assistants of this course were responsible for implementation of this course. More explicitly, in theoretical part, the researcher never gave knowledge about teaching methods and performed sample microteaching related to these methods. In addition, in practical hours, the researcher did not give any feedback to selected group's microteachings as well. Instead, the other course assistant was asked to make comment. Moreover, regarding giving feedback about

lesson plans, the researcher worked with the other course assistant again. Firstly, these lesson plans were evaluated independently with the help of rubric of lesson plan which was formed at the beginning of semester. Then, they were compared and compromised through discussion on the differences. After making consensus, feedbacks were given to the participants as soon as possible by the other course assistant instead of the researcher since it was thought that giving negative feedback might damage rapport between the researcher and the participants. Therefore, participants would not talk interview comfortably, reflect their opinion easily, and give honest answers what was happening in group.

This rapport between the researcher and the participants was sustained in data collection process. For example, the researcher and the participants met many times for interview and observation during data collection process. In each interview times, the researcher asked each participant if there is problem about video recording or audio recording. After he received "no", he reminded again their identities were not stated anywhere in dissertation. During interview, the researcher tried to create warm atmosphere to be comfortable in answering questions honestly. In addition to interview, every week the researcher observed participants when they were preparing lesson plan related to teaching method they have just learned in that week. These group works were conducted in determined place and time. The researcher was involved in these meetings as a non-participant role to record the details of group work objectively and to avoid influencing group work to direct a specific way (Merriam, 2009). Therefore, he sat in a corner of the place not to disturb any of them. In other words, observation happened without manipulation as described by Whitehead (2005).

3.10 Ethical Issues

Prior to beginning of this semester, permission from Institutional Review Board related to ethical issue of METU was received. (Appendix H). After that, all student enrolled in the science methods course was informed about this study without explicitly stating purposes, data collection process, observation and interview part of this study. As a result, volunteered group in which all members agreed to take part in this study was chosen. Then, all participants were asked to read and sign consent form (Appendix I) at the beginning of the study. In this consent form, participants

were informed about content, aim and duration of the study. In addition, it was stated that responds, identity, records of these participants were kept confidentiality. Furthermore, the fact that no one did not damage from this study were added. All these stated above was expressed by the researcher one more time verbally before singing consent form to remove question mark concerning confidentiality in their mind, and get honest involvement in this study.

As course requirements, each group was asked to prepare lesson plans related to teaching method they have just learned in the theoretical part of the course, to make microteachings and write critique papers. As a result of these requirements, they were graded to determine final grades. In order to be ethical and objective, the grading of all assignments of selected group was made by another course assistant instead of the researcher.

CHAPTER IV

RESULTS

The aim of this study was to investigate collective efficacy of preservice science teachers in the science methods course, investigate the influence of sources of collective efficacy on group behavior, and to investigate the influence of collective efficacy on group performance and on self-efficacy of preservice science teachers during the science methods course. In the light of these purposes, research questions were formulated as below:

1) How do preservice science teachers describe "working in this group" in a semester-long science methods course?
2) How is preservice science teachers' collective efficacy developed in the science methods course?
3) How is preservice science teachers' collective efficacy changed over time in science methods course?
4) How do the sources of collective efficacy (mastery experience, vicarious experiences, verbal persuasion, and psychological and affective states) in the science methods course contribute to group behavior?
5) How does preservice science teachers' collective efficacy contribute to group performance in the science methods course?
6) How does preservice science teachers' collective efficacy contribute to self-efficacy of group member concerning science teaching in the science methods course?

The unit of analysis of this study was a group which was composed of four preservice science teachers in the science methods course. All of these preservice teachers were at sixth semester of science education program. These preservice science teachers were two males and two females. Their ages were between 21 and 24 and their GPA ranged from 1.86 to 3.46. Their teaching experience varied from

zero to two years. Moreover, all of them had group work at least once during science education program before they attended this group work. Some of them had positive attitude towards group work, whereas the others had negative attitude.

In explaining the results of this study, pseudonyms were used for these preservice science teachers to reflect their thoughts to readers. These pseudonyms were selected as Selin, Ceyda, Mehmet and Kemal. The results of this study were given in order of research questions stated above.

4.1. Research question 1

RQ1. How do preservice science teachers describe "working in this group" in a semester-long science methods course?

In order to elicit their description concerning group work that preservice science teacher experienced during science methods course, they were asked some questions. Moreover, their group work was observed by the researcher. In the analysis of these data which were obtained from these instruments, it was reached that they saw group work as "collaborative work". Under this definition, it was seen that they focused on five subtopics which are positive interdependence, group accountability, face-to-face interaction, psychological safety and group processing. These findings were discussed comprehensively below.

Collaborative Work

All group members declared that they did everything together for the requirements of the course instead of sharing the workload of the group to work individually and then, joining these individual parts to produce the group product. For example, concerning this issue, Kemal stated:

> *We did everything together. For example, we gathered on Friday to prepare the lesson plan. Firstly, we discussed the teaching method and tried to find topic of the lesson plan which fits characteristic of the teaching method. Then, we wrote objectives of the course. After that, we passed on to writing introduction of the lesson plan. We considered what the teacher could do in the introduction part. We wanted to attract the students' attention to the lesson. Therefore, we tried to find enjoyable activities or ask some questions….*

In addition to their responses, it was observed that they worked collaboratively. For example, they tried to participate in group work every week. Each member expressed their opinion easily about what they would do in the lesson

plan. Moreover, they discussed each opinion and they tried to reach a consensus by convincing the others about why their opinions were appropriate for lesson plans. Then, in the light of selected opinions, they prepared lesson plan together.

Furthermore, in order to understand how they studied clearly, they were asked to use a metaphor for their group working and explain why they chose it. They emphasized that their group work resembled "making honey", making cake", "ants' working" and "working of teachers in community". In these metaphors, it was observed that they prepared lesson plans by working collaboratively as well. Selin mentioned like that *"I want to liken us to bees. They make honey together. We tried to prepare lesson plans together as well. All of us tried to make contribution to each part of it"*. Ceyda's, Kemal's and Mehmet's words can be seen respectively below:

> *I liken us to a patisserie because all of us tried make a good lesson plan like four cooks working on a single cake. I saw a program on television in which the cooks made beautiful cakes. In the program according to the order, four cooks made cakes together which would be more beautiful than if they made their own. Therefore, I can liken our group work to work of these cooks.*
>
> *I think we like ants. We always worked by planning and programming everything as well. We tried to be successful. So, everybody knew their responsibility and was willing to make a contribution. No one acted carelessly. For example, no one said that they did not want to do any part. Everybody tried to make a contribution in every part of lesson plan as much as they could.*
>
> *We were like a community of teachers. Normally, inservice teachers come together and consider how they teach lesson to students. Even, they prepare common lesson plans and exams. This was what we did. We came together, researched, selected topic, gathered materials… In order words, we spent time together to prepare best lesson plans for students to learn. Obviously, we worked as like community…*

Under collaborative work, they focused on five subtopics in their responses which are positive interdependence, group accountability, face-to-face interaction, psychological safety and group processing.

Positive Interdependence

All of the group members stated that they depended on each other when they met the requirement of the course. Concerning this course, new science teaching methods were explained each week and it was asked to prepare lesson plans related to these teaching methods. Moreover, in some weeks, based on their lesson plans,

they performed microteachings. Since they have just learned these teaching methods, they had difficulty in preparing lesson plans efficiently. Therefore, it was observed that there was a tension in the group every week to develop lesson plans which would fit the norms and knowledge given in theoretical part of lesson and in the microteaching of assistants of this course. Because of this tension, they began each group work by asking some questions to each other to ensure understanding of the teaching methods. Moreover, it was seen that they cared about each other's thoughts to make decision about preparing lesson plans such as choosing topic of lesson plan. Therefore, they asked some questions like "What do you think of…," "Do you agree…" to reach consensus on their decisions. These signs showed that they needed each other to prepare lesson plans. Positive interdependence can be seen in Kemal's following sentences:

> *In the meetings, instead of using one person's ideas and proceeding with them, we talked on each idea and we tried to reach a common idea. For example, when we prepared lesson plan for role playing, we discussed topics of the lesson plan. Finally, we made decision on the topic of states of matter. Then, everybody added something about this lesson plan. For example, Mehmet suggested that the teacher should divide class into three sections representing solid, liquid and gas; Ceyda suggested that as warm-up activity, the teacher should use music. After we evaluated these suggestions, we used them in the lesson plan. This was how we proceeded with lesson plans by adding bit by bit.*

Similarly, Ceyda stated that every member in the group was important to make proper lesson plan. Ceyda expressed:

> *We always acted together. As I said before, we always gathered to make lesson plans. We arranged work time according to our free time. If anything came up for one of us in the last minutes, we rescheduled. Everybody was aware of their responsibilities. Nobody tried to avoid coming to the meetings. Therefore, we tried to make contributions to lesson plan. In the end, we produced very good lesson plans.*

In addition to personal statement of all group members, positive interdependence can be seen in the preparation of the lesson plans. For example, when they gathered to make lesson plans, they discussed views about parts of that lesson plan to choose the most appropriate one for the teaching method. Such a situation above was exemplified in observation records as follows:

(The following conversation took placed in the preparing of the lesson plan for 5E instructional model. They had made the decision about topic which was electric circuit. Then, they were talking about how they capture the attention of students or create curiosity in classroom in the engage part of 5E instructional model.)

...

Selin: What do we do to capture students' attention?
Kemal: We can use a picture.
Selin: What shall we show in the picture?
Mehmet: Picture of Tesla can be interesting.
Selin: Lets' look at it. (They were looking at picture from internet)
Ceyda: Aaa. Our topic is electric circuit, connection of bulb. We are not interested in electric. So, the picture we will select should be related to electric circuit.
Selin: That is true.
Mehmet: We can show a video such as a video related to the principle of functioning of generator.
Ceyda: It is not appropriate for our topic.
Mehmet: I get it. It should be related to electric circuit.
Selin: We can use role playing to capture students' attention. We can post a paper on students like bulb, battery, and wire etc. then, we can ask students to build a serial circuit. What do you think of that?
Ceyda: Yes, we can use it.
Mehmet: Okey, it is good.
Kemal: This does not only help us capture students' attention but it will also measure their prior knowledge.
Selin: Okey then, let's do it.

...

Group Accountability

In the beginning of this course, it was stated that they were evaluated as a group for the products they created during the course. In other words, there was not individual evaluation. Therefore, in the group work, it was observed that each member took their responsibility for the requirements of this course. For example, everybody attended in meetings regularly. All of them tried to take part and make contribution in each part of lesson plan. This situation was described by Mehmet in the following:

I was working in a job to earn money. So, first two weeks, I did not attend group meetings very often because meeting time was not suitable for me. I thought that I did not fulfill my responsibility. To gather and be included in the preparation of lesson plans, I changed take off days. Since then, I took part in all the meetings.

Similarly, Ceyda stated that her responsibility was developed thanks to this group work, and in order to contribute to group work, they come to the meetings by getting prepared individually. As Ceyda said as follows:

> *I worked a lot because the lesson plans we prepared would everybody's grade. This situation developed my sense of responsibility. For example, before coming to meeting, I was thinking of three things: what characteristic features of the teaching method are, what the topic of our lesson plan should be, and what kind activities we can use.*

Face-to-face Interaction

The group was asked to prepare lesson plans related to teaching method they have learned in the theoretical part of the course. Within this scope, all group members in this group came together to prepare lesson plans every week. These meetings were held in silence and in the same environment. In these meetings, they were seated in two lines which were opposite to each other. This led to an increased interaction between group members. It was seen that this helped them exchange, discuss and evaluate opinions about the lesson plans easily. In addition, all of group member agreed that they were involved in face to-face interaction to create lesson plan. For example, Mehmet mentioned below:

> *...In the meetings, we tried to use different activities in lesson plans to capture the attention of students. For this purpose, we searched possible activities from internet individually. Then, we discussed them in detail when we gathered. After that, we chose the most appropriate one and tried to develop this idea together. For example, we chose the topic of state of matter after long discussion for role playing lesson plan. This idea belonged to Ceyda. Ceyda also said how role playing would be conducted in the classroom. I said to everyone that we could not do it like Ceyda's suggestion. I drew on a paper to explain how role playing should be. For this, I suggested that we should divide class into three sections: solid, liquid and gas and students should act according to the section they located. My speech convinced the other group members, and they said that let's do it in the way you told us.*

Moreover, thanks to face to face interaction, they helped each other to understand missing points about teaching method. Concerning this issue, Kemal expressed:

> *I learned the teaching methods effectively in group work because sometimes I missed the course, and sometimes I did not understand them in the course. In the meetings, I asked missing points to my friends. They explained to me, and I understood better how we should integrate the teaching method into the*

lesson plan. If these lesson plans were prepared individually, there would be more missing points in my mind. This would be reflected on lesson plans. Thanks to group work, I learned not only the teaching methods but also implementation of these teaching methods; therefore, I tried to correct my deficiencies.

Psychological Safety

It was seen that they worked together in a psychologically comfortable environment which makes it easy to express their ideas to each other. In the group work, there is no hesitation about declaring their ideas. For example, they asked one another easily about what they did not understand about the lesson plan or the teaching method. They shared their opinions about what would be done in lesson plan. For example, Mehmet expressed himself about psychological safety like that: "*We communicated each other comfortably. There is no hesitation about that. I could share my ideas easily in the group work. Also, I have learned to listen to the other people, and respect their opinions…".*

Apart from other group members, Selin approached psychological safety from different perspective. She stated that their friendship was helpful to create a comfortable environment to express ideas easily. Concerning this issue, Selin indicated below:

First several weeks, some friends came late in group work. I warned them about lateness. They were disappointment in the beginning about my attitude, but they forgot about it after a while. They were involved in the group work. They continued to express ideas about what we should be done because we were close friends, and we have known each other for a long time. If I worked in another group, maybe, they would be offended me. This would have a negative influence on the group work. Maybe I would not want to participate in the group work.

Group Processing

In the group work, it was observed that the group members worked in processing system, which consists of "accumulation", "interaction", "examination", and "accommodation" phases. In phase of accumulation, they acquired knowledge about what would be done for their lesson plans. Especially, it was seen that they searched mostly to find a topic for their own lesson plans or activities related to teaching methods from the internet. They did this research individually before coming to group meeting. Moreover, they continued this research during group work

when they could not reach the final decision about what would be done. Then, after acquiring the necessary knowledge, it was observed interaction among the group members to share their findings in these meetings. In this phase, they exchanged their ideas and opinions to establish a ground for examination. While exchanging ideas, the group members examined each idea by interpreting them in terms of strength or weakness considering the theoretical foundation for each teaching method. For this purpose, they highlighted the important points of the teaching methods and formed arguments to support their ideas. Therefore, they tried to negotiate in order to reach a common idea. After they made decision on common idea, this idea was developed by integrating new points raised by other group members. Based on observation records, these phases can be clearly seen in the discussion of the group members when preparing of the lesson plans below.

Accumulation: They acquired the necessary knowledge for the preparation of the lesson plans.

(The following conversation took place in the preparation of lesson plan for demonstration method. They tried to find an appropriate activity.)

...

Selin: I found experiment about "sound" but I was uncertain whether this is an appropriate example for demonstration.
(Selin showed a book which includes this experiment)
Mehmet: Okey, we can use it.
Selin: Yes, we can use it, but do students easily predict the result of the experiment?
Mehmet: We teach science to middle school students. They do not predict it easily. In which grade can this activity be used?
Kemal: 6^{th} grade in curriculum.
Ceyda: I have found another activity as well. We can demonstrate the color change of potato using the reaction between starch and iodine solution. Then, we can show that lemon juice is added, it turns into its original color.
Selin: (She examined it from the curriculum) it is out of curriculum. Students are not expected to know that starch gets into reaction with iodine.

...

Interaction: They exchanged their opinion with each other regarding what they would do in the lesson plans.

(The following conversation took place in the preparation of lesson plan for the method of project-based learning. They tried to exchange ideas about the formation of group in teaching procedure.)

...

Ceyda: We will ask students to form group
Selin: How many people will you want these groups to be?
Ceyda: For example if the classroom has 20 people, there will be four or five people in a group.
Selin: I think that there should be no more than four people in a group.
Mehmet: Let's form group randomly. In other words, students should not form groups with students sitting next to them.
Kemal: Students should be not allowed to choose their group members. Instead, let's have the teacher select group members in these groups.
Selin: Let's make the groups heterogeneous so that all hardworking students do not gather in the same groups. Also, these groups should be heterogeneous in terms of gender.

...

Examination: They discussed each idea by emphasizing strength and weakness to select the most appropriate one for lesson plan.

(The following conversation took place in the preparation of lesson plan based on argumentation. They found some concept cartoons which include several information about the science topics, and they examined these cartoons whether they were suitable for constructing complex argument. For this purpose, they paid attention that the cartoon they would select was helpful for students to form "rebuttal" which means extraordinary or exceptional conditions when the claim in the argument is not true.)

...

Ceyda: I found another cartoon which is related to "the rotation of Earth".
Selin: I think this is better one and students can use "rebuttal"
Ceyda: What is "rebuttal"?
Selin: (She explained it by showing a plastic bottle) opening of this bottle is closed. But there is a hole on its surface. Water does not flow because there is a difference between internal pressure and external pressure. This prevents the flow of water. I say that if I squeeze this bottle, water will flow. Do you understand? There is an exceptional event. By saying this, I complement my argument.
Kemal: Do the rebuttals have to be in every situation? For example, what if this bottle is made of glass, you cannot say this.
Selin: Okey, then you say that because this bottle cannot be squeezed, this event cannot happen.
Kemal: That's why, the example of Ceyda is not suitable for this.
Selin: That's true. It looks like factual knowledge.
Mehmet: In this example, do you think that students discuss like that?
Ceyda: it will end quickly.
Selin: Okey, then let's continue with cartoon about skiing.

...

Accommodation: A selected idea was developed by integrating the group members' thoughts on it. Then, they decided about how to implement this in the lesson plan.

(The following conversation took place in the preparation of the lesson plan for field trip. They specified the topic of the lesson plan which is "Level of organization in ecosystem". They were expressing their ideas about how lesson should be conducted.)

...

Ceyda: The teacher explains concepts of living things or nonliving things, species, population, and ecosystem in the classroom. Then, he/she distributes worksheets to the students. On the worksheet they are expected to write the examples of living things, nonliving things etc. in the garden of the school. Therefore, he/she takes students to the garden of the school.
Selin: The teacher leaves student free. Students firstly discover the garden by themselves. They fill the worksheet about example of concept above. Then, they come together and talk about what they found.
Ceyda: Yes. The teacher can create discussion environment. Students should say their findings with reasons.
Selin: Then, they should tour [the garden] one more time with the teacher. The teacher should say that these are violet or these are population because…
Mehmet: He/she checks the missing parts of their understanding, doesn't he/she?
Selin: Yes.
Mehmet: I think that the teacher should not leave them free. You said that the teacher should leave student free. I think the teacher should give direction to students to manage the class.
Kemal: Students should learn by themselves. They should try to find the examples of these concepts at the beginning.
Mehmet: Okey, it makes sense but it will be hard to manage students.
Ceyda: Okey, then the teacher should firstly specify the pathway of the tour. So, management does not pose any problem.
Selin: Yes. The teacher should give a direction at the beginning. For example, "you will start from the right side of the garden, draw a circle, and then you come this point. When you come there, the tour is finished and everybody will sit down"
Ceyda: Yes. The teacher can give a direction like this.
Mehmet: Okey, then.
Kemal: It seems fine.
Ceyda: Okey, let's do it like that.
Selin: Okey.

...

4.2. Research question 2

RQ2. How is preservice science teachers' collective efficacy developed in the science methods course?

In order to understand whether collective efficacy was developed in this group, they were asked to describe opinion about group work and group itself. In the analysis, it was seen that they develop the belief about group abilities for preparing lesson plan. Moreover, it was found that the four subdimensions which are "collaborative work", "shared purpose", "attitude towards the group work", and "group cohesion" had important influence on the formation of that belief. These all findings were discussed comprehensively below.

Belief about Group Abilities for Preparing Lesson Plan

They were asked whether they rely on their group about getting prepared for effective lesson plans which are appropriate for the rubric mentioned before. This question was asked three times in the fifth, eighth, and the end of semester.

Until fifth week, the researcher observed the group work of three lesson plans for demonstration, 5E learning cycle and argumentation by participating in these meeting during the semester. In these meetings, in order to prepare their own lesson plans, the group members discussed about what they would do in the lesson plans. They tried to make common decisions. However, while doing this, it was seen that some members preferred to ask some questions to the researcher to get approval about the lesson plans. For example, they asked questions such as "teacher, what do you think about…", "Is what we are doing true". In addition, it was observed that there was tension in the meetings since they did not know what to do clearly. This situation showed that they did not have enough belief as a group about making lesson plans. However, according to the interview, they stated that they had belief as a group concerning the preparation of the lesson plans. For example, Selin stated that even though they believed in own their group regarding preparing lesson plan, they were hesitant about making decision because they did not adapt themselves to preparing lesson plans in the first weeks. In the following, Selin's words can be seen:

> *I believe we can prepare lesson plan. In the first week, we did not know what we should do. We could not adapt. This week we have prepared lesson plan*

faster than first week, and we tried to fix common mistakes with feedback. Therefore, I believe we can make effective lesson plans in the future.

Under this belief in their group for preparing lesson plan, the group members reported that there were some factors which contribute to formation of this belief. These factors were "collaborative work", "shared purpose", "attitude towards to the group", and "group cohesion".

Collaborative Work

During group work, it was observed that they acted in unison. More specifically, they made all decisions about what could be done together. Instead of the sharing parts of the lesson plans, preparing each part individually and joining them together and finally they prepared their lesson plans together. This was confirmed by each group member's statement that "we did everything together". The following was response of Mehmet:

After the class on Thursday, everybody made an individual investigation about the lesson plan. For example, we searched the possible topic of the lesson plan. After that, we gathered on Friday morning. We brainstormed ideas. I think these ideas were more beneficial. In the light of these ideas, we almost prepared the teaching procedure of the lesson plans together in which SPS and NOS aspects were integrated. To a large extent, the flow of lesson was arranged. Sometimes, there would be missing parts of the lesson plans, we gathered again on Monday to complete them.

Shared Purpose

The group members were asked about the purpose of the group in preparing lesson plans. It was seen that they gave nearly same answer. All of them expressed that their purpose was to learn teaching methods efficiently and reflect these teaching methods in their lesson plans appropriately. They added that as a group, they worked in the light of this purpose during this course. This situation can be exemplified through Kemal's statement below:

Actually, our purpose has not changed since the beginning of the group work. It was to prepare lesson plans in the best way according to the characteristics of the teaching methods. We followed this purpose from the first week to the last week. For example, we get zero point from the assessment part of the first two lesson plans. This was important deficiency for us. So, we tried to fix this deficiency. After we understood how we could do it, we got full scores from this part in the following lesson plans.

Attitude towards Group Work

All group members explained that they benefited from the group work. For example, they all expressed that they helped each other to understand the characteristics of the teaching methods, and integration of them into the lesson plans. Besides, Kemal mentioned that thanks to the group work, they used the creative and efficient activities he had never seen in the lesson plans before. He added that he may implement these kinds of activities in his future teaching. Kemal favored group work as follows:

> *…When we gathered in the meetings, I asked my friends what I did not understand. They helped me not only understand these teaching methods but also implement them in the lesson plans. In addition, thanks to my group mates, I could see different and creative activities for the lesson plans. In terms of that, I found group work as effective. For example, we designed a lesson for laboratory work, and we chose global warming as a topic. Ceyda suggested an experiment related to global warming. Although I knew the reasons of global warming, and possible consequences of it on environment theoretically, I never saw an experiment or activity of global warming. We conducted this experiment whether this worked or not before when we prepared the lesson plan. We could observe the effect of carbon dioxide on the rising temperature clearly in laboratory environment. If I made this lesson plan alone, probably I would choose the one of the classical example of experiments in chemistry or physics. Thanks to group work, we used different idea, and different activity. Also, I believed that I would use this experiment in my real classroom when I become inservice teacher. Considering these positive aspects, I think group work was beneficial.*

In addition to learning gain, all of the group members stated that they benefited from this group work in terms of interaction. Concerning interaction, they stated that although they knew each other and were friends, they improved communication and developed better relationship among them. This idea was supported by Ceyda's statement below:

> *I saw that we built closer relationships with each other. This group work added another dimension to our friendships. Normally, we spent little time together within a week. With this group work, we met frequently. We chatted and prepared lesson plans at the same time…*

Moreover, they expressed that they develop their sense of responsibility. Based on this, they participated the group work regularly, and they worked harder. Kemal indicated this through his words:

My sense of responsibility was developed. Normally, I usually make my assignment on the day before the deadlines. I do not care much, but in this group work, I had to consider others because we all were responsible for preparing lesson plan. Therefore, we did not put off completing lesson plan to the day before the deadline. We tried to finish early.

Furthermore, all of the group members stated that they developed critical thinking skill thanks to group work because everybody came up with different ideas in their group meetings. They also narrated that these ideas broadened their horizon; therefore, they learned to look at things from different perspective. Concerning this situation, Mehmet expressed:

Forming creative and different ideas help us think critically. I think we as a group developed critical thinking because we produced creative ideas, and we tried to improve these ideas by discussion. For example, we decided to teach the concept of ecosystem in the lesson plan for fieldtrip method. Instead of explaining only living things such as trees and plants in this lesson plan, we considered that we should add nonliving things as well because they have mission providing shelter for living things in ecosystem.

So far, the attitude of group members has examined into three categories. In addition, some direct questions were asked to reveal the attitude of the group members to the group work. For example, they were asked whether they could have preferred working in a group again or working independently if there had not been an obligation for them to work in a group during this course. All of the group members expressed that they would choose group work instead of working independently because preparing lesson plans was complex task to handle, and they gained more from the group work with respect to learning. For instance, Selin explained her views as follows:

Working with a group and working alone have cons and pros. If I weigh these cons and pros, group work is more logical for preparing lesson plans because if I studied alone, my mind would go blank. In other words, I would not produce different ideas, develop my creativity. Instead, in the group work, group mates helped me when I was confused. Also, workload was reduced by the group work…

Finally, it was asked to describe their attitude towards the group work in this course. Ceyda and Kemal mentioned that they had positive attitudes towards this group work because they gained in learning. For example, Kemal expressed himself below:

I think my attitude towards group work is positive because here I am learning teaching methods effectively. Sometimes, I missed the lessons, and I did not understand major concepts covered in the lesson. I asked my group friends to explain these points I did not understand. When they explained to me, I understood them very well. If I worked individually and missed some lesson, I would not understand the teaching methods or integration of them in the lesson plans. This would reflect on my lesson plan so, I would get low grade.

Mehmet said that his attitude was neutral. It was added that although there were benefits on learning, some problems related to communication in the group work took placed. Mehmet's word about this situation was given in the following:

My attitude was neutral because in my opinion, there were pros and cons of this group work. In terms of learning, group work was great. We said let's prepare lesson plans, and succeed in them because we will become teachers. So, learning was so effective. I never forgot the teaching methods I learned in this semester but we faced some problems as well. For example, in the last three or four lesson plans, Selin tried to make change without asking us. She made decision by herself. This event created a tension in our group which affected our relationship with her. Maybe she had personal problem. She should not reflect this to the group…

Selin declared that her attitude was placed between positive and neural because of pros and cons of the group work they did in this course. This situation can be seen clearly in Selin's statement as follows:

It is between positive and neutral because I am not accustomed to the group work. I expect my group mates to be like me. For example, I wanted to prepare lesson plans with meticulous care in this group work. But, they were not more meticulous than me. This created some problem in the group. I had to have a talk with them about this. On the other hand, there are positive sides of this group work was: sharing ideas, my group friends' telling things that I could not think, reducing workload etc.

Group Cohesion

The group members were asked if they could have worked just like they did in this group if they had worked in a group formed by the assistant of this course. They stated that it would have been hard to work with another group since capturing harmony like this group is difficult. More specifically, Ceyda and Selin stated that they may have worked with other group work; however, working with harmony depends on other people in the group. For instance, Selin explained this situation below:

I am not sure. If there had been different people who I did not communicate very well in the group, maybe we would have had difficulty in working at the

beginning since we would not know each other. We would try to get to know each other during the preparation of four or five lesson plans. Maybe, we would have trouble in arranging common time for studying together, or we would not be flexible in some topics. In this group work, we did not face big problem about these topics. For example, lateness took place in the beginning, and this was discussed since everybody's time was precious. We could not start group work with two people. When we warned them, maybe they were disappointed in the beginning. They forgot about it after a while. They were involved in group work. They continued to express their ideas about what to do because we were close friends, we have known each other for a long time. If I had worked in another group, maybe, they would have been offended by me. This would have made negative influence in group work. Maybe I would not have wanted to go to the group work.

Kemal declared that they would not work with another group because he thought that group work with other people would not be same as this group work in terms of working style. He was sure that if he had worked in another group, they would have shared workload to work individually; therefore, he believed that group work with other people would have been ineffective. As Kemal narrated below:

I probably would not have worked. I would have preferred to work alone rather than work with another group. Since I would not spend much time with them (other students in the classroom), we would have finished the preparation of the lesson plans by sharing parts of them. Or, I would not have been effective because I would not have thought I could have been in harmony with them. Since I saw the contribution of the current group mates to me in this group work, and I was in harmony with them, I found the group work more effective.

Mehmet had the same thoughts as Kemal. He mentioned that he would not work with another group. Differently, he showed a reason from his past experience.

I would not want it (working in another group) since some people are irresponsible. Irresponsibility is something really bad. Last year in another course, my group got dispersed because the one of group mate did not attend any meetings. We had to pass to other groups. I tried to be harmonious with another group, but I could not do it. I do not want to experience the same thing. So, I would not want to work in another group since it is difficult when the other people in the group do not show desire like you. Everybody has to be willing to do something. In this group, we all wanted to prepare successful lesson plans, and we worked hard for this.

4.3. Research question 3

RQ3. How is preservice science teachers' collective efficacy changed in the science methods course?

In the previous research question, it was found that after the first three lesson plans, the group developed the belief about group ability for preparing lesson plan which referred to collective efficacy regarding preparing lesson plans.

In order to examine how this collective efficacy changed over time in the course for the third research question, the group members were asked twice after second three lesson plans and last three lesson plans. More specifically, they were questioned whether they believed their group about preparing effective lesson plans and were expected to compare themselves in terms of this belief between their previous state and present state.

After they prepared the second three lesson plans related to field trip, project-based learning and problem-based learning until the eighth week, All of the group members declared that they still believed their group for preparing lesson plans, and this belief got improved. Moreover, it was observed that they got used to group work and being group. They tried harder in order to prepare more appropriate lesson plans than the first their lesson plans they prepared before. For example, Selin made the following explanation at this week:

> *I think the group has developed self-confidence because we, as a group, made effort to prepare lesson plans and then, we got good results in the last three lesson plans. When we saw that we can do it, and we can succeed in it, our belief for the group got improved. So, I believe we can write better lesson plans now.*

Although Ceyda and Mehmet made explanation similar to Selin, Kemal said that he believed more his group when compared to other groups in this course. Kemal expressed his views:

> *In the first interview, I said that I believed in my group but I had little hesitation in my mind. Now this belief was improved because I scrutinized other group lesson plans and their grades. When I compared them and us, I saw that we were more successful. So, I believe more in my group about getting prepared lesson plans.*

At the end of the semester, they were asked again whether they believe their group about preparing effective lesson plans. All of the group members mentioned

that they believed their group concerning preparing lesson plans. For example, Mehmet explained as follows:

> *I believe we can prepare good lesson plans because we figured out how to prepare a lesson plan. For example, in the first two lesson plans, we got 10.75, and 10 points out of 14, respectively. This created tension. When we examined these lesson plans, there was problem in closure and assessment parts of them. I said that we did not make these parts, and we had to sort them out. We focused on them, and we understood how closure and assessment parts should be made. Then, we got 13.25 points from the following lesson plan. After that, our belief to the group improved. We tried to keep this success in other lesson plans. Although we made some mistakes last lesson plans, and our scores decreased a little, I still believe my group about preparing effective lesson plan.*

When they were asked to compare their group's situation in the previous three weeks with their current situation, Ceyda and Mehmet stated that their belief about their group for preparing lesson plan was enhanced. For example, Ceyda expressed herself in the following sentences:

> *My belief to the group was enhanced. When I experienced the preparation of the lesson plans, this belief was improved because we tried to prepare better lesson plan than the previous ones. We got positive feedback from the assistants continuously. Also, we have never heard negative comments from other groups in class as we presented our lesson plan as microteaching to them. When all are considered, my belief about the group for preparing lesson plan was improved.*

Kemal said that they keep his belief constant even if the group faced some problems. Kemal narrated this situation as follows:

> *The behavior of Selin created a problem during one and a half week. She was making some correction on lesson plan without informing us. I thought that we should not have formed the group in the beginning. But, when we understood the reason of the problem, this thought disappeared. We realized that she did not act intentionally. We continued to work as group. So, I still believe in my group. If we did not believe, we would not continue as a group, and prepare good lesson plans. We would reflect our dissatisfaction to our teacher or assistant. Since we believed in our group, we continued until the end.*

Selin expressed that although her confidence decreased slightly due to occurrence of some problems, she still believed in her group about preparing lesson plan. Selin declared:

> *After the second three lesson plans, I do believe more in my group. Maybe, now this belief weakens since we could not prepare the last three lesson plans*

in an effective way. But, maybe we got bored, or the preparation of these lesson plans may have clashed with the exams. Even, weather may have affected our performance. But I still believe we can prepare good lesson plans as a group.

4.4. Research question 4

RQ4. How do the sources of collective efficacy (mastery experience, vicarious experiences, verbal persuasion, and psychological and affective states) in the science methods course contribute to group behavior?

In the second research question, it was found that the group members develop collective efficacy about preparing lesson plan. According to Bandura (1997), there were sources of collective efficacy. therefore, Then, in order to understand sources of collective efficacy on this group behavior, questions related to mastery experience, verbal persuasion, vicarious experience, and psychological and affective state were asked. In the analysis, results can be examined in four main categories below.

Influence of Mastery Experiences

During the science methods course, the group was asked to prepare lesson plans related to teaching methods covered in the theoretical part of the course. As a result, they tried to work to prepare lesson plans every week and they prepared nine lesson plans in total during this course. Therefore, it was asked how their experiences about preparing lesson plan every week influence their next work and their next lesson plan preparation. In order to understand this influence, the group members firstly were asked how successful lesson plan experiences influenced their next work. Then, they were asked how unsuccessful lesson plan experiences influenced their next work. In the following, the examination of these questions was presented:

Influence of Successful Lesson Plan Experiences

At the end of the semester, in order to evaluate the influence of successful experience on their next work or their next lesson plan preparation, firstly the group members were asked to express one successful group experience about lesson plan preparation during the science methods course. Ceyda, Mehmet and Kemal stated that they found fieldtrip lessons plan experience successful. As a reason, they declared that they worked harder in the preparation of this lesson plan, and considered every detail of lesson plans. For example, Mehmet explained his experience in the following:

I found fieldtrip lesson plan preparation successful because we would make microteaching related to it. We sat and thought what we could do. We said let's take students to the science museum. We went there, and talked with officials but there is no time in their schedule. We got disappointed. Then, we thought about what we could do this, again. Another alternative did not come to our mind except for taking students to the school garden. Immediately, we thought what we can do in the school garden. We decided to teach the subject of ecosystem. We wanted to write this lesson plan beautifully. We prepared it to smallest detail. For example, we put first aid kit in the lesson plan if students get hurt. Ideas like that began to be formulated in the group work. There was very nice environment, and everybody in the group was sharing their ideas. We only tried to make the lesson plan perfect…

Selin expressed that lesson plans related to fieldtrip and project based learning were successful experience for her group because they got highest score from these lesson plans and they worked on them a lot to make better lesson plans. Selin expressed herself below:

We got 13.5 out of 14 on both the fieldtrip and project based learning lesson plans. I think they were the most successful lesson plans. We really thought a lot. For example, we thought where we can go for fieldtrip. In the end, we decided to do fieldtrip in the school garden because we did not have any choice but we saw that in that garden, different and beautiful things can be done with students. Ceyda performed beautiful microteaching of it too. In project based learning lesson plan, we did not perform microteaching, but we thought in detail when we were preparing the lesson plan.

After expressing their successful experience, they were individually asked to describe their feelings about this experience as a group. All of the group members declared they felt happy, and this kind of experience gave the group confidence. In addition, they implicitly mentioned that they improved the belief to the group about preparing following lesson plans. For instance, Selin indicated her opinion as follows.

We were happy because we got reward in exchange for working a lot. We thought that we could do this, and we continued this success. Everybody in the group thought like that. Kemal and Mehmet normally were pessimistic. They said we could not make this preparation of lesson plan. After this success, they said we could do it. This provided positive enforcement for us to prepare the following lesson plans. We promised each other that as a group, we would make the best, and be successful at the following lesson plans.

Similarly, Kemal made parallel explanation above; however, he stated explicitly this kind of experience made the group feel confident. As Kemal narrated:

We saw that we could do preparing lesson plan, and we were good at this. As a group, we felt more self-confident. We were conscious of this in preparing next lesson plans, and we wanted to develop ourselves on the preparations of lesson plans based on other teaching methods. So, these (successes) were good for us and give us confidence.

After that, it was asked how this experience influenced the preparation of the lesson plans for the following weeks. All of the group members declared that they wanted to keep this success; therefore, they tried to work very hard on the following lesson plans. For example, this situation was seen in Kemal's sentences below:

We wanted to achieve the same success in other lesson we would prepare. So, if we had shortcomings in the previous lesson plans, we tried to remove them. We wanted to make much better lesson plans. We tried to improve them. Also, we did not want to proceed at the same speed. We strived to make a much better one every time.

In conclusion, all of the group members stated this kind of successful experience caused them to feel more successful. This feeling helped them gain more confidence, motivate them to keep their success, and make much better lesson plans.

Influence of Unsuccessful Lesson Plan Experience

In order to examine the role of unsuccessful experience of the group on the following lesson plan preparations, same process was used. Firstly, the group members were asked to pick one unsuccessful group experience about the preparation of the lesson plans. All of the group members stated that they were unsuccessful at 5E learning cycle lesson plan because they did not prepare lesson plan according to the feedback from the course assistant. For example, Mehmet explained his experience as follows:

I can say we were unsuccessful at 5E learning cycle lesson plan since we did not follow feedback. Therefore, we got zero point from closure and assessment parts of the lesson plan in the second week. It was awful situation for our group. We said that we cannot keep doing like this…

After that, they were asked to describe feeling of the group after gaining this experience. Kemal and Ceyda stated that they felt sad as a group after this experience. Moreover, Selin expressed that although there is sadness in group, this experience helped them to get enthusiasm to make better lesson plan. Selin's sentences were provided below:

We were angry at ourselves. When we examined the lesson plan again, we saw that we did not do anything in closure and assessment parts of this lesson

plan. We wrote only one sentence for these parts. We were sad since we did not get reward in exchange for effort, but when we saw deficiencies, we got enthusiasm to make it better by removing these deficiencies.

Mehmet claimed that this sadness had no effect on group work. Instead, they got ambitious to make better lesson plans. He said: "*We got ambitious. There was no sadness. We thought how we made these mistakes. We said that we had to fix this. We tried very hard to make better lesson".*

Finally, they were asked to explain how this experience influenced their preparation of lesson plan for the following weeks. All of the group members indicated that this experience made them push themselves more for preparing better lesson plans. For example, Ceyda stated:

This made us sad but we did not say we could not do preparing lesson plan. On the contrary, we said that we should make it better and we should push it. We acted like that. We got highest points from the next lesson plans. This shows that we developed ourselves and we removed our deficiencies.

In conclusion, all of the group members stated that although they felt unsuccessful or sad with this kind of experience, they got more ambitious to make better lesson plan by working hard and overcoming their deficiencies.

Influence of Vicarious Experiences

In the science methods course, every week the professor of the course gave the theoretical information related to teaching methods in one hour. Then, the course assistants performed microteaching using these teaching methods in the classroom. Based on their observation, the group was asked to prepare lesson plans. After they prepared the lesson plans, they were expected to do microteaching using their lesson plans. In addition, they observed other groups' microteachings of their lesson plans. Therefore, the group was asked whether they considered the professor's lecture, other groups' and course assistants' microteachings as a model during preparing their own lesson plans. These three categories were examined in detail below.

Influence of Other Groups' Microteachings

The group was asked three times whether they took other groups' microteaching as a model on preparation of their own lesson plans. They gave written answer to this question as a group at the sixth, ninth and fourteenth week of the semester in the critique papers.

At the sixth week, they stated that they liked some features of other groups' microteaching, and they tried to implement them in their own following lesson plans. This situation can be seen in following sentences:

> *….Betul [member of one of other groups] had used pictures in her group's microteaching to engage students' attention and we used this engagement strategy for our lesson plans because we realized that picture really create curiosity and attract student attentions…*

At the ninth week, they mentioned that after they observed two strategies, namely "taking notes" and "encouragement of students" in other groups' microteachings, they took model of them in their own lesson plans. They expressed:

> *When we observed other groups' microteachings, we realized that they tried to do their best and they cared about their performances. For example, Fatma [the member of another group] did a quite good microteaching. Firstly, she showed a picture. Then, she asked some question about the picture, and she wrote students' answers to the board. We think this was a good strategy to make sure students not forget these answers for the following activity. Moreover, she encouraged students to support their idea by asking questions. As a group we thought that teachers should encourage their students so that students' participation to the lesson would be increased. Therefore, we decided to apply these two strategies to our lesson plans and microteachings.*

At the fourteenth week, they explained that they liked the creativity of other groups, and they tried to think a more creative way when they were preparing lesson plans. This situation can be clear in the quoted answer below:

> *We especially liked other groups' creativity. For example, Elif [the member of another group] did fascinating microteaching because they taught digestive system in a more concrete way by role playing. Moreover, Ozlem [the member of another group] joined laboratory work and problem-based learning method in her microteaching. Here, she used more different materials, and she created curiosity among us. As a group, we really wanted to do microteaching like those. So, we adopted the important parts of other groups' microteachings that we liked into our own lesson plans.*

In addition to these group answers above, at the end of semester, all of the group members were asked individually whether they took other groups' microteachings as a model on the preparations of their following lesson plans. Selin and Ceyda stated that they admired other groups' creativity, and they got more motivated to make much better lesson plans in terms of creativity. Concerning this situation, Ceyda narrated as follows:

Ceyda: For example, a group taught digestive system using role playing. We liked it very much, and we enjoyed it. Also, this microteaching affects us positively. We said that we should prepare nice lesson plan just like that. So, we tried to find more creative, enjoyable activities.
The researcher: Did you take these [the other groups' microteachings] as a model?
Ceyda: We can say we took these as a model. We already tried to do our best every time. In other words, we wanted to make more successful lesson plans. When we saw such performances of the other groups, we became more enthusiastic. We thought we should prepare creative and enjoyable lesson plans just like them.

Both Mehmet and Kemal said that they used the successful parts of the other groups' microteachings in their own lesson plans, and they did not repeat the same mistakes that the other groups made in their lesson plans. For example, Mehmet expressed his view as:

We thought microteaching as a reflection of the lesson plan. We were talking to each other that we can use activities they used, and the aspects we liked. For example, Fatma, who is the member of other group, tried to make students think by asking various questions. We integrated questions like those in our next lesson plan. If we did not like some aspects in these microteachings, we would not use them in our lesson plans by discussing with each other.

In conclusion, they (as a group or individually) declared they took other groups' microteachings as a model when they were preparing their following lesson plans. To put it more specifically, they mentioned that while they did not make the same mistakes the other groups did, they integrated the important parts of these microteachings in their own lesson plans.

Influence of Professor's Lecture

Every week the professor of the course gave information related to teaching method in one hour during the semester. In addition, activities related to the teaching methods were shown. In the group work, it was observed that this knowledge was beneficial, and they took what the professor said as a model. For example, the professor's suggestions about the implementation of the teaching methods were considered as important, and they discussed them in group work. This situation could be seen in the dialogue below:

(The following conversation took place during the preparation of the lesson plan for fieldtrip. They were discussing about giving homework to their students in

their lesson plan. For this purpose, they paid attention what the professor said about this issue.)

…

Ceyda: The professor has shown that the teacher could ask students to prepare newspaper, I like this idea very much. Shall we do it like that?
Selin: I liked this idea very much too. Maybe, we should ask them to prepare a journal.
Ceyda: Preparing journal can be too difficult for them. They should make a poster or a one–page newspaper.
Selin: Okey.

…

In addition, at the end of the semester, the group members were asked how the professor influenced their preparation of lesson plans in order to ensure contribution of the professor on the group. All of the group members expressed that the professor emphasized the characteristics of each teaching method, and she gave information about what can be done for the implementation of these methods. They added that they discussed this information in the group meetings, and they prepared lesson plans in the light of this. Regarding this occasion, Kemal expressed himself as follows:

Kemal: We were learning methods in detail. For example, 5E learning cycle included phases such as Engage, Explore... If we did not know what these phases means, we would not implement this method properly. Since the professor said what should happen in each phase, we took them into consideration when we were planning the lesson plan. Such information like that she gave helped us learn methods and prepare lesson plan.
The researcher: Were you talking about what the professor said in the course?
Kemal: Of course we were talking. For example, Ceyda mentioned that the professor stressed checklist to evaluate students learning, and we can use it in our lesson plan. Like this, because the professor stressed very much, we used science writing heuristic approach in lesson plan for laboratory work.

In conclusion, all of them declared that they considered the professor showing the examples and the suggestions about the implementations of the teaching methods in the theoretical part of this course.

Influence of Course Assistants' Microteachings

Every week the professor introduced a teaching method in one hour, and then the assistants of the course performed a sample microteaching related to the teaching method in the following hour. The group had a chance to observe the microteaching

of every teaching method. Therefore, the group members were asked whether there was influence of the course assistants' microteachings on their group work or preparation of the following lesson plans. Ceyda and Selin stated that observing sample of microteaching was helpful for them. They took them as a model on preparing their own following lesson plans. For example, Selin mentioned as follows:

> *Yes. It [observing the course assistants' microteachings] was absolutely beneficial. We took notes about these microteachings. These notes were beneficial since we examined what the assistant did in each part according to these notes. In group work, we considered about the implementation of the assistants to make decision about topic of our lesson plan. We said to each other that we should make adaptation according to how the assistants did it.*

Similarly, both Mehmet and Kemal stated that microteachings of the assistants helped them prepare lesson plans effectively because they took them as role models. On the other hand, they added that in some microteachings, they did not observe each part of lesson plans (e.g. introduction, teaching procedure, closure and assessment of lesson); therefore, they had difficulty in preparing the parts they had not seen clearly. For instance, Mehmet' sentences about this situation were presented in the following:

> *It [observing the course assistants' microteachings] was beneficial. For example, microteaching of the assistant's argumentation [teaching method] was nice example for us. This was real argumentation. We saw flow of course, engagement of student into lesson, formats of questions. They were important for us. In that lesson plan, we benefited from the assistants. We tried to make similar lesson plan to those of assistants. On the other hand, sometimes the assistants could not show complete implementation of each teaching method. For example, we did not see closure part of the lesson. It was a problem for us because we did not know what to do in closing lesson. However, this situation caused us to work harder. We tried to make closure part in light of information the professor said. Or, we asked the assistants how you would make closure at the end of the lesson.*

In conclusion, they agreed that observing the microteaching of the course assistants was helpful to make effective lesson plans which fit the characteristics of the teaching methods although two of the group members criticized the assistants for not enabling them to observe each part of the lessons in their microteachings.

Influence of Verbal Persuasion

After the group performed the microteachings related to the teaching methods, other groups in the classroom were asked to evaluate their performance. These groups pointed out strengths and weaknesses of their performance, and provided some suggestion to improve their lesson. In addition to this kind of feedback, the group got written and verbal feedback about their lesson plans from the assistants of the course every week. Therefore, the group was asked how the feedback of other groups and the course assistants influenced their preparation of the following lesson plans. These were examined in detail under two categories:

Influence of the Other Groups' Feedback

The group made four microteachings in total. These microteachings were related to teaching methods of demonstration, fieldtrip, analogy, and laboratory work, respectively. After the group made each microteaching, other groups made comment about their microteaching by explaining its weaknesses and strengths. Therefore, the group was asked three times whether the feedback of other groups influenced their preparation of the following lesson plans. They gave written response to this question as a group at the sixth, ninth and fourteenth week of the semester in the critique papers.

At the sixth week, they expressed that with the feedback, they kept implementing strong part of their microteaching in their following lesson plan, and they corrected mistakes to make it better. This situation could be seen in the group's statement below:

> *The other groups' critiques about our performance are important because we prepare lesson plan in the light of these feedback. When we hear our strengths, we say that we will do these again in next teaching performance and lesson plans. Also, when we hear our weaknesses, we try to correct them or change the way that we do since as a group we cannot see our mistakes or we think there are not any problems but in the performing microteaching, our friends look in different perspectives and we realize our mistakes. It is a great chance for us to improve our lesson plans and teaching performance.*

At the ninth week, they provided similar explanation like previous one. They explained that they improved their lesson plans by developing strengths, and correcting mistake thanks to the feedback of other groups. The group' sentences regarding this occasion:

Yes, the feedback was important since other groups explained us both our strengths and weaknesses. After that, we keep focusing our strengths to the next lesson plans and teaching performance. However, we change and correct our weaknesses and we try to do our best. When we look at the last 3 lesson plans we can see that we achieved this.

At the fourteenth week, they added they continued to improve lesson plans by considering the feedback of other groups. As the group narrated:

It is important. We tried to improve strengths and correct mistakes. For example, in Mehmet's microteaching, our friend in the classroom said that the topic may not be appropriate for the analogy method. We can keep this in mind and we can pay attention about appropriateness of the topics when we prepare lesson plans. Consequently, our friends' feedback is important for developing our next lesson plans and teaching performance.

In addition to group response, at the end of semester, the group members were asked individually whether other groups' performances influenced their following lesson plan preparation. Selin stated that they took the comments of the other groups into consideration. She added that when they got positive feedback about parts of their performance, they kept doing them in the next lesson plans. On the other hand, when they got negative feedback for any part of their performance, they tried to change or improve it. Concerning this situation, Selin words were given as follows:

Selin: We were evaluated in terms of positive and negative aspects. This was very good. When we got positive criticism, we saw which part we do well. Other people can see negative aspects as well. When we got negative criticism, we explained why we did this. We said that we tried to do like this, maybe this was seen differently than we planned. This became feedback for us to make good lesson plan.
The researcher: Did you take this criticism into consideration in your lesson plans?
Selin: Yes. When we got positive criticism, we said that we prepared this part well, and then we kept it like that or we developed this. When we got negative criticism, we said that we could not do this part, we changed it, and we tried different things.

On the other hand, Ceyda expressed that the groups usually gave suggestions instead of negative feedback. She added that they evaluated these suggestions in the group meetings, and they tried to implement them in the next lesson plans. Ceyda explained:

Ceyda: After a while, everybody began to say the same things in the class. Apart from these, we did not get much negative criticism. They never said you

did not do this. If we had deficiency, they said you did not mention this or they said that it would be better if you did this. We got positive feedback like that.
The researcher: Did you take this criticism into consideration in your lesson plans?
Ceyda: We took them into consideration. We said that we should prepare this part well. Or if there is missing, we should fix them.

Although Kemal agreed with Ceyda about lack of negative criticism, he added that if they got positive feedback about parts of their microteachings, these helped them gain confidence and they kept this part in their next lesson plans. Kemal mentioned about this in the following:

Kemal: In general, we did not get serious negative criticism. They said only "we like that" and "it was nice". They avoided criticism because there was a thought that if I pointed out to their mistakes, so would they in the class. Apart from these, some important criticism took place.
The researcher: Did you take this criticism into consideration in your lesson plans?
Kemal: If criticism was sensible and positive, this enabled us to gain confidence. It was important that my friends said positive aspects of the microteaching. We tried to integrate them into following lesson plans.

Like Kemal, Mehmet narrated that positive feedback helped them motivate to make better lesson plan. He added that when they got negative feedback about any part of microteachings, they did not repeat this for the following lesson plan. Mehmet expressed his views below:

When Selin performed the microteaching for demonstration, we got nice criticism. As other members of the group, we understood that we should keep as it is. So, we pushed ourselves to make better lesson plans. When we got negative feedback, we tried not to do this in the lesson plans again.

In conclusion, all group members agreed that when they got positive feedback about any parts of microteachings, they kept doing or improving them in the following lesson plan. In addition, two of the group members stated that these positive feedback increased their confidence, and motivated them to work harder. Concerning negative feedback, while two group members declared that they did not get serious negative feedback about any parts of microteaching, the other group member added that they made correction about these negative parts to make better lesson plans.

Influence of the Course Assistants' Feedback

Every week the course assistants gave the feedback about the lesson plans to the group. Especially, they pointed out mistakes or missing points to help them prepare better lesson plan. In addition, after the group performed the microteachings, the course assistant mentioned strength and weakness of them. In the light of these, it was asked how these feedback of course assistants influenced on the following lesson plan presentation. They gave written answer to this question three times as a group at the sixth, ninth and fourteenth week of the semester in the critique papers.

At the sixth week, they explained that their lesson plans were improved with this feedback of course assistants because they tried to correct mistakes; therefore, they prepared better lesson plan in the third lesson plan. The group expressed themselves in the following sentences:

> *We think our lesson plans are getting better and better. When we look at our lesson plans, now our mistakes are fewer. For example, we did not write objectives about NOS and SPS. After taking feedback, we added them to our lesson plans. Another example is that we had some problems about closure part of the lesson plans. We did not write it clearly in the first two lesson plan but we overcome this deficiency with this feedback. ... Consequently, we try to improve ourselves and our lesson plans to reach the best.*

At the ninth week, they declared that feedback of the course assistants motivated them to keep their success for the following lesson plans:

> *When we consider our lesson plans, we can say that we did our best. For example, in the lesson plan for field trip, we reviewed previous lesson plans (mistakes and deficiencies), and we tried to correct them completely. As a result, we had nearly no mistake. Our course assistants made positive comments about lesson plans and our microteaching. Therefore, we want to keep success in the following lesson plans and microteachings, and we got nearly full points from the lesson plans for problem-based learning and project-based learning as well. As a result, we can say we get the return for effort/labor…*

At the tenth week, they stated that they tried to prepare better lesson plan from previous ones by paying attention to the feedback of the course assistants. Therefore, they added that they work harder to reach this aim.

> *Our main goal was to prepare better lesson plans from previous ones. Therefore, we tried to correct mistakes and strengthen weaknesses of our previous lesson plans so that we would not do the same mistakes in the next lesson plans. We aimed to search more about teaching method before we prepared our lesson plans. We tried to study collaboratively. Also, we cared*

about the opinion of other groups, and we cared about what our assistants said as feedback about our lesson plans and our microteachings…

In conclusion, they explained that the feedback of the course assistants was helpful for them to make better lesson plans; therefore, they tried to work harder on their lesson plans by developing weaknesses.

Influence of Psychological and Affective States

The researcher participated the group meetings to observe how the group worked every week. These meetings happened silence and comfortable environment. In these meetings, it was observed that they dealt with stress or anxiety for preparing the lesson plans every week. For this purpose, they usually made jokes, told stories about daily life or listened to music. Below one of these jokes was seen in the dialogue of the group members based on observation records:

(The following conversation took place in the preparation lesson plan for problem-based learning. After they decided what they would do, they have started to write lesson plan. However, Ceyda had problem about the computer, their friend was teasing Ceyda).

…

Kemal: Push "tab" to start new line.
Ceyda: I do not know "tab", what is "tab"?
Kemal: Did you ask me really what "tab" is?
Selin: You took the lesson of "computer application in education" twice (laughing)
Kemal: I am keeping quiet if you ask seriously what "tab" is?
Mehmet: Do you use "space" to start new line?
Ceyda: I forgot. I did with something but this is not simple. (laughing)
Mehmet: (laughing)
Kemal: She teases us!
Ceyda: No, on the contrary.
Mehmet: Of course, girls do not know these.
Ceyda: Ridiculous. I cannot know terminology. But I can do it without knowing name. You do not know something very well, do I tease you? Camera is recording too. Why do you tease me? (laughing)
Kemal: (he shows "tab")

…

In addition to this observation, at the end of the semester, the group members examined in terms of psychological and affective state of the group

Concerning this issue, Ceyda mentioned that there was no stress in working environment. She added that in addition to preparing lesson plan, they talked from daily life and this helped them work hard. Ceyda's statement was as follows:

> *We did not feel tension. There was nice environment. This environment was neither too serious nor too friendly. We prepared lesson plans by talking to each other. This was good because we did our job. At the same time, we chatted. There was a warm and friendly environment. This helped us be more productive.*

Moreover, Selin, Mehmet and Kemal explained that they made jokes, told funny stories and listened to music and these kinds of activities made them get motivated to focus on their jobs. Kemal expressed himself in the following sentences:

> *We lost concentration after a couple of hours. Then, we shared funny things with each other, and we talked five or ten minutes. I think these motivated us because when we continued to prepare lesson plan again, this helps us focus easily….These jokes should be made because a person cannot focus after fifty or sixty minutes. We made jokes, said funny stories or listened to music. They decreased our stress, and provided relaxation. When we got relaxed, we could focus and do works better.*

In conclusion, they stated that they worked in a relaxed, comfortable environment. In order to create the relaxation, they made jokes, told stories or listened to music. They added that these kinds of activities helped them to be motivated or focus to become more productive.

4.5. Research question 5

RQ5. How does preservice science teachers' collective efficacy contribute to group performance in the science methods course?

During the science methods course, the group prepared nine lesson plans based on teaching methods they have learned in theoretical part of the course. Every week two course assistants evaluated lesson plans independently from out of 14 and under seven subtopics which are objectives; instructional resources, materials or technology; introduction; teaching procedure; closure; usage of teaching methods; and assessment. After evaluating lesson plans every week, these two assistants came together to discuss and make consensus regarding the differences on their evaluation. Then, feedback was given every week to the group as soon as possible before they prepared the following lesson plan.

Concerning this research question, lesson plans were accepted as indicator of group performance. In order to respond this research question, firstly these lesson plans was analyzed in terms of improvement lesson plan. Then, the role of collective efficacy on this improvement was examined.

Improvement of Lesson Plans

As noted above, lesson plans were evaluated out of 14 according to the rubric (Appendix G). Based on this evaluation, the total grades of these lesson plans were presented in Figure 4. It was clear from this figure that there was improvement from the first lesson plan to the last lesson plans although there is not continuous development. More specifically, in the first two lesson plans, they got the lowest scores of lesson plans. However, from third lesson plan, it was observed that their total grades began to increase, and they got highest score at the fourth and fifth lesson plans. Following two lesson plans, their total grades decreased slightly. However, in spite of decreasing in total grade, they still kept the total grades of these lesson plans high. Finally, they again reached highest score at the last lesson plan. As a result, it can be said that they improved themselves in preparing lesson plan until the fifth lesson plan and they tended to keep this improvement in the following lesson plans. The group's lesson plan for demonstration and lesson plan for field trip were given in Appendix J and K. The improvement in lesson plans was seen by comparing the lesson plans.

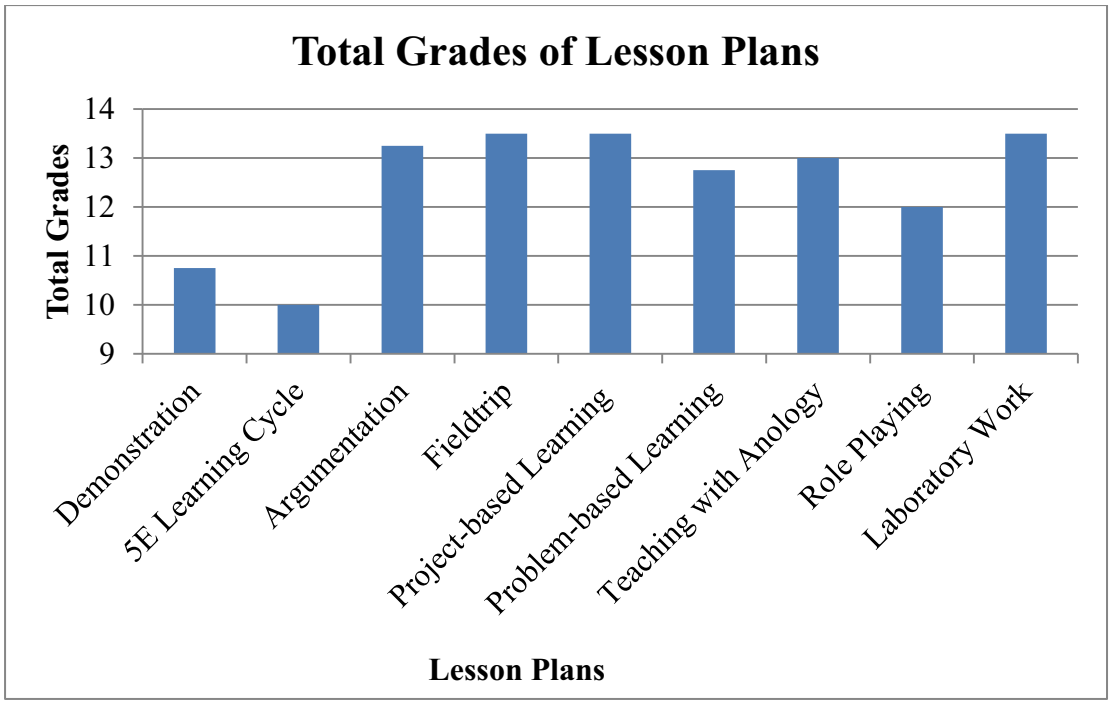

Figure 4. Total Grades of Lesson Plans

In order to assess the group's performance properly, there was a need for detailed examinations. Therefore, it was necessary to analyze the parts of lesson plans. All grades that the group got from the parts of these lesson plans were shown in Table 9. According to this table, in general it could be seen that they had important deficiencies in writing objectives. In addition, in the first two lesson plans, they made mistakes on closure and assessment part of lesson plan; however, these mistakes were fixed at third lesson plan. Furthermore, during sixth lesson plan, some deficiencies were observed in the parts of teaching procedure which led to decrease the total grade of these lesson plans. In the following, more specific detailed examination across each part of lesson plan was given to comprehend the improvement on preparing lesson plan clearly.

Table 9

Grading of Lesson Plans

	The Parts of Lesson Plans							
Lesson Plan	**Objectives (2 points)**	**Material and Tech. (1 point)**	**Introduction (2 points)**	**Teaching Procedure (2 points)**	**Closure (2 points)**	**Usage of Teaching Method (3 points)**	**Assessment (2 points)**	**Total (14 points)**
Demonstration	0.75	1	2	1.5	1	3	1.5	10.75
5E Learning Cycle	1.25	1	2	2	0	2.25	1.5	10
Argumentation	1.25	1	2	2	2	3	2	13.25
Fieldtrip	1.5	1	2	2	2	3	2	13.5
Project-based Learning	1.5	1	2	2	2	3	2	13.5
Problem-based Learning	1	1	2	1.75	2	3	2	12.75
Teaching with Analogy	1.25	1	2	1.75	2	3	2	13
Role Playing	1.5	1	2	1.5	2	3	1	12
Laboratory Work	1.5	1	2	2	2	3	2	13.5

Objectives

The group was asked to write objectives based on 5 criteria in the rubric (Appendix G). It was declared that objectives should be clear, measurable, specific than broad, related to intended results, and related to curriculum. Objectives based on these criteria were evaluated out of 1 point. If objectives included these five criteria, they got 1 point. If they met four of these criteria, they gained 0.75 point. In addition, providing three criteria led them to gain 0.5 point. Finally, by two criteria, they got 0.25 point.

Moreover, objectives related to NOS and SPS were expected to write. Concerning NOS, the group was asked to write content-embedded objective which means that NOS aspects such as tentativeness, subjectivity should be embedded in the context of learning science content to provide meaningful learning for students. Regarding SPS, it was asked that they should write SPS objective at application level instead of level of recalling or understanding of SPS. In other words, they were expected to design objective to make middle schools students apply SPS in learning environment. Each NOS and SPS was evaluated out of 0.5 points based on four quality levels which are excellent, good, moderate, and poor.

In the light of all this explanation above, the total grades of objective part out of 2 points across lesson plans were given in Figure 5. Based on this figure, it was evident that the group had problems about writing objectives from the first lesson plan to the last lesson plan.

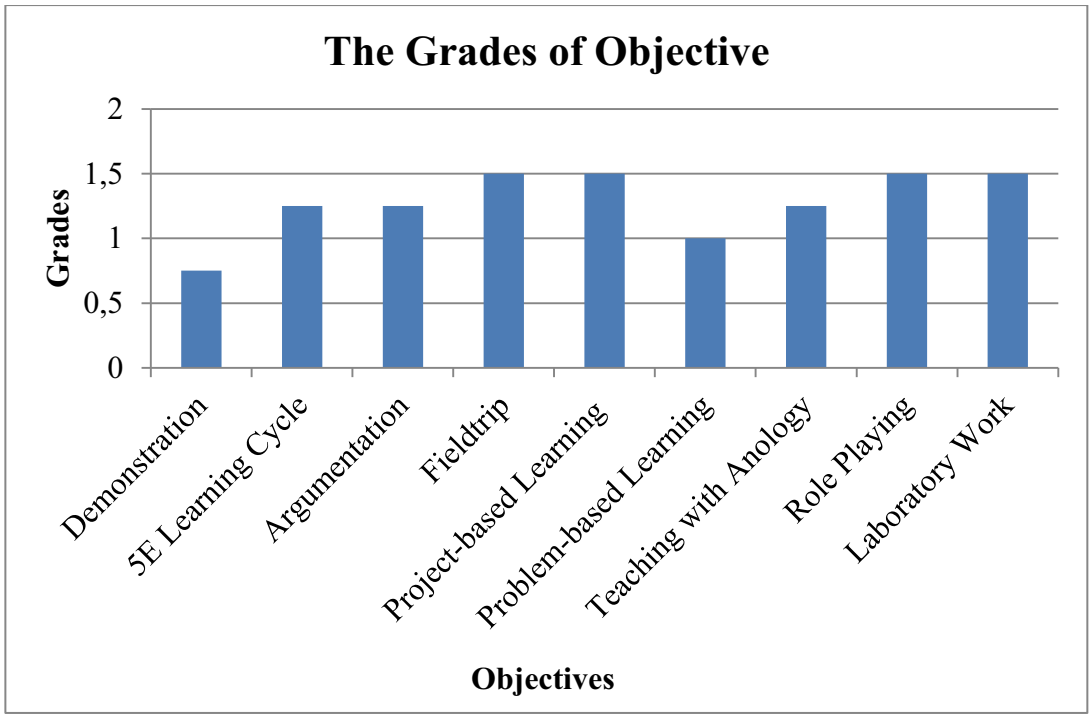

Figure 5. The Grades of Objective Part across Lesson Plans

In order to examine the problems in the objective part sufficiently, detailed grading of objective part from lesson plans was also shown in Table 10. According to this table, it was seen that in lesson plan for demonstration, the group made mistake about measurability of objective. For example, concerning the topic of "Interaction between sound and matter" at sixth grade, they formulated one of objectives like that "*Realize the relationship between sound and vibration"*. Because of the verb "realize", it was accepted that it was hard to measure whether the objective is gained or not at the end of the lesson. In addition, in the lesson plan, it was seen that they did not write NOS and SPS objectives. Then, regarding lesson plan for 5E learning cycle, from seventh grade curriculum, "connection types of light bulb" was chosen as the topic of this lesson plan. It was observed that they fit the all criteria, which are clearness, measurability, being specific than broad, relatedness to intended results, and relatedness to curriculum. Moreover, while they still did not add SPS objective, they wrote two content-free NOS objectives instead of content-embedded such as "*Explain the differences between observing and inferences (NOS), Explain creativity that is one of the NOS aspects (NOS)"*. For the following week, the group prepared lesson plan for argumentation approach related to "relationship

between concepts of force and solid pressure" which was from seventh grade curriculum. After examination, it was seen that like previous lesson plan the objectives were appropriate for the all criteria, and they did not write SPS objectives. On the other hand, they kept writing content-free NOS objectives although feedback from course assistant was given and it was stressed that content-embedded NOS objectives was asked. Next, lesson plans for fieldtrip and project-based learning, they started to write SPS objectives; however, it was seen that they were at knowledge or understanding level. For example, in lesson plan for fieldtrip based on the topic "Level of Organization in Ecosystem"., they wrote these objectives like that *"Explain the importance of communication among scientists (SPS), Explain the observation that is one of the SPS (SPS)".* After that, in the following week, lesson plan for problem-based learning about "food chain" at eighth grade was examined, it was detected that the some objectives were not clear and specific. For example, they wrote a one objective like that "*Name the hypotheses related to frog population".* As it was clear from this objective, the dependent variable of the possible hypotheses was not stated. For example, about frog population, it was not added what the problem was, such as decreasing or increasing frog population. In addition, this objective was too broad because the group did not give any indication about the place of frog population. Then, last two lesson plans, although they were appropriate for stated criteria, they continued to write content-free NOS objectives and SPS objectives with knowledge or understanding level. As a result, from the first lesson plans to the last lesson plan, they had deficiency about writing NOS and SPS objectives. On the other hand, they developed themselves about writing clear measurable, specific objectives which were also related to intended results and curriculum.

Table 10

Detailed Grading Presentation of Objective Parts across Lesson Plans

	Objectives					**SPS objective**				**NOS objective**				
Criteria / **Lesson Plan**	**Clearness**	**Measurable**	**Related to intended result**	**Specific than broad**	**Related to curriculum**	Excellent	Good	Moderate	Poor	Excellent	Good	Moderate	Poor	**Grade**
Demonstration	+	-	+	+	+				●				●	0.75
5E learning Cycle	+	+	+	+	+				●			●		1.25
Argumentation	+	+	+	+	+				●			●		1.25
Fieldtrip	+	+	+	+	+			●				●		1.5
Project- based Learning	+	+	+	+	+			●				●		1.5
Problem-based Learning	-	+	+	-	+			●				●		1
Teaching with analogy	-	+	+	+	+			●				●		1.25
Role playing	+	+	+	+	+			●				●		1.5
Laboratory Work	+	+	+	+	+			●				●		1.5

Instructional Resources, Materials or Technology

It was asked that the range of resources, materials or technologies were effectively integrated into the context of the lesson. In all lesson plans, it was observed that they stated resources, materials, or technology used in lesson plan and they explained where these would be used in the lesson explicitly. Therefore, they got full points from this part in each of the lesson plans. Figure 6 demonstrated this situation more clearly below.

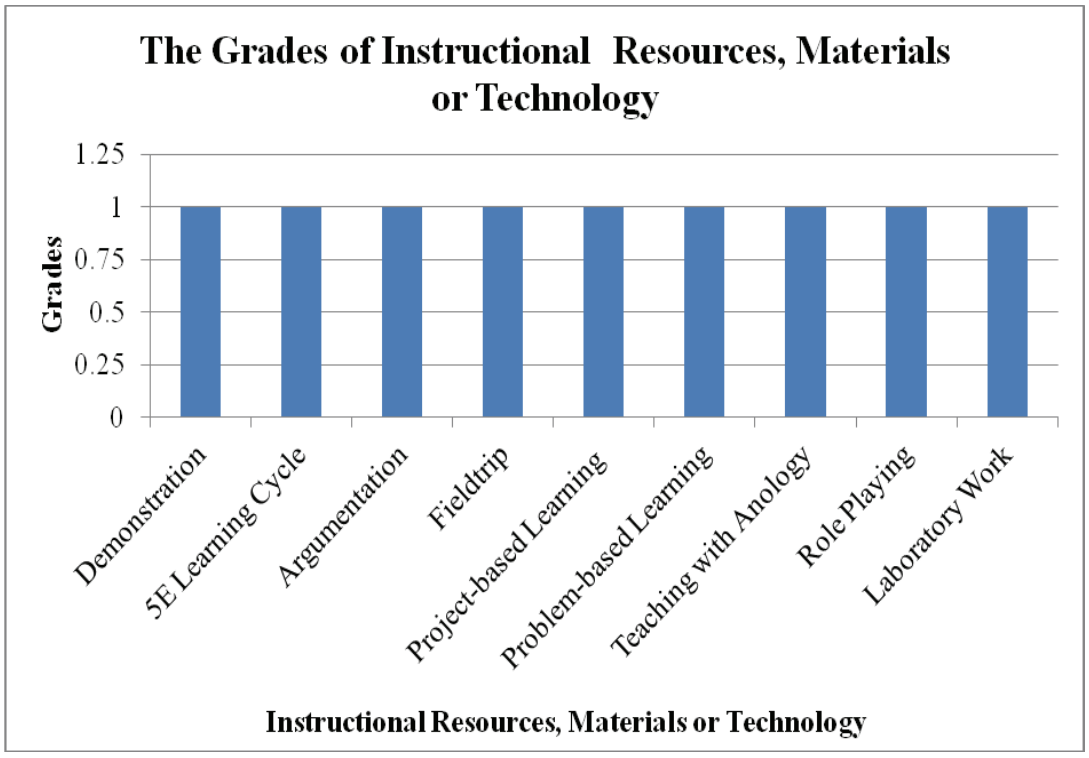

Figure 6. The Grades of Instructional Resources, Materials or Technology across Lesson Plans

Concerning effective integration of these resources materials or technology into lesson; for example, in argumentation lesson plan, they stated resources materials or technology firstly such as activity sheets, PowerPoint slides, concept cartoon and pictures. Then, they planned the lesson by using materials or technologies as follows:

(The group used concept cartoon related to speed of ski in lesson plan for argumentation. In the cartoon, there are four children's different ideas about speed. They were telling what the teacher would do step by step in the lesson.)

...In order to attract students' attention, the teacher shows ski pictures via ***PowerPoint slides****. Then, she/he starts to question 'have you ever skied on the snow' and 'what do you prefer for skiing?'... the teacher shows the* ***concept cartoon*** *via* ***PowerPoint slide*** *and also gives* ***paper including this concept cartoon*** *and teacher say that 'please read carefully each child's statement* ***in this cartoon****'. Students read the statements and teacher asks them randomly to explain each statement...*

Introduction

The group was expected to start the lesson by using one of strategies such as usage of strong motivational device, connection to prior learning, and/or and asking essential questions. In the analysis, it was seen that one of these strategies was implemented in introduction part of all lesson plans. In addition, the group explained how they would use these strategies in classroom in detail. For example, in lesson plan for demonstration, the group started the lesson by asking some questions about "the creation of sound". This introduction part of lesson plan for demonstration was presented as follows:

The teacher starts the lesson by asking questions to review previous lesson. Firstly, he/she asks 'How is sound created?'. He/she expected students to answer like that 'the vibration of particles creates sound'. Then, he/she asks students to put their hand to their throat, and speak or make some noise. After that, he/she asks what students feel. He/she expects students to get 'vibration' answer...

As can be seen, the group wrote clearly every detail about what do they do in introduction. Therefore, they got full points from this part. Likewise, detailed explanation was sustained in other lesson plans. However, the group used different strategies. For instances, in lesson plan for 5E learning cycle, they implemented role playing not only attracting students' attention but also making them remind prior knowledge about connection of bulbs in electrical circuit. In argumentation lesson plans, they showed some picture related to skiing to attract students' attention and in the light of this, they asked some questions. Similarly, this strategy was also used in lesson plan for fieldtrip, project-based learning, problem-based learning, and teaching with analogy. Concerning lesson plan for role playing, they asked questions about previous lessons related to "states of matter" and "phases of matter" to remind prior knowledge. Differently, they put a quiz to measure prior knowledge about topic

which is “global warming” and discussed questions in the quiz with students in lesson plan for laboratory work.

As mentioned earlier, similar to introduction part of lesson plan for demonstration, they gave very detailed explanation in other lesson plans. Therefore, they kept getting full points from this part in all lesson plans. In Figure 7, this grading of introduction part across lesson plans was given.

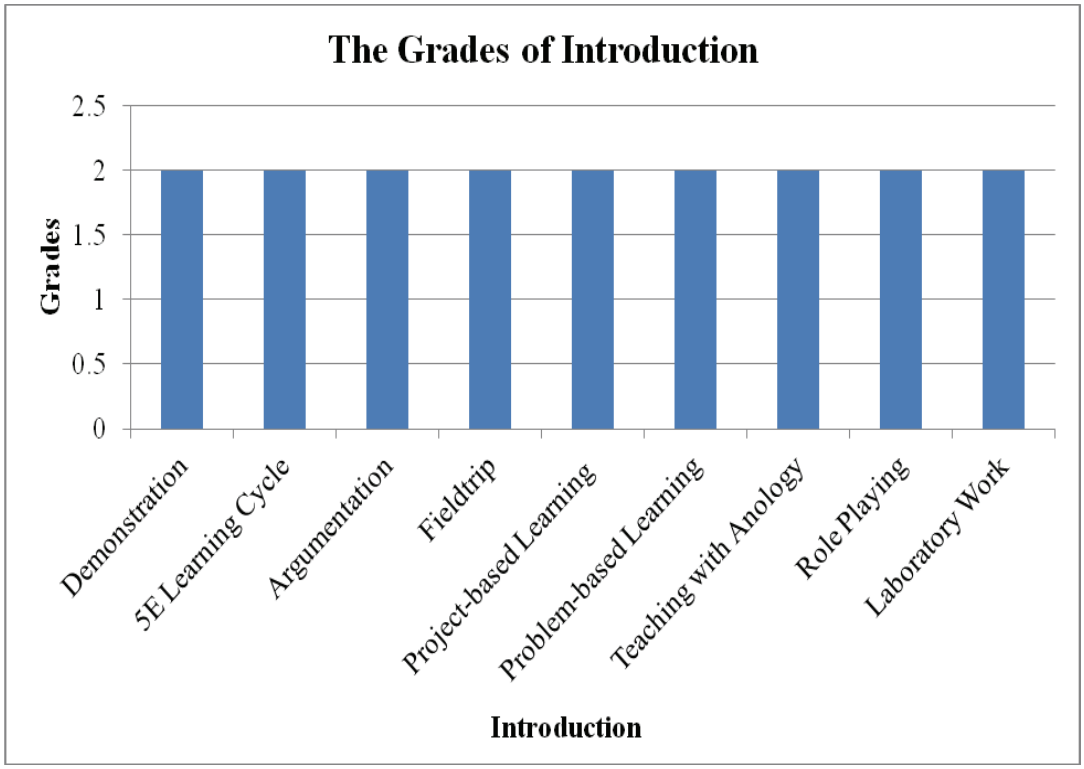

Figure 7.The Grades of Introduction across Lesson Plans

Teaching Procedure

In this part, it was asked that activities about teaching should be based on correct concepts and related directly to objectives of the lesson. These activities should be given in detail. Moreover, in the light of objectives, one NOS aspect and two SPS should be integrated adequately in teaching procedure. Figure 8 demonstrated the grading of teaching procedure across lesson plans. It was clear from this figure that although there was improvement on teaching procedure from the first lesson plan to the fifth lesson plans, this improvement began to decline slightly with the sixth lesson plan. However, in the last lesson plan, the group could get highest score again from this part.

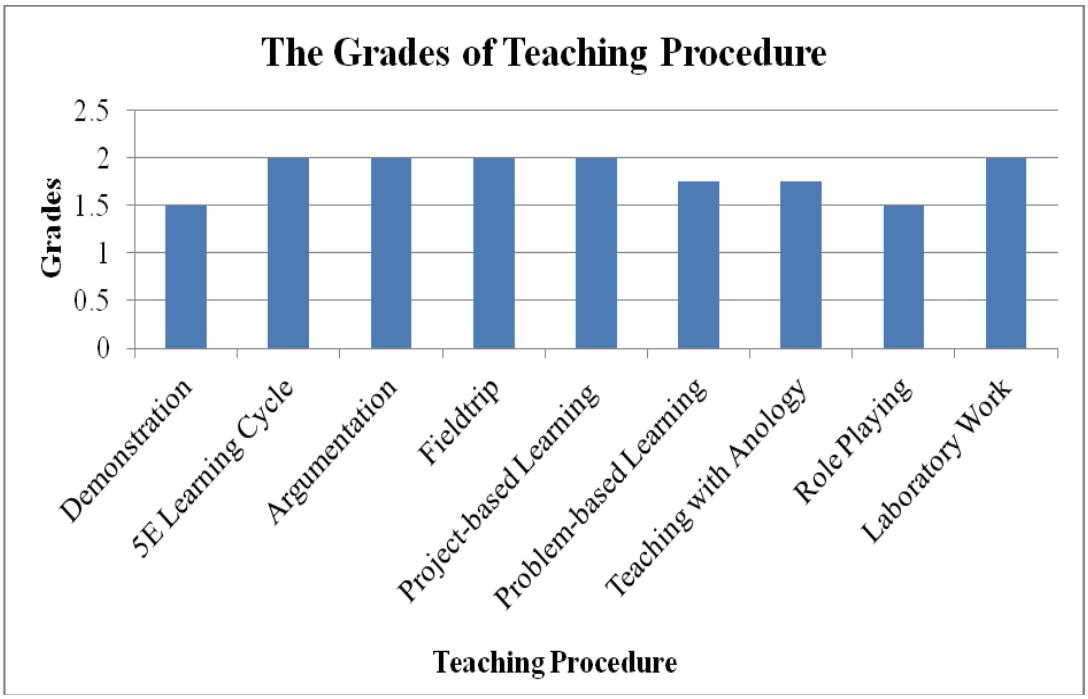

Figure 8. The Grades of Teaching Procedure across Lesson Plans

In order to explain the group's development about teaching procedure, lesson plans were examined in detail, respectively. In lesson plan for demonstration, they made activity related to vibration of sound. After analysis, it was observed that they did not explain this activity in detail. Another mistake was that although they did not specify objectives of NOS aspect and SPS, they tried to integrate them in teaching procedure. However, this integration was done inadequately. Based on these deficiencies, they got 1.5 points out of 2 points. This situation could be shown below:

> *…The teacher gives students "prediction paper" (Appendix 1). Firstly, students predict how demonstration will be done (NOS, creativity) and the teacher explains the procedures of demonstration. Then, again students predict what the result of experiment is. While students write their prediction in 'prediction paper', the teacher walked around. Then, students discuss their prediction. After that, the teacher makes demonstration step by step. She puts some rice on bowl which covered with stretched balloon, and makes some noise around bowl with different distances and students observe it. By completing demonstration, another paper which is 'observing paper' will be given to students (Appendix 2). While writing their observation, the teacher again walks around the classroom. At this time, observations are shared and discussed. Then, another paper which is explaining paper will be given to students to write their explanation of relationship between vibration and movement of rice (Appendix 3).Students share their explanations and teacher never gives the right answer at this stage (SPS inferring)…*

In the part above, it can be seen that the group had misconceptions about NOS and SPS because they expressed that making prediction was creativity of NOS aspects, and sharing explanation was inference skill of SPS. Therefore, there was a problem related to integration of NOS and SPS in the lesson. Moreover, they did not give detail about conducting lesson. For example, they did not state what students would observe, what their possible explanations would be, what kind of questions would be asked by the students in discussion, and how the teacher or other students would respond to these questions.

On the other hand, the group provided all criteria stated for teaching procedure in lesson plan for 5E learning cycle and argumentation. They explained what teacher would do in the lesson in detail. They tried to integrate NOS and SPS by explaining adequately based on their objectives. Therefore, they got full points of this section. For example, in lesson plan for argumentation they used the following activity:

(In this lesson plan, the teacher showed a concept cartoon about skiing. There were four different ideas about speed of ski. The teacher tried to conduct argumentation by asking some questions).

> *...The teacher reminds students about what they would do. She says that 'Consider that these four children are in competition. According to this, you are going to write down your answers of question that I will ask and after that we are going to discuss your answers one by one'. First question is according to you, which person in the cartoon gives the right answer? Students answer the first question (they selected one of ideas). The teacher asks each student's answer, and writes the number of answers by counting to the board for each statement. Second question is that what is your explanation for your decision (Expected answer for 3rd child in the cartoon: because having the smallest ski, 3rd child will sink into snow that means that his pressure is high and as a result of this he will go faster than others. Expected answer for 4th child in the cartoon: because he is slim, his pressure is low, and he does not go down into snow so that he will go faster than others...) Then, the teacher continues with third question which is that "what is your evidences…. As a result of this, they will get a final decision, also, teacher add that "some of your friends changed their opinions, don't they? (Answer is yes). Besides, in science the knowledge can change nothing remains stable. For example, you can think Earth's shape. Scientists thought that it is like a tray, then, thought like a ball. As a result, like your opinion everything can change over the time. (NOS, Tentativeness).*

As can be seen above, the group explained what teacher would do in lesson in detail. For example, it included teacher's questions, possible answers of students to these questions, and teacher's and students' role in this activity. In addition, they integrated a NOS aspect into lesson adequately by giving sufficient explanation and example. As a result, they developed themselves in teaching procedure in these two lesson plans, and they wrote this part which was appropriate for criteria stated above. Therefore, they got full point from this part.

The group continued this improvement in teaching procedure lesson plan for in fieldtrip and project-based learning. They explained activities very clearly, and they got full points from this part. However, in the following week, it was observed that they made some mistakes when explaining activity in lesson plan for problem-based learning. Therefore, they got 1.75 out of 2 points. Their points decreased slightly when compared to the previous lesson plan. The mistaken part in the activity of problem-based learning lesson plan was presented below:

(The activity selected for this lesson plan was related to find the reason of decreasing frog population in local lake. They were trying to explain teaching procedure.)

> *…While they discuss, students may consider the air pollution issue. They formulate their hypothesis as the more the air pollution take place, the more the frog die. The teacher again asks the reason of their thought. (Expected answer is that when air is polluted, there exist harmful substances in the air. When frogs respire this air, they may get sick and die). The teacher again asks to students whether they are sure or not and if they sure, and gives the envelope related to air pollution (Appendix 3). When groups of students discuss about decreasing of frog population in terms of prey-predator relationship….*

In that part, it was not clear that how students got sure about hypothesis that the air was the reason of decreasing frog populations. In addition, like this unclear part, teaching procedure of the lesson plan included similar several mistakes.

In lesson plan for teaching with analogy, the group tried to explain organs in humans system (target concept) by comparing organelles in animal cell (analog concept). In this process, although they gave very detailed explanation about similarities between these analog and target concepts, they did not give importance in explaining breakdown points between these concepts. Therefore, similar to problem-based

learning lesson plan, they got 1.75 out of 2 points. This situation could be seen in their sentences: "*...After discussing similarities, teacher asks breakdown points between organs and organelles. (Expected answers are that lysosome is very small; however, stomach is big. Also, their shapes are different and so on*."

In lesson plan for role playing, they explained activity related to role playing. However, it was seen that they have grammar mistakes; therefore, it was hard to track what was happening in the lesson. In addition, they integrated a NOS aspect into activity inadequately because the group had misconception about creativity of NOS aspect. Therefore, they got 1.5 out of 2 points which is lower score than analogy lesson plan. In role playing lesson plan, some part of teaching procedure was stated below:

(They tried to teach the phases of matter by role-playing. For this purpose, classroom was divided into three rooms with desks. Each room represented phases of matter as solid, liquid and gas. Students were asked to act the particles of matter, and change their locations according to the directions of teachers.)

> *...For example, when the solid room's temperature increases, student acting solid particles will move to liquid room or vice versa. Therefore, you are going to use your creativity about particles' action. Let's start the activity. When teacher says temperature increased 50 ^{o}C for solid room, solid particles, which their temperature is -10 ^{o}C, will become liquid (NOS creativity)...*

In lesson plan for laboratory, the group explained activity in detail. In other words, they presented very clear explanation about what teacher and students would do. In the light of the objectives of the lesson NOS and SPS are integrated adequately with enough explanation. Therefore, they got full points from this part in the lesson plan.

Closure

In this part, it was asked that they closed lesson by using one of strategies such as review of lesson, asking essential questions, preview of future learning, application or extension of lesson concepts. Based on this evaluation, the grading of closure is presented in Figure 9.

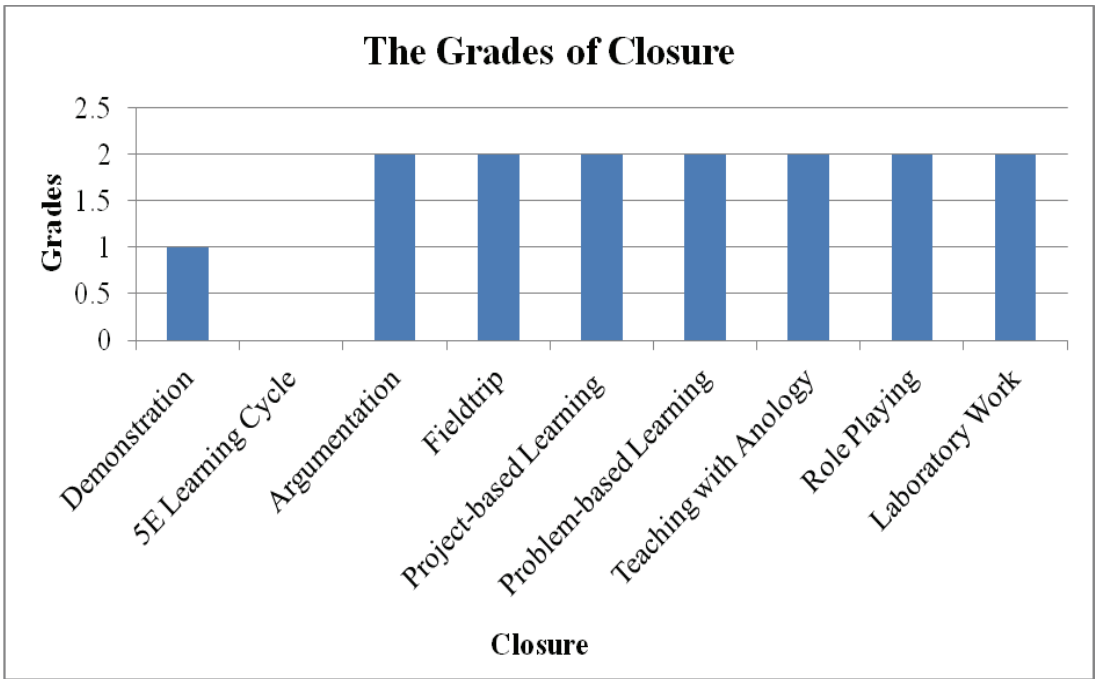

Figure 9.The Grades of Closure across Lesson Plans

From this figure, it was seen that although the group had serious problems about closing lesson properly in the first two lesson plans, especially in the second lesson plan. However, this situation got better during third lesson plan. This improvement in the closure part was sustained to the last of the lesson plan.

More specifically, in demonstration lesson plan, the group did not explain in detail about how the teacher would close this lesson. Therefore, they got 1 point out of 2 points. For example, the group's closure of demonstration lesson plan was given in the following sentences: "*Teacher asks students to summarize demonstration and result of the demonstration. Then, teacher revises it briefly. Finally, teacher gives homework and writes it down to the board."*

As can be seen above, although they stated that teacher and students summarized lesson, they did not explain what they expected from students in this summary clearly or how the teacher revised lesson in detail.

In lesson plan for 5E learning cycle, they did not write anything in this part. Therefore, they got 0 out of 2 points. Therefore, there was decline of the grade of closure from lesson plan for demonstration to lesson plan for 5E learning cycle. However, by lesson plan for argumentation, they began to get full points from this part because they wrote the closure of lesson in detail. They made brief conclusion

about what students learned in the lesson. The closure of the lesson plan for argumentation was shown below.

(In this lesson plan, after four different ideas about speed of ski in the cartoon were discussed, teacher summarized the lesson by explaining right answer with reasons once more).

> *After reaching right answer, the teacher makes a brief conclusion that the statement of 4th child is right because slim child has less solid pressure if the surface areas are equal to other children. For this reason, 4th child skies faster than others. Moreover, the teacher asks question why their opinions changed during the discussion to refer to tentativeness aspects of NOS, and ask to give an example from science.*

As can be seen above, in closure part, they emphasized once by telling right answer with reason. In addition, they wanted students to give an example about tentativeness aspects of NOS to make sure of students' understanding even though tentativeness was discussed in teaching procedure.

As a result, during these three lesson plans, although they got lowest score from this part in the second week, they improved themselves at lesson plan for argumentation, and they wrote closure part which was appropriate for evaluation criteria stated above. Therefore, they got full point from this part. Similar to argumentation lesson plan, it was observed that the group tended to close lesson by summarizing in detail from rest of lesson plans. Therefore, they kept getting full points from the part.

Usage of Teaching Method

The group was expected to show the characteristic of the teaching method in the lesson plan, and integrate this teaching method with activities appropriately. Figure 10 presented the group's grading of usage of teaching method. From this figure, it was apparent that group succeeded in reflecting characteristic of teaching method in the lesson effectively. Therefore, they got full points from eight lesson plans. On the other hand, in the second lesson plan which was related to 5E learning cycle lesson plan, some deficiencies about this issue was observed. In the following, all lesson plans was discussed in terms of usage of teaching method explicitly from the first lesson plan to the last lesson plan.

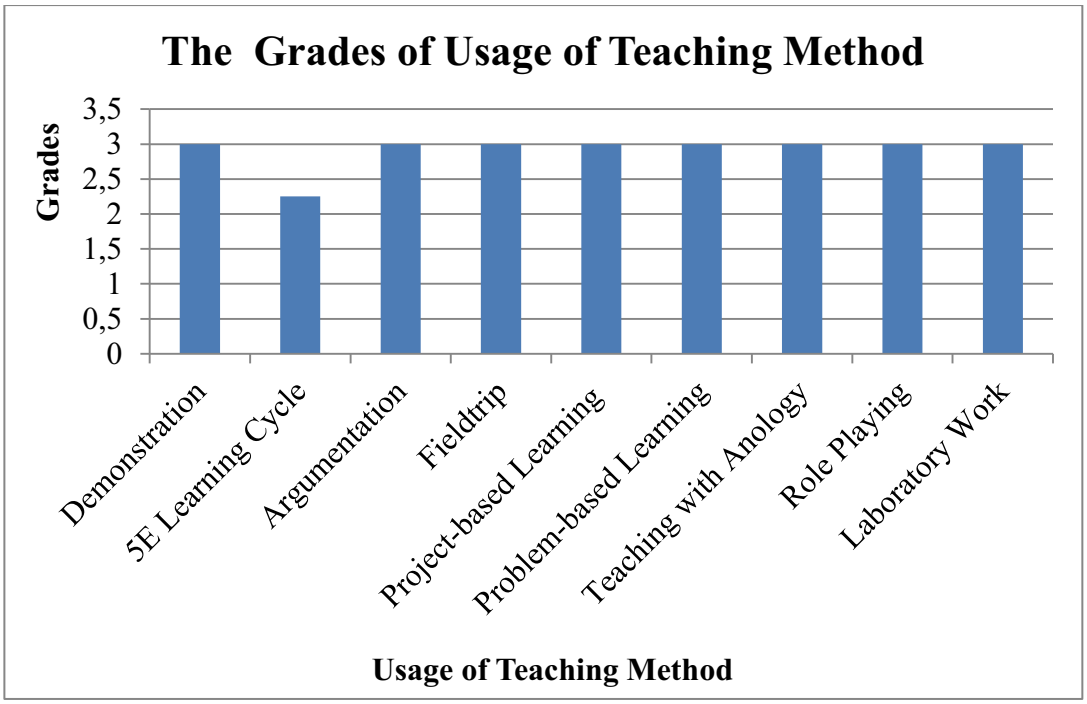

Figure 10. The Grades of Usage of Teaching Method across Lesson Plans

In lesson plan for demonstration, they implemented successfully Predict-Observe-Explain technique (POE) in an activity related to vibration of sound. Therefore, they got full points from this part. Usage of teaching method in demonstration lesson plan was shown as follows:

> *...While students write their prediction in 'prediction paper' (Appendix 1), the teacher walks around. Then, students discuss their prediction. After that, she makes demonstration step by step. She puts some rice on bowl which covered with stretched balloon, and makes some noise around bowl with different distances and students observe it. By completing demonstration, another paper which is 'observing paper' will be given to students (Appendix 2). While writing their observation, the teacher again walks around the classroom. At this time, observations are shared and discussed. Then, another paper which is explaining paper will be given to students to write their explanation of relationship between vibration and movement of rice (Appendix 3).*

This quotation revealed out that students were asked to predict what would happen in the demonstration. Then, activity was demonstrated, and the teacher let them observe it. Finally, it was expected that students explained this activity based on observation. In addition, the group prepared three different worksheets related to phases of POE, and they asked them to fill these worksheets respectively according to the sequence of the lesson.

On the other hand, in lesson plan for 5E learning cycle, they tried to explain what the teacher would do in each phases in detail. However, last phase of 5E which is 'Evaluation' was not explained very well. Therefore, they got 2.25 out of 3 points, and their grade decreased slightly than demonstration lesson plan. Usage of teaching method in 5E learning cycle lesson plan was shown in below:

> ***Engage:****… In order to attract students' attention, the teacher starts a classroom activity….She selects students randomly and asks them to act as bulb, cable and battery to construct a circuit…*
> ***Explore:*** *….the teacher asks "what affects the bulb brightness"… then, she distributes materials to each group (10 cables, 5 bulbs, 5 batteries). She says that you are going to make own experiments to find the answer of this question by using these materials…*
> ***Explain:*** *after finishing experiments, the teacher draws a table on blackboard to groups' results. …Then, by asking questions, she fills the table that includes students' observations and also results...*
> ***Elaborate:*** *…the teacher asks students 'if I change the wire types into plastic what will happen to brightness of bulbs?'…*
> ***Evaluation:*** *The teacher makes quiz.*

As can be seen above, in "Engage phase", the group used role playing activity to capture students' attention and create curiosity about topic which would be taught. Then, in "Explore phase", students were asked to work together to find answer of the question. Here, the purpose was to construct their knowledge by themselves. Next, students reported their results and observation in "Explain phase". After that, in "Elaboration phase", it was expected from students to apply newly learned concepts to new contexts to develop deeper understanding about the topic. Therefore, the question in Explain phase was modified with new situation. Finally, in order to assess students' understating, the group presented a quiz in "Evaluation phase".

When compared to all phases of 5E learning cycle, it was clear that they did not give importance to "Evaluation phase". In other words, they did not state how to evaluate their learning in detail. For example, they did not describe assessment strategies to gather evidence of students' learning explicitly. Therefore, the grade of usage of teaching method was decreased.

The following week, the group tried to integrate adequately characteristic of argumentation into selected activity in the lesson plan. For this, at the beginning of this course they showed concept cartoons including four different claims about speed

of ski. Then, the teacher tried to create discussion environment by asking questions. The group's statement about the usage of teaching method in the lesson plan below.

> *The teacher reminds students about what they do. She says that 'Consider that these four children are in competition. According to this, you are going to write down your answers of question that I will ask and after that we are going to discuss your answers one by one'. First question is according to you, which person in the cartoon gives the right answer? Students answer the first question (they selected one of ideas)… Second question is that what is your explanation for your decision …Then, teacher continues with third question which is that what is your evidences…. While discussion, teacher asks fourth question that why do you think other statements are wrong?... Last question is that is there any exceptional situation in your claim?...*

From this quotation, it was observed that students were asked to choose one claim, show evidence of this claim, and refute other claims. Therefore, the group tended to reflect main characteristic of argumentation in this lesson plan, and they got full points from this part again.

This successful integration of teaching method into selected activity continued with the other following lesson plans. For example, in lesson plan for fieldtrip, the group made some preparation before fieldtrip such as visiting fieldtrip place before to decide what they focus, preparing worksheet to fill by students, deciding students' rules, and preparing first help kit. After fieldtrip, they planned to make discussion about what they learned. Concerning lesson plan for project-based learning, they gave a mission to students, and they were asked to prepare a project as a group to complete this mission. In lesson plan for problem-based learning, they gave a situation to students. Students were asked to find the problem of this situation by giving some clues step by step. In teaching with analogy lesson plan, they selected analog concept that students learned from previous lesson and they showed similarities between analogy concept and target concept. Then, they stated their breakdown points. Regarding lesson plan for role playing, they put warm activity, then, made role playing, after role playing they reviewed what they learned. In laboratory work, they conducted lesson into two main parts. In first part, prior knowledge was retrieved by asking questions related to topic. Then, experiment with topic was conducted by students. In this process, safety rules were noted by the teacher. After that, students were expected to record data according to science writing heuristic approach which improved skills of inquiry and argumentation.

Concerning this approach, students were asked to formulate claims based on research question. To test their claims, they carried out experiments. Then, they justified claims by providing evidence.

Assessment

It was expected that assessment procedure clearly explained in detail, and were related to all objectives of the lesson. As illustrated in Figure 11, the group had some deficiencies in the first two lesson plans. During third lesson plan, they succeed in correcting these deficiencies except from lesson plan for role playing.

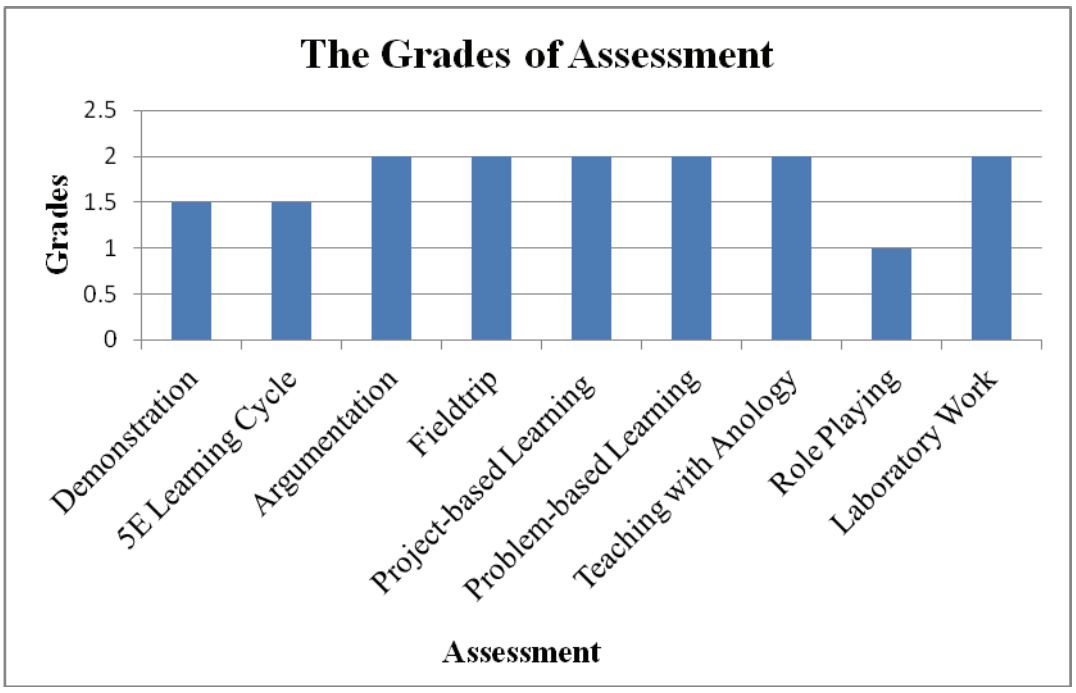

Figure 11. The Grades of Assessment across Lesson Plans

More explicitly, in lesson plan for demonstration and 5E learning cycle, they gave homework or quiz as assessment but they did not explain clearly how the teacher would assess students' learning in this homework. For example, the following sentences were related to the group's assessment of demonstration lesson plan: "*The teacher gives homework as an assessment. Please put a tea glass in front of the loudspeaker with high and fixed volume (such as computer speaker). Then observe the effects and write it down on a paper.".*

As mentioned above, the group only expressed what kind of assessment was used. However, they did not give detail about this process. For example, it was not

certain how the teacher evaluates this homework. Therefore, they got 1.5 points out of 2 from this part of these two lesson plans.

On the other hand, in lesson plan for argumentation, they explained how they would do assessment in detail. For instance, they stated that the teacher made a quiz that includes questions related to all objectives, and evaluated this quiz out of 100. In addition, they mentioned how much the score of this quiz would affect final grade students they get. This assessment was seen in the following:

> *The teacher gives a quiz (Appendix 4) that all questions are related to objectives 1, 2, 3, 4. If more than 90% of student will get higher than 75 points (over 100) from this quiz, it was assumed that student reach goals of the lesson. Moreover, teacher makes quizzes during semester and this quiz results will be reflected to final score of quiz as 10%. Also, for 5th objective, teacher verbally measures the students' knowledge but next lesson she/he will make quiz related to tentativeness.*

Based on this detailed explanation of assessment, they got full points from this part in this lesson plans, and they improved themselves compared to previous two lesson plans. Furthermore, it was observed that the same style of assessment was written in the following lesson plans. Therefore, they continued to get full points except lesson plan for role playing. In this lesson plan, the assessment was written below:

> *For 1st objective, teacher expects that students observe phases of matter as a result of temperature changes…For 5th objective, teacher observes the students whether they change their rooms individually according to direction, for 6th objective, teacher asks a question, if more than 90% of students give expected answers, it was assumed that the objectives will be gained by them.*

After analysis, it was seen that although they tried to write an assessment for each objective, most of this assessment was not related to objectives of the lesson directly. For example, the first objective of the lesson plans was to explain observation that is one of SPS. However, the assessment of this objective was related to observation of phases of matter. In addition, there were problems about clarity. For instance, in assessment of the 5th objective, they did not state what happens after the teacher observed students whether they changed their rooms individually according to direction. Likewise, for assessment of 6th objective, they expressed that they asked a question. However, they did not write this question. In the light of this evaluation, they got 1 out of 2 points.

In conclusion, considering all parts of lesson plan from the first lesson plan to the last lesson plan, it was seen that the group did not face problem in some parts of lesson plan which are introduction, instructional resources, materials and technology. Moreover, the group improved themselves in making closure, using of teaching methods, making assessment during third lesson plans. Furthermore, there were some deficiencies on writing objectives and teaching procedure in general.

Reason of Success in Lesson Plan Preparation

After the group prepared first three lesson plans for demonstration, 5E learning cycle, and argumentation, they was asked whether they believed they were successful in preparing lesson plan during this course.

In that time, all group members stated that they found their group as successful. However, they gave different reasons. For example, Selin mentioned that they developed the collective belief to the group. She added that this belief created motivation which causes them to feel successful. In other words, she stated that they believed in the group ability for preparing lesson plan. This referred to collective efficacy. Selin's words about this situation were as follows:

> *I think we were successful since we tried to do our best each week. For example, in the beginning, we thought that the teaching of physics subjects was difficult. But, so far we have prepared two lesson plans related to concept of "sound" and "electric circuit." We did it, and we really succeed in them because we believed in our group. This motivates us to prepare much better lesson plan in the following week.*

Ceyda focused on verbal feedback as a reason. She mentioned that this feedback contributed to their success. Therefore, it was reported that verbal persuasion source of collective efficacy played important role in their success. Ceyda expressed herself in the following sentences: "*...the feedback of the course assistants was very positive. It made us believe more in our group. So, we tried to improve our lesson plans, and started to get nearly full grade from them.".*

On the other hand, Mehmet and Kemal added that every week they tried to prepare better lesson plans which fit the criteria in the rubric of lesson plan; therefore, they worked very hard. As a result, it was observed that mastery experience source of collective efficacy made contribution to their success. Mehmet's statement was given below:

We want to prepare better lesson plan than previous one. We wanted to improve ourselves. So, we worked very hard. As a result, we created good products. Since we work very hard on the lesson plans every week, I think we are successful as a group.

In sum, during these three lesson plans preparation, it was reported that all group members found themselves successful in preparation of lesson plan. As a reason, they made different explanation. Although one of them argued that collective efficacy led to this success, the others specifically emphasized on the sources of collective efficacy which are verbal persuasion and mastery experience.

After taking their views, they continued to prepare lesson plans related to fieldtrip, project-based learning, and problem-based learning, respectively in following three weeks. When they finished preparing lesson plan for problem-based learning, the group members were asked again whether there was a change about feeling successful when they compared situation in previous three lesson plans with their situation in current three lesson plans.

All of them stated they still found themselves more successful in these lesson plans. Likewise, they gave different reasons. For example, Selin and Kemal stated that by preparing lesson plans every week, they understood how well they prepare lesson plan clearly. In other words, they mentioned about the influence of mastery experience of collective efficacy on their group performance. For instance, regarding this issue, Selin narrated below:

When comparing to last three lesson plans and current three ones, current lesson plans are better in terms of content since we understand well what we should do in lesson plan by preparing lesson plans every week. This increased our success…

On the other hand, Ceyda stated that they believed in the group about preparing lesson plan; therefore, they felt more successful. Therefore, she emphasized directly about influence of collective efficacy on their success in these sentences: "*From these lesson plans, we got high grades especially for fieldtrip and project-based learning. We started to believe much our group to prepare lesson plan. So, this makes us feel more successful.".*

Mehmet thought that there was improvement on psychological state of the group; therefore, they felt more successful. This referred to the influence of

psychological and affective state of collective efficacy on group performance. Mehmet explained his views as follows:

> *We are more successful since the harmony in the group increased. First weeks, we did not know what to do about the preparations of lesson plans. This created a tension and stress in the group. This affected our work. When we got high scores from current lesson plans, this tension and stress decreased. We felt more successful now.*

In brief, it was found that they developed themselves about lesson plan preparation; therefore, they felt more successful. Similar to the reasons of their success in the preparation of first three lesson plans, one of the group members claimed collective efficacy directly had an impact on their performance while three of them indicated that psychological and affective state, and mastery experience, which are the sources of collective efficacy, contributed to success in their lesson plans.

Lastly, in the following three weeks, they prepared lesson plans for analogy, role playing and laboratory work. Students were questioned again if there was a change about feeling successful in preparing lesson plan when they compared their situation in previous three lesson plans with their situation in current three lesson plans.

Kemal and Selin declared that there is no change of level of feeling successful at preparing lesson plans. Selin's statement was given below:

> *There is no change about this feeling from that time to now. The grades of the lesson plans dropped little. I believe that we are still successful since we are conscious that we are a group, we tried to act like that. We shared ideas, discussed them and helped each other to correct our missing all the time.*

On the other hand, Ceyda and Kemal stated that they felt more successful than their situation in the second three lesson plans since they gave more effort. Mehmet expressed:

> *Actually, there is increase in our success. We improved ourselves as individually during this process since we made contribution to each other. Because of that contribution, everybody tried to be more effective in group work. This increases our success.*

Concerning the reason of this feeling, Selin and Ceyda said that they mastered preparing lesson plan because they had experience about it every week. That is to say, mastery experience source of collective efficacy played essential role

in their success. For instance, Ceyda mentioned this occasion in the following: "*I find my group successful because we know how we should prepare effective lesson plans. We have experienced continuously on the preparation of lesson plan, and we get used to it…".*

On the other hand, Mehmet and Kemal emphasized that positive feedback of the course assistants and other groups make them feel more successful. More explicitly, they claimed that as a source of collective efficacy, verbal persuasion led to their success in preparing lesson plans. For example, Kemal's sentences were provided below:

> *I find my group more successful since we got positive feedback from the course assistants about lesson plans. Also, other groups made good comments when we performed microteaching of laboratory work. They said that they never saw the activity for global activity, and they could implement of this in their real class….*

In short, during the preparation of the last three lesson plans, it was reported that all group members still found the group successful while two of them expressed that they develop this success more. Regarding the reason of their success, at this time, they mentioned the influence of mastery experience and verbal persuasion.

In conclusion, the group prepared nine lesson plans during the science methods course according to the teaching methods they have learned in the theoretical part of this course every week. According to the examination of lesson plans, it was observed that they improved themselves about preparing lesson plan in the second three lesson plans compared to the first three lesson plans, and they tried to keep this improvement during the last three lesson plans.

In addition, all of the group members declared that in this process they found themselves as successful in preparing lesson plan after each three lesson plans. Moreover, almost all group members added that this success was improved continuously in this time periods. Concerning the reason of this feeling successful in preparing lesson plan, some of the group members expressed directly that they developed the belief about group for preparing lesson plans; therefore, this belief made contribution to their success. On the other hand, the other group members explained the reason of their success based on the sources of collective efficacy. In

other words, as reasons, they mentioned about the influence of mastery experience, verbal persuasion, and psychological and affective state on their success.

4.6. Research question 6

RQ5. How does preservice science teachers' collective efficacy make contributions to self-efficacy of group members concerning teaching of science in the science methods course?

Before investigating the influence of collective efficacy on self-efficacy of the group members, whether there was a change on self-efficacy between in the beginning of the semester and at the end of the semester was examined. For this, not only qualitative data but also quantitative data of STEBI-B were collected. First of all, a Wilcoxon Signed Rank Test was conducted to analyze this quantitative data. This test revealed no significant difference in scores of personal science teaching efficacy beliefs (PSTE), z = -1.60, p = .11 Likewise, it was founded that there is no statistically significant difference in scores of science teaching outcome expectancy (STOE), z = .91, p = .36. According to Pallant (2007), like all nonparametric technique, Wilcoxon Signed Rank Test is less sensitive to find differences between two occasions. Therefore, qualitative data about self- efficacy were also analyzed. Contrary to the results of the test above, it was reported that the group members focused on two topics which are "development of personal science teaching efficacy", and "development of science teaching outcome expectancy". These findings were discussed comprehensively as follows:

Development of Personal Science Teaching Efficacy

In the beginning of the semester, the group members made different explanation about their self-efficacy in science teaching. For example, Selin mentioned that she had some experience about teaching science. Therefore, she added that she believed in herself about teaching science. Selin narrated her view below:

> *I can do that [teaching science]. I believe in myself since I have been giving private science lessons to middle schools students for a while, and I have got positive comment from them. They said they understood well when I taught the lesson.*

On the other hand, Mehmet stated that because he had no experience about teaching science, he did not have enough confidence to science teaching. Mehmet's

sentences were like that "*I do not know. I have no experience about teaching experience. Maybe I can teach science but not all science concepts.".*

Like Mehmet, Kemal explained that he did not believe in himself because he had deficiency about the necessary skills to teach science. Kemal mentioned: "*It [teaching science] seems difficult for me. Although here [in science education program], I have learned much knowledge about concepts of science in detail, I do not how to teach this knowledge on students.".*

Ceyda expressed that there is uncertainty about her ability to teach science. Ceyda's statement was: "*I believe I can teach science but I am not sure I become effective since I do not know to what extent I should teach the concepts of science.".*

After they got opinions about their self-efficacy about teaching science, conducting the science methods course has been started. As mentioned earlier, in this course, the group prepared lesson plans for demonstration, 5E learning cycle, and argumentation, respectively during first three weeks. At the end of third week, they were asked if they believed in themselves to teach effectively science to middle school students. Although Ceyda, Selin and Mehmet were uncertain, they declared that they improved the belief regarding teaching science individually. For example, Ceyda's, explained this occasion through her words: "*I do not claim that I can teach science effectively because I do not have enough experience or I do not have any evidence to prove. However, I have this belief; therefore, I can do it.".*

On the other hand, Kemal said that they believed in himself about teaching science based on previous experience. Kemal's sentences like that: "*The other day I tried to perform the microteaching in front of my peers. I asked some questions related the topic to attract students' attention and I saw that I am good at it. So, I gained confidence regarding teaching science.".*

After that, they wanted them to present some reasons about their thoughts about self-efficacy. They gave different reasons related to the experience they had in group work. For example, Ceyda mentioned that as a group, they took the other group' microteaching plans as models make them prepare effective lesson plans; therefore, she enhanced the belief in herself about teaching science. Implicitly, she underlined that vicarious experience of collective efficacy influenced on her self-efficacy. Ceyda's view was provided in the following:

We observed other groups' microteaching, and we saw some important points about the content of lesson. We tried to integrate them into our next lesson plans. Also, we recognized that there were some mistakes in them. We tried to not make these mistakes. As a result, I think we prepared lesson plans very well. Now If prepare lesson plan alone, I will continue to use these important points, and not to repeat these mistakes. This made me believe myself in teaching science.

On the other hand, Mehmet said that the feedback of the course assistants and other groups had impact on believing himself regarding teaching science. In other words, he emphasized that the verbal persuasion of the course assistants and other groups about their group lesson plans led to development of his self-efficacy. Mehmet mentioned:

I have confidence about teaching science since as a group we were preparing lesson plan by considering smallest detail. Then, we got feedback from my assistants and other groups. They usually expressed what they liked in our lesson plans or microteachings. When we got positive feedback, we wanted to make it better. Therefore, I think that this is so beneficial since here I am affected individually. This provides me gain confidence about myself [teaching science].

Selin and Kemal stated that they learned how to prepare lesson plan individually when they were preparing lesson plan as a group every week, and this experiences caused them to believe in themselves about teaching science. More explicitly, they mentioned that the mastery experience of the group about preparing lesson, which is source of collective efficacy, helped them develop the belief regarding teaching science. Regarding this issue, Selin's sentences were given as follows:

In the meetings, we discussed many points every week to prepare lesson plans. For example, we considered how the teacher would gather students' attention into lesson. Or, we argued how the teacher would associate the science concept into real life. Or, we discussed choosing appropriate activities to selected topic and class level. Now, I had confidence to teach science since I experienced [about them] a lot in these meeting.

In brief, it was emerged that compared to their initial statements about self-efficacy at the beginning of the semester, there was improvement about the group members' personal efficacy beliefs regarding science teaching during the preparations of the first three lesson plans. In addition, it was observed that the group members focused on different sources of collective efficacy -mastery experience,

vicarious experience, and verbal experience- to explain the reason of this development.

In the following three weeks, they prepared three more lesson plans related to fieldtrip, project-based learning, and problem-based learning, respectively. After the preparation of lesson plan for problem-based learning, it was asked again whether they believed themselves to teach effectively science to middle school students as individually and compare themselves current situation with prior situation in which they prepared first three lesson plans for demonstration, 5E learning cycle, and argumentation. In the light of this question, they stated that their personal science teaching efficacy got improved. For example, Selin explained their opinions in the following: "*Since my self-confidence has increased, there is development about my thought that I can teach science to middle school students.".*

As a reason, Ceyda and Mehmet expressed that as a group they mastered on preparing lesson plans more than first three lesson plans; therefore, this caused them to improve personal science teaching efficacy effectively. Explicitly, this showed the important role of the mastery experience of collective efficacy on personal science teaching efficacy. For example, this situation was seen in Ceyda's sentences:

> *These lesson plans reinforced my confidence about teaching science because more experience about lesson preparation as a group helped me understand how the parts of lesson plan should be made. For example, I realized clearly how to close the lesson or make assessment based on the objectives of the lesson in these lesson plans.*

Although Selin made explanation with same line with her friends, she touched on different point that she expressed that success in the group made her believe herself very much. Selin's statement was: "*Our success as a group, and the grades we got showed that we prepared effective lesson plans. This made me increase self-confidence. I think I can prepare lesson plan, if I work like we did in the group work.*

On the other hand, Kemal mentioned that he observed other groups' microteachings and he would take them as a model in teaching science to his future students. He added that this event led to enhance his personal science teaching efficacy. In other words, it was emphasized that his personal science teaching

efficacy was improved due to vicarious experience source of collective efficacy. Kemal explained his view as follows:

> *We had a chance to observe other groups' microteachings. They found creative activities for each teaching method than the first three lesson plans, and I will implement some of them in my class [when I become inservice teacher] to attract students' attention. I think this makes me develop my confidence [about teaching science]*

In sum, it was clear that their personal science teaching efficacy was enhanced in the period of the preparation of lesson plans for fieldtrip, project-based learning, and problem-based learning. While three of the group members underlined mastery experience source of collective efficacy in preparing lesson plans as the reason of this improvement, the other group member emphasized that vicarious experience source of collective efficacy made him believe more to teach science effectively.

Lastly, they prepared three more lesson plans related to teaching with analogy, role playing and laboratory work. Then, Ceyda, Selin and Mehmet stated that they improved their personal science efficacy belief than the former situation in which they prepared lesson plans for fieldtrip, project-based learning and problem-based learning. For example, Selin indicated her opinion like that: "*I believe more in myself because I learned new three teaching methods thanks to our group lesson plans. So, I can teach more science concepts with these methods.".*

Regarding the reason, Mehmet, Selin and Ceyda mentioned about the mastery experience about preparing these lesson plans made contribution to this development. More explicitly, they stated that having experience about preparing group lesson plans every week led to increase their self-efficacy about teaching science. For example, Mehmet expressed that such experiences developed himself concerning teaching science by eliminating their personal deficiencies. Mehmet's thought was given below:

> *As a group, we tried to prepare much better lesson plans like previous one. Therefore, we always searched activities for the lesson plans, integrated these activities into lesson by using teaching methods in every group work. By experiencing as a group, I developed myself more about them in these lesson plans as well. So, I gained more confidence about science teaching. I think I can teach effectively now.*

Like Mehmet, Selin emphasized that such group experience about lesson planning helped her increase her confidence to teach science. Selin said: "*In these lesson plans, we as a group tried to find more creative activities for preparing lesson plans. This experience widened my horizon. It seems that I can teach every science concepts effectively to students.".*

In parallel to Mehmet's and Ceyda's statement, Ceyda expressed that her anxiety decreased because of the experiences about preparing lesson plans as a group every week. Ceyda's words: "*Preparing lesson plans as a group made my anxiety decrease since individually I had more experiences about lesson planning as well when we were preparing the lesson plans.".*

On the other hand, Kemal focused on another source of collective efficacy which was verbal persuasion. He mentioned that his self-efficacy belief about teaching science was influenced by verbal feedback of the course assistants on their group lesson plans. Kemal's sentences was given in the following:

> *We continued to get positive feedback about these lesson plans from our course assistants even if we made some mistakes. This showed that we were good at preparing lesson plan. This made me improve the belief [in myself about teaching science]. I can prepare lesson plans which were similar to group lesson plans.*

As a result, during the preparation of the last three lesson plans for teaching with analogy, role playing and laboratory work, the group members' personal science teaching efficacy were improved more compared to their situation in the preparation of former three lesson plans. Three of the group members argued that mastery experience sources of collective efficacy was important factor while one group member claimed that another source, verbal persuasion had an impact on the improvement in personal science teaching efficacy.

In conclusion, the group prepared nine lesson plans based on different teaching methods. It was reported that all group members enhanced their personal science teaching efficacy continuously. Regarding this development, they gave some reasons related to the sources of collective efficacy, which are mastery experience, vicarious experience, and verbal persuasion. Mostly, they pointed out the influence of mastery experience. Moreover, it was seen that the group members could change the reason of their improvement on their personal science teaching efficacy over

time. In other words, as a reason about the improvement, while one of the group members underlined a specific source of collective efficacy in the preparation of first three lesson plans, another different source of collective efficacy was emphasized by the same group member during the preparation of following three lesson plans.

In general, all these findings showed that collective efficacy made contribution to the group members' self-efficacy indirectly. In other words, it was found that the improvement of personal science teaching efficacy was provided by the sources of collective efficacy.

Development of Science Teaching Outcome Expectancy

In order to learn their initial opinions about their science teaching outcome expectancy, the group members were asked whether they believed that they would make contribution to the success of students in science learning as a teacher before the science methods course was conducted. Although all of them mentioned that they would be effective science teachers, they pointed out different reason of their belief. For example, Selin and Mehmet expressed that their teaching experience played important role in the development of their belief. Selin mentioned like that *"I think I can be effective teacher. So, as I mentioned before, I gave private lessons to middle school students. One of these students said "you taught very well". This made me believe myself to become a good teacher…."*.

On the other hand, Kemal explained that he wanted to implement the experience about his student life when he became inservice teacher. He believed that this event would help his own students become successful at science. Kemal's words:

> *I can help students to be more successful. For this, I want to have much contact with students, students' families and school management. This triadic communication made me become successful when I was a student. So, I believe when I establish this communication, my students will become successful automatically.*

Like the other group members, Ceyda believed that she would be useful for her students to teach science. As a reason of his thought, she mentioned about the influence of her education in science teacher education program. Ceyda expressed her view in the following:

> *I believe. I have been learning how to teach science to students [in science teacher education program], and especially I have been gaining experience*

about student-centered approach. So, I believe myself I can teach science, and my students would learn science well.

Their science teaching outcome expectancy was examined again after they prepared three lesson plans for demonstration, 5E learning cycle, and argumentation. They were asked to compare themselves with initial opinion at the beginning of this course. All of them expressed that they believed themselves more as a teacher to make students understand science topic and become successful in this course. Concerning this situation, Selin's sentences were given below:

I believed more that I would make contribution to my students about learning science because we tried to prepare lessons plans like real teachers. I learned many important points from these lesson plans, I will try to implement them in my classroom.

Regarding underlying reason of their thought, all group members pointed out mastery experience source of collective efficacy had an impact on the improvement of their expectancy. More explicitly, it was mentioned that as a group, they prepared the lesson plans to help students understand topic very effectively; and thanks to these practices, they developed their personal expectancy that they would be useful in students' learning science. Kemal, Mehmet and Selin explained their views in the following:

Kemal: In the group work, we discussed every part of lesson plans. We asked each other whether students understood or whether we should simplify the knowledge. I believe this influenced me. I always will consider about how my students learn science effectively. This is engraved in my subconscious…

Mehmet: We tried to reduce abstract topics to make students learn better. For this, we linked science concepts with daily life issues in our lesson plans. This make me develop as individually. I can make contribution to the learning of my students like doing that.

Selin: …for example, in these lesson plans, we always tried to start lesson with interesting activity to attract their attention. So, I will implement these in my classroom to increase my students' attention so that my students will learn science.

In parallel to this explanation, Ceyda likened scenario with what they were preparing in lesson plan:

Actually, we are preparing lesson plans like scenario, we write everything step by step in lesson plans. We try to take level of students into consideration. For instance, we discuss whether it is difficult for student to

understand any example related to the topic of the lesson plan. If we disagreed about an example, we would have given another example from daily life. Since I learned such this [considering students' learning] in the group work, I believe that I can help student learn science in real classroom.

In brief, during the preparation of lesson plans for demonstration, 5E leaning cycle and argumentation, they believed more that their students would learn science effectively. As a reason, they pointed out the influence of mastery experience source of collective efficacy.

Next, they prepared three more lesson plans related to fieldtrip, project-based learning and problem-based learning, respectively. After the preparation of the lesson plan for problem-based learning, it was asked again whether they believed as individually that they would be effective in students' learning of science, and compare themselves with their previous situation in the first three lesson plans. All of the group members stated that they improved more the belief that they would contribute to students' success in science as a teacher. For example, Selin expressed:

I definitely believe more that I can make contribution to students' learning science because when I have considered my middle school science teachers, I realized that they made direct instruction. If I compare myself with them, I think that I can make difference on students' learning science; therefore, my students will become more successful. For example, I can attract students' attention with my methods I have learned or turning abstract concepts into concrete.

After opinions were taken about their belief, they were expected to give some reasons. Similar to previous situation, they mentioned that group experience in preparing lesson plans led to believe themselves more that their teaching would positively influence on students' learning. In other words, it was reported that mastery experience helped the group members to improve science teaching outcome expectancy. For example, Kemal indicated:

I definitely believe since [as a group] we generally consider everything to make students learn easily, but we discussed comprehensively whether activities were appropriate, or whether this science topic was taught with the teaching method in these lesson plans. What we have done in the group work made me learn such topics as well. I will pay attention to them in my teaching. Thus, I believe myself more that I can be effective teacher to my students' learning science.

In sum, compared to previous situation in which they prepared the first three lesson plans for demonstration, 5E learning cycle and argumentation, their personal

belief about their teaching would have impact on students' learning science was improved more because of mastery experience of collective efficacy in the current lesson plans.

Lastly, they prepared three more lesson plans for teaching with analogy, role playing, and laboratory work. Then, they asked same question again. Kemal and Selin again pointed out that they developed more their belief that they made students understand science effectively when compared to their situation in the second three lesson plans. For instance, Selin's sentences were provided below:

> *It is improved since during these three weeks, we learned three more different teaching methods effectively, and all of these teaching methods made positive contribution to me. I will use all of them [when I become an inservice teacher]. I believe I can be helpful with these teaching methods for the success of students.*

Although Mehmet and Ceyda emphasized their belief was improved, they approached from different points. They thought they made students like science and developed positive attitude towards science. In addition, they asserted that this resulted in the students' success in science. Ceyda stated about this situation:

> *I believed myself more since I think I can turn negative attitude of students about science into positive. I can urge them to learn, and I can improve their enthusiasm for learning. I think all of these will influence on my students' success in learning science positively.*

As a reason of development of their belief, they mentioned that they planned to use similar activities or application in these three lesson plans to help their students learn science effectively. For example, Ceyda's opinions were presented below:

> *In the group work, we were thinking whether students would understand science topic. For this, we took into consideration the grade level of students. We tried to prepare our lesson plans in the light of that. For example, we simplified knowledge or, we tried to give examples from daily life. I am planning to consider all of these in my teaching to increase the success of my students.*

In short, all group members mentioned that they enhanced their belief more that they would be helpful for their students to learn science in the preparation of last three lesson plans. Concerning the reason of this development, they addressed mastery experience of collective efficacy in these lesson plan preparations.

To conclude, it was found that from first three lesson plans to the last ones, all group members believed that they would be effective to make student learn science and become successful. Moreover, it was reported that this belief was enhanced continuously in this time length, and mastery experience source of collective efficacy played essential role in the development of this belief.

4.7 Summary of Results

In the present study, as a first result, the group members were found to conduct collaborative work when they were preparing lesson plans based on science teaching methods in the science methods course. Under collaborative work, they emphasized five elements were positive interdependence, group accountability, face-to-face interaction, psychological safety and group processing including accumulation, interaction, examination and accommodation. Moreover, it was found that the group members developed collective efficacy regarding preparing lesson plan, and this development was happened thanks to the four factors which were collaborative work, shared purpose, attitude towards group work, and group cohesion. In addition, the group members pointed out that their collective efficacy was improved continuously. Furthermore, it was reported that the sources of collective efficacy had an impact on formation of group behavior. For example, for mastery experience, previous successful and failure experience about lesson plan preparation caused the group to prepare more qualified lesson plans in the following weeks. Likewise, in verbal persuasion, positive and negative feedback from the course assistants and the other groups in the classroom helped the group members to motivate to prepare better lesson plans. For vicarious experience, they mentioned that they took the course professor's suggestions, the course assistants' and the other groups' microteachings as a model when they were preparing lesson plan. Concerning psychological and affective states, they explained that they worked in an environment which was free from stress, fear and anxiety. This situation provided them more concentration about preparing lesson plan. Another important finding of this study was that group performance regarding lesson plan preparation was increased over time. The group members emphasized that collective efficacy directly or indirectly influence the improvement of group performance. In other words, while some group members mentioned they develop the belief to group about preparing

lesson plans, the others gave the sources of collective efficacy as a reason the improvement. Among the sources, the group members never mentioned vicarious experience. Last finding was related to the influence of collective efficacy on self-efficacy of group members concerning teaching science. It was found that the sources of collective efficacy played important role in enhancing personal science teaching efficacy and science teaching expectancy outcome. Especially, mastery experience of collective efficacy was emphasized mostly from the group members.

CHAPTER V

DISCUSSION

This chapter presented the review of findings, discussion of these findings in the light of literature. It also included implications for educational practice, recommendation for further research, and conclusion.

5.1 Discussion of Findings

Collective efficacy is one of group motivational constructs which refers to belief the group about their capabilities to accomplish a mission (Bandura, 1997). In the literature, it was highlighted that collective efficacy made an influence in the formation of group behavior, development of group performance and group members' self-efficacy (Bandura, 1997; Goddard, 2001; Fernandez-Ballesteros et al., 2002; Fives & Looney, 2009; Peterson et al., 2000). Therefore, in this study, it was aimed to investigate collective efficacy of preservice teachers who work in the same group.

As a first finding of this study, it was found that they engaged in collaborative work when they were preparing lesson plans. More explicitly, all group members claimed that they worked together to prepare every part of lesson plans. The reason why they conducted collaborative work may be explained by the effect of past experiences of preservice science teachers about group work since some of them stated that in their past group works, they divided group assignment into parts, preparing them individually without interaction, and lastly joined them to form final product. They emphasized that they found these group works ineffective for their learning. Therefore, they may choose working collaboratively in this group work because it provides real and meaningful learning (Chiriac, 2014). In addition, the all group members declared that the science methods course was important for them to learn how to teach science to middle school students, and the knowledge they learned in the course was valuable for their teaching profession. Therefore, to understand the content of the course clearly and to eliminate their personal deficiencies about

teaching, they might work collaboratively. Regarding collaborative work, it was reported that there were some factors which help them work as union. All group members argued that they depended on each other to prepare lesson plan; therefore, they created psychologically comfortable environment to express their ideas, and they used face-to-face interaction continuously. In addition, they emphasized that each of them make contribution to preparation of lesson plans. Lastly, it was expressed that they worked in a process including accumulation of needed knowledge about lesson plan they would prepare, exchanging opinions about what they would do in lesson plan, examination of these opinions by discussion to select the most appropriate ones, and the development of the selected opinion for implementation in the lesson plan. These all findings were parallel with Johnson et al. (1991)'s core attributes of successful group work, which are positive interdependence, psychological safety, face-to-face interaction, group accountability, and group processing, respectively. These findings also confirmed Jones, Jones, and Vermette's (2011) idea that lesson planning is difficult job for preservice teachers. Concerning this issue, Clark and Dunn (2001) argued that they should consider about instructional requirements, conditions, materials, activities and evaluation at the same time. Therefore, this attributes of group work may be effective for them to learn how lessons should be planned properly. In addition, in this course, they prepared lesson plans related to newly learned science teaching methods. However, they did not have enough experiences concerning use of these teachings methods in the lesson plans. Therefore, they may give importance to interaction among group members and group members' opinions to create qualified lesson plans.

Another important finding of this study was that they developed the belief about capabilities of the group towards preparing lesson plans. This finding was consistent with Bandura's (1997) collective efficacy construct "a group's shared belief in its conjoint capabilities to organize and execute the course of action required to produce given levels of attainments" (p.477). Considering this definition, it can be said that the group members developed collective efficacy towards preparing lesson plan. In addition to this finding, it was found that some constructs including collaborative work, shared purpose, attitude towards to group work, and group cohesion made contribution to the development of collective efficacy. Firstly,

concerning relationship between collaborative work and collective efficacy, Lent et al. (2006) emphasized that collective efficacy is aggregation of group members' beliefs concerning how they perform *as a unit.* In a similar vein, in the present study, all group members stated that they did everything collaboratively in preparing the lesson plans. Secondly, they stated that during preparing lesson plan, they had common goal which was to learn teaching methods effectively and reflect this teaching method in their lesson plan appropriately. This was congruent with Bandura (2000)'s claim that collective efficacy derives from the belief of group members in desirability of a common goal. Thirdly, it was found that all of the group members expressed that thanks to the group work, they developed themselves in terms of learning, sense of responsibility, critical thinking skills, and interpersonal skills such as communication, friendship. Moreover, two of them explicitly stated that they had positive attitude to group work whereas other two members defined their attitude as neutral. Actually, although these two members declared that their attitude toward the group work was neutral, they indicated that this group work make contribution to their personal intellectual and social development. Therefore, it may be said that two members had positive attitude underlying their subconscious. Having positive attitude may help formation of collective efficacy among preservice teachers for preparing lesson plan. This finding was consistent with Jones and Carter's (2007) study. They stated that attitude may play important role in development belief system. Lastly, all group members expressed that they created group cohesion; therefore, they worked with other members in the group with harmony. In a similar vein, Carron et al. (1996); Carron and Brawley (2000) reported that group cohesion was related to group members' feelings of commitment to the group. Moreover, Lee and Farh (2004) argued that group cohesion was significantly related to collective efficacy and group performances. In line with this idea, in the present study it was found that group cohesion had an influential factor on the development of collective efficacy.

Baker (2001) claimed that collective efficacy had dynamic structure, and evolved when the group work was progressed. In the light of the statement, in the current study, how their collective efficacy of the group members changed over time was also investigated. As noted before, the group prepared a total of nine lesson

plans in a semester-long science methods course. This duration divided into three equal time length. Consisted with Baker's (2001) study, it was found that the group members' collective efficacy towards preparing lesson plan was improved from the first three lesson plans to the second three lesson plans. Decrease in the level of anxiety of the group members may lead to this improvement since they expressed that they were stressful when they were preparing lesson plans at the beginning of the course. When they gained experience every week, they may get used to it and begin to feel more confidence to their group for preparing lesson plans. On the other hand, from the second three lesson plans to the last three lesson plans, while two members expressed that the level of collective efficacy got stronger, one member stated that the level of collective efficacy was not changed, and other member mentioned that her belief to the group about preparing lesson plan weakened slightly. Some problems such as workload, pressure of other courses, family issues, and time length of the semester may negatively influence these two group member's collective efficacy.

Bandura (1997) postulated that there were four sources of collective efficacy, which were mastery experience, vicarious experience, verbal persuasion, and psychological and affective state. Regarding mastery experience, past group experience played significant role in the development of collective efficacy (Goddard, 2001, Goddard et al., 2004, Lee & Farh, 2004). Moreover, Bandura (1997) and Myers et al. (2004) argued that previous successful experience encouraged the group to create more efficient products while previous failure experience influenced negatively the group behavior such as exerting less effort, showing less persistence. Similar to their explanation, in the present study it was indicated that successful lesson plan preparation motivated the group members to keep their success, and make them produce much better qualified lesson plans in the following weeks. On the other hand, all of the group members claimed that failure experience about preparing lesson plans may influence their group work just like successful experience, and they tried to work hard and correct mistakes to prepare more qualified lesson plans. This finding contradicted with Bandura's (1997); Myers et al.'s (2004) ideas about failure experience and it could be inferred that other motivational factors might have an effect on the formation of this situation. For

example, Ramnarain (2016) claimed that intrinsic and extrinsic motivations are important motivation constructs in educational environment. In the line with this idea, the group members in the present study might be motivated intrinsically, and they wanted to learn use of new teaching methods. For this purpose, they continued to give more effort or show persistence to prepare their lesson plans even if they had had previous failure experience. On the one hand, extrinsic motivation might lead them to work harder in that situation. As mentioned earlier, they were graded from lesson plans they produce together. Considering the grade they would get at the end of semester, they might get motivated to produce qualified lesson plans.

Bruton et al. (2014) pointed out that vicarious experience such as taking any other groups' positive behaviors as a model in their own group work caused high collective efficacy of group members. Therefore, the influence of vicarious experience source of collective efficacy was investigated in the current study. During the science methods course, every week the professor of the course explained theoretical background of a science teaching method, and showed some sample activities related to this method. Then, the course assistants performed sample microteaching with respect to related teaching method. On one hand, the group had a chance to watch other groups' microteachings based on their lesson plan. As a result, the finding of current study showed that the group members took other groups' microteaching, the course professor's lecture, and the course assistants' microteachings as models when they were preparing their own lesson plans. These all findings were consistent with Bandura (1997) and Goddard et al.'s (2004) statement that vicarious experience of collective efficacy was related to taking a model of other group or other people such as supervisors or colleagues, parents, peers, who have similar goals and familiar opportunities or constraints. The reason of why they took them as model when they were preparing lesson plans might be lack of enough experience about science teaching methods. Thanks to the science methods course, all group members began to familiarize these teaching methods. Therefore, they might take the other groups in the class, the course professor' lecture and the course assistants as models to gain practical knowledge about implementation of these teaching methods into their lesson plans.

In the science methods course, after the group performed microteaching based on their lesson plans, the other groups were asked to give feedback about their performance. Likewise, the course assistants emphasized their strengths and weaknesses about their microteaching. In addition, the course assistant gave detailed feedback about their lesson plan every week. Regarding influence of verbal persuasion in this environment, it was found that other groups' positive feedback encouraged them to prepare better lesson plans with respect to qualification. Similarly, all group members expressed that the feedback of the course assistant was effective for them to eliminate their mistake in the following lesson plans. These findings confirmed Bandura's (1997), and Sorlie and Torsheim's (2011) claim that positive feedback about the group product or performance provided encouragement to be more success at the task. Moreover, in the present study, the group members tried to correct their mistakes in the light of the other groups' negative critics. In this respect, there was a contradiction between the result of the present study and Bandura's (1997), Sorlie and Torsheim's (2011) opinion that negative feedback led to demotivate group members. This contradiction can be explained by effect of other motivational factors (e.g., intrinsic motivation, extrinsic motivation). Like mastery experience, they might have an impact on the development of this situation. Another reason could be less number of negative feedback. All group members mentioned that in the class other groups usually avoided making negative comments to the group because they did not want get negative comment when they performed their microteaching. Therefore, the real influence of negative feedback might not emerge in the class.

Psychological and affective states are another source of collective efficacy. Bandura (1997), Goddard et al. (2004) pointed out that fear, stress, anxiety about task in the group lead to decline group confidence; conversely, feeling arousal can motivate people to improve their future performance. In parallel to this idea, the group members in the present study reported that they eliminated stress by conducting some activities in group work such as making jokes, telling funny stories, or listening to music. They added that without stress, they concentrated on preparing lesson plan deeply, and became more productive.

The other major finding is related to the performance of the group's lesson plan preparation. From the beginning of semester to the end of semester, lesson plans were qualified in some parts such as closure of lesson, assessment, and usage of teaching method. On the other hand, they kept making some mistakes in writing objectives and teaching procedure. Deficiency in writing objective can be explained by the limited experience of preservice teachers in this area. Although they took a lesson about writing objective in the second year of the science teacher education program, they might not have done enough practice. Regarding teaching procedure, it was found that the group members did not explain the activity used in some lesson plans in detail. This may be stemmed from expressing themselves inadequately since in the preparation of lesson plans, it was necessary to use official language of university which is English to write lesson plans instead of their native language.

In parallel to the development of lesson plans during this process, the group members also mentioned that they found group performance successful. As reason of this success, they claimed that directly or indirectly collective efficacy contributed to their group performance on lesson plan preparation. More specifically, some group members expressed that their belief to the group about preparing lesson plan which refers to collective efficacy caused them to improve group performance. This finding was consistent with the previous studies indicated that collective efficacy is significantly related to group performance (Bandura, 1997; Goddard, 2001; Greenlees et al., 1999; Gully et al., 2002; Hasan & Ali, 2007; Hodges & Carron, 1992; Klassen & Krawchuk, 2009; Lent et al., 2006; Myers et al., 2004; Peterson et al., 2000; Wang et al., 2014). On the other hand, in the present study, the other group members underlined that the sources of collective efficacy such as mastery experience, verbal persuasion and psychological and affective state were responsible for the improvement of their group performance. The finding might be related to Junqueira and Matoti's (2013) explanation that after people interpret the consequences of their actions, the judgements of competence are developed based on these interpretations. Because collective efficacy and self-efficacy were derived from social cognitive theory of Bandura (1997), this situation may be relevant for collective efficacy as well. Therefore, the group members may express themselves by using the experiences in the group activity which is related to sources of collective

efficacy in order to explain the reason of their improvement of group performance. On the other hand, regarding the sources of collective efficacy, none of the group members showed vicarious experience as a reason of this development. This pointed out that compared to other sources; vicarious experience had no significant impact on their perception. Concerning this issue, Bandura (1997) argued that models should have similar characteristics with observer to notice influence of vicarious experience. However, in the present study, the group members may not see really the other groups as equal in terms of ability, competences and motivation even though they stated they took other groups in the class as model when they were preparing lesson plan.

One of the most important findings of the study was that the sources of collective efficacy played important role in the development of the group members' personal science teaching efficacy and science teaching outcome expectancy. This findings supported the literature that collective efficacy was significantly associated with self-efficacy of group members (Fernandez-Ballesteros et al., 2002; Fives & Looney, 2009; Goddard & Goddard, 2001; Lent et al., 2006; Lev & Koslowsky, 2009; Skaalvik & Skaalvik, 2010; Viel-Ruma et al., 2010). Similar to previous findings, it was found that while they never mentioned the effect of collective efficacy directly, the sources of collective efficacy led to enhance their personal science teaching efficacy and science teaching outcome expectancy. This situation can be explained again by Junqueira and Matoti's (2013) claim that interpretation of experience shapes efficacy information. Therefore, all group members explained the reason of the improvement in personal science teaching efficacy and science teaching outcome expectancy based on the experience in the group work.

As noted before, the group prepared nine lesson plans during this course. Personal science teaching efficacy and science teaching outcome expectancy was examined after each three lesson plans. Regarding personal science teaching efficacy, it was reported that the group members improved continuously the belief that they can teach science effectively. In addition, the group members gave different reasons about this development and they mentioned separately the influence of mastery experience, vicarious experience, and verbal persuasion. This may demonstrate that personal perception resulted in this difference. Moreover, influence

of mastery experience source of collective efficacy was emphasized mostly by the group members. This was congruent with Bandura's (1997), Palmer's (2006a) notion that mastery experience was the most influential sources of efficacy information. Moreover, it was found that they changed their reason of the improvement on their personal science teaching efficacy. In other words, in the period of first three lesson plans while one member could emphasize that verbal persuasion of collective efficacy was responsible for the improvement, he claimed that his personal science teaching efficacy enhanced thanks to mastery experience source of collective efficacy in the second three lesson plan preparation. This might be stemmed from that sources of collective efficacy could not influence equally on development of personal science teaching efficacy in specific time period.

Concerning science teaching outcome expectancy, it was found that the group members believed that they would be effective to make students become successful in science. Moreover, it was found that the group members' science teaching outcome expectancy was enhanced continuously, and preparing lesson plan as a group every week which is related to mastery experience had an impact on the improvement of their belief. This finding was consistent with Bandura's (1997), Palmer's (2006a) studies showing powerfulness of mastery experience. Possible reason why mastery experience of collective efficacy was major responsible factor on improving science teaching outcome expectancy may be related to perception of group members. Concerning this issue, they expressed that as a group, they considered some important points such as level of students and their interest when they were preparing lesson plan. These points may be perceived as important on student's learning science effectively or developing positive attitude towards science; therefore, they may improve themselves individually about these points to be effective inservice teachers.

5.2 Implications of this Study

The results of the study showed that collective efficacy played essential role in creating positive group behavior and improving preservice science teachers' group effectiveness and self-efficacy regarding science teaching. Considering these results, science teacher educators should take this construct into consideration to develop their students' group work in their science methods courses. For this purpose, such

courses can be designed to form collective efficacy in the group work. For example, the four factors, collaborative work, shared purpose, attitude toward group work, and group cohesion, which influence the development of collective efficacy should be considered in these courses. More specifically, science teacher educators should encourage preservice science teachers to conduct collaborative work in their science methods courses. At the same time, they should let these preservice teachers who have similar purpose and good relationship with each other gather to work. In addition, the attitude of the group work should be improved by explaining benefits of group work, and showing creative and effective group product from the real life. After providing development, the sources of collective efficacy (mastery experience, vicarious experience, verbal persuasion, psychological and affective state) can be implemented in the courses in order to improve collective efficacy among preservice science teacher. For this purpose, instructional activities or course assignment related to these sources can be selected by science teacher educators. For instance, they can want their own students as a group to prepare lesson plans several times for mastery experiences. Then, they can be asked to perform microteaching based on the lesson plans. Verbal experience can happen when the microteachings may be discussed in the class to realize their strengths and weaknesses, and to prepare qualified lesson plans. Moreover, to provide vicarious experiences, science teacher educators should create an environment for their students to observe efficient microteachings to take them as models in preparing following assignments. Furthermore, science teacher educators can help their students to create a work environment which is free from stress, anxiety, and fear in order to implement the psychological and affective state source.

The science teachers educators should also take collective efficacy into consideration for their other courses. Similarly, in order to develop collective efficacy, collaborative work, shared purpose, attitude toward the group work and group cohesion should be emphasized in the courses. Moreover, the science teacher educators should integrate sources of collective efficacy in the context of the courses liked mentioned above.

Another implication of the current study is related with science teachers. In the literature, it was declared that teachers had negative previous experiences

concerning group work such as difficulties on classroom and time management, some group members' bad temper and irresponsibility and ineffectiveness in learning and communication (Gillies & Boyle, 2010); therefore, science teachers avoided conducting group work. However, in the present study, the findings showed that all group members mentioned that their learning gain, sense of responsibility, critical thinking skill, and social skills such as communication was improved thanks to group work. From this perspective, science teachers should be more willing to integrate group work in their courses to enhance their students' learning of science, and their skills stated above.

The results of the present study also pointed out that the group members developed positive attitude toward working together. Considering that collaboration was accepted as 21st century skills for lifelong learning (NRC, 2010), science teachers can accustom their students to work together in early ages to gain positive attitude towards working together in order to retain collaboration skill in their life.

In the present study, it was reported that the sources of collective efficacy in the group work positively influence the group members' self-efficacy concerning teaching science. Similarly, science teachers can also help their students improve their self-efficacy regarding learning science by implementing in-class activities related to these sources in their group work like science teacher educators. Moreover, collective efficacy should be taken into consideration by science teachers to improve group performance of their students since in the present study it was found that the sources of collective efficacy made contribution to group performance on lesson plan preparation as well. For this purpose, firstly group work should be encouraged in classrooms. Then, the sources of collective efficacy should be integrated in content of lessons. For example, in the Turkish science curriculum, there are some objectives related to designing projects related to solving environmental problems, doing recycling and living sustainability (MoNE, 2013). In order to prepare effective projects about these topics, firstly science teachers can ask their students to conduct group work. Then, they can provide some activities regarding the sources of collective efficacy like mentioned above for preservice science teacher education.

5.3 Recommendation for Future Research

This study aimed to investigate collective efficacy in the group work of preservice science teachers during science methods course. This study may be developed in some respects for future research. For example, Klassen and Krawchuk (2009) mentioned that to observe the influence of collective efficacy on group performance clearly, there was need more extended time in this kind of research. Therefore, from this perspective, it might be useful to widen time period by conducting a longitudinal study.

In addition, there were some research about collaborative work between preservice teacher and inservice teacher to prepare authentic teaching activities (Kenny, 2010; Zhou et al., 2011). Based on the findings of these studies, it would be valuable to explore how the group work of preservice science teacher and inservice science teachers would be effective when the formation of collective efficacy is provided.

Apart from these recommendations, there are also general recommendations about development of collective efficacy research. First of all, there is limited number of research about this construct in the literature (Bandura, 1997). Especially, preservice science teacher should be investigated more in other courses of teacher education program to ensure the importance of collective efficacy in the group work. In addition, research on students in compulsory education in terms of the construct was also limited (Goddard, 2001). Therefore, in school context, there may be need for investigation of collective efficacy to develop related literature as well.

In recent years, the fact that science teaching efficacy should be examined based on topic-specific has become a trend. For example, there are studies which investigating preservice science teachers' efficacy belief on evolution (Akyol, Tekkaya, Sungur & Traynor, 2012), or force and motion (Tanel, 2013). As mentioned earlier, collective efficacy and self-efficacy were derived from the same theory (Bandura, 1997). Therefore, similar to teaching efficacy, the influence of collective efficacy on understanding the specific science concepts in the group work may be the subject of new future research.

Finally, in the science education literature, there are developing areas in science education such as argumentation, socioscientific issues, environmental

education, STEM education. Integration of collective efficacy into these areas can bring new dimension to this kind of research.

5.4 Limitations of this Study

This study was conducted with a group in science methods course during one semester. In this process, the researcher used many times video camera and audio recorder to collect data. The presence of this kind of devices may influence their talk and behavior in the group work. For example, they may not answer questions in interviews honestly by saying real thoughts, or the researcher being included in the group work to make observation may influence the behaviors of participants although the researcher took in the group work as non-participant.

Secondly, the science methods course did not contain all teaching science methods. This study was limited to nine science teaching methods.

Another limitation is that as a group, they developed nine lesson plans based on teaching methods which have different characteristics from each other. For example, some of them were easily integrated in the lesson plans than the others. However, the evaluation of lesson plans to assess group performance was done regardless this issue.

Finally, the group members used the official language of the university which was different from mother language to fulfill requirements of this course. Therefore, this may influence on the findings of the study.

5.5 Conclusions

Collective efficacy is significant factor influencing group behavior and group effectiveness (Bandura, 1997). In the literature, there were some research about this construct among inservice teachers, university students, students in compulsory education, and sports team (e.g., Baker, 2001; Goddard & Goddard, 2001; Lee & Farh, 2004; Lizzio & Wilson, 2005; Tasa et al., 2007). However, there was limited number of research conducted with preservice teachers concerning collective efficacy. Therefore, to fill in this gap in the literature, in the present study, it was aimed to examine collective efficacy among preservice science teachers, investigate the role of sources of collective efficacy on group behavior, and the role of collective efficacy on group performance and on self-efficacy of group members. This study was conducted in the context of science methods course. In this course, nine science

teaching methods were introduced to the students every week. In the light of the teachings methods, the participants as a group were expected to work together to prepare common the lesson plans. Then, the group presented microteachings of these lesson plans to the class.

The participants of this study were four junior preservice science teachers who worked in the same group in this course. Case study was used to investigate this research. For this, pre interview, focus group interview, post interviews, observation, critique papers, and lesson plans were analyzed qualitatively. In addition, STEBI-B was used to explore whether there is difference of preservice science teachers' self-efficacy about teaching science. For this, Wilcoxon Signed Rank test was conducted to analyze this scale.

The findings of this study showed that they depended on each other, and everybody in the group made contribution on preparing lesson plans. In addition, it was reported that they gathered to work face-to-face, and in their meetings they easily expressed ideas in comfortable environments. Moreover, it was stated that they worked in a process, namely accumulation, interaction, examination and accommodation. Based on these findings, it was concluded that these preservice teachers conducted collaborative work.

Another finding pointed out that the belief about group ability for preparing lesson plan which was collective efficacy was developed, and this collective efficacy was improved over time. Additionally, all group members explained that there were four factors in developing their belief. First of all, they mentioned that they conducted collaborative work. Regarding this issue, it was also observed that they worked together as a group in all parts of the lesson plans instead of dividing workload, preparing responsible part, and joining all these parts at the end. Secondly, they emphasized that they had same purpose on preparing lesson plan. Thirdly, they pointed out that they have positive attitude toward the group work. It was reported that the group work made contribution to their individual learning, sense of responsibility, critical thinking ability, and interaction with each other. Finally, they also mentioned about group cohesion which provided harmony in working were taken place.

The role of the sources of collective efficacy on group behavior was also investigated. It was found that having successful or unsuccessful experience about lesson plan preparation led to improve preparation of the following lesson plan. In addition, the group members mentioned that feedback concerning their lesson plans was taken into consideration to improve better lesson plans. Moreover, it was stated they developed lesson plans in the light of modeling of the professor's lecture the course assistants' microteachings, and other groups' microteachings. Finally, they mentioned that they worked in relaxed and comfortable environment which caused them to motivate preparing lesson plans.

Regarding the contribution of collective efficacy on group performance, most of them stated that by the help of sources of collective efficacy, they enhanced lesson plan preparation. Similarly, it was reported that collective efficacy influenced indirectly development of personal science teaching efficacy and science teaching outcome expectancy.

As a result, in the light of these findings, the science teacher educators, science teachers, and curriculum developers should give importance to develop collective efficacy among group work of students or preservice science teachers. For this purposes, four factors, collaborative work, shared purpose, attitude toward group work, and group cohesion, should be considered about the development of collective efficacy. Furthermore, collective efficacy should be enhanced by integrating specific instructional activities and assignments related to the sources of collective efficacy into the courses.

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APPENDICES

APPENDIX A: PRE-INTERVIEW QUESTIONS

Introduction

Hello, my name is Volkan Atasoy, I am doctorate students and research assistant in elementary science education program. I have been conducting a research concerning group work during science method course. Therefore, I think that your opinion make good contribution to my research. I thank you for your cooperation.

1) How old are you?
2) What is your GPA?
3) Which semester are you studying science teacher education program now?
4) Have you had any experiences about teaching?
    - Where did it happen?
    - When did it happen?
    - How long did it last?
5) Have you had any experience about long-lasting group work until 344 science method course? If yes,
    - Where did it happen?
    - When did it happen?
    - What kind of experience did you have?
6) Do you believe that you can teach science to middle school students effectively now? Why?
7) Do you believe that your teaching makes students understand science effectively and become successful?

APPENDIX B: FOCUS GROUP INTERVIEW QUESTIONS

Note: Questions in the parenthesis were asked in the second focus group interview to compare their situation with previous one.

1) How is going your group work?
    - Are you satisfied with your group work?
    - Is there a harmony in the group?
    - What is the contribution of this group work for you?
    - (Compared to your situation in the first focus group interview, what kind of changes happened in your group work?)
2) What is your purpose as a group when you work together?
    - (Is there any change in your purpose until first focus group interview?)
3) Do you feel dependent to each other when you work in the group?
    - (Can you compare yourself with your situation in the first focus group interview?)
4) As a group, do you believe that you would prepare qualified lesson plans?
    - Yes or No; why?
    - (Compared to your situation in the first focus group interview, what kind of changes happen in your belief?; if a change exits , what is the reason of this change?)
5) Do you find your group performance successful in lesson plan preparation?
    - Yes or No; why?
    - (Compared to your situation in the first focus group interview, what kind of changes happen in your opinion?; if a change exits , what is reason of this change?)
6) Do you believe that you can teach science effectively to middle school students?
    - Compared to your situation in the pre-interview, how does your opinion change?
    - If there is change, what is the reason of change of your opinion?
    - If not, why?
    - Which aspect(s) do you see yourself as satisfactory in teaching science? Why?
    - Which aspect(s) do you see yourself as unsatisfactory in teaching science? Why?
    - (Compared to your situation in the first focus group interview, what kind of changes happen in your belief?; if a change exits , what is the reason of this change?)

7) Do you believe that as a teacher you would make students understand science effectively and become successful?

- Compared to your situation in the pre-interview, how does your opinion change?
- If there is change, what is the reason of change of your opinion?
- If not, why?
- Which aspects do you believe that you would be helpful for students? Why?
- (Compared to your situation in the first focus group interview, what kind of changes happen in your belief?; if a change exits , what is reason of this change?)

APPENDIX C: POST-INTERVIEW QUESTIONS

Introduction

I want to emphasize some points. Your responses to interview and your personal information will be kept in confidential. Your responses will be used only in my dissertation. In addition, your name will not be mentioned anywhere. Instead, another different name will be preferred. Therefore, I want you to be comfortable and become honest in your responses.

Before beginning to make interview with you, I want to ask if you have any questions about this study or any thought you would like to state. I guess this interview take approximately 90 minutes. I want to record this interview by using audio-recorder. Would you mind using it? If you have any questions about this study later, you may contact me thorough email: vatasoy@metu.edu.tr

If you ready, I want to begin to ask questions.

1) What does this group work mean to you?
    - in terms of learning, interaction, sense of responsibility…
2) If I want you to describe your group work by using one adjective such as successful, smart, what would your objective be? Why?
3) If I want you to describe your group work by using metaphor, what do you choose? Why?
4) Do you have any expectation from this group before they start to work?
    - In terms of learning, interaction, sense of responsibility…
    - If there is, is your expectation met?
    - Yes or No; why?
5) What major challenges and problems did your group face in terms of group work? How did you handle it?
6) What do you gain from group work in this course?
    - Concerning learning, interaction, thinking development, sense of mission and responsibility.
7) Can you describe your attitude to group work in this course? Why? (positive, negative, neutral).
8) Can you tell me about process of making lesson plan?
    - How do you work?
    - How did you reach agreement about what needs to get done at each meeting?
    - How did you find ways to bridge different ideas in formation lesson plan and presentation of this plan?
    - How did you help members who are having difficulty with lesson plan, methods and presentation of this plan?
    - How do you find ways to capitalize on the strength of each member?
9) Every week, in order to prepare lesson plan, you chose a science topic from the curriculum. How did you choose this topic?

- Can you prepare lesson plans according to science teaching methods in every science topic?
- Do you think that selected topic is significant factor in preparing efficient lesson plan related to these teaching methods? Why?

10) As a group, you learned nine science teaching methods in this course. Do you believe that as a group, you would prepare efficient lesson plans to each teaching methods? Why?
11) What is your purpose as a group when you work together?
    - Is there any change in your purpose until second focus group interview? Why?
12) Do you feel dependent to each other when you work in the group?
    - Can you compare yourself with your situation in the first focus interview?
13) In general do you believe that as a group you would prepare efficient lesson plan?
    - Yes or No; why?
    - Compared to your situation in the second focus interview, what kind of changes happen in your belief?; if a change exits , what is the reason of this change?
14) How would you describe your role in this group when you are making lesson plan and microteaching?
    - What is usually your role in this group?
    - How did you contribute to this group?
    - How do you evaluate your performance as member of this group?
15) Please sort the following sentences from the best reflection of your opinion about your group work to the least reflection of that. Why do you make this sorting? Explain.
    - It is important for me to work better than the other group members
    - It is important for me to keep harmony in the group.
    - It is important for me to obey the group's decision
    - It is important for me to work independently from other group members.
16) If there was not obligation about group formation in this course, would you prefer group work again or working independently? Why?
17) You chose group members by themselves at the beginning of the course. If the group was formed by randomly, would you work with harmony in another group? Why?
18) As you know, the professor of this course introduced new science teaching method every week, and showed sample activity related to these teaching methods. How did this situation influence your group work or preparation of lesson plan?
19) The course assistants performed sample microteaching related to the science teaching method you have just learned. How did this influence your group work or preparation of lesson plan?
20) Some weeks, you prepared very qualified lesson plans. Can you describe one of such an experience?

- After these kinds of experience, as a group how did you feel about?
- How did these kinds of experience influence your following group work or preparation of lesson plan?

21) Conversely, some weeks, you prepared not very qualified lesson plans. Can you describe one of such an experience?
    - After this kinds of experience, as a group how did you feel about?
    - What did you do not to face the same situation?
    - How did these kinds of experience influence your following group work or preparation of lesson plan?
22) During this course, you observed the other groups' microteachings. How did these microteachings influence your following group work or preparation of lesson plan?
23) After you performing microteaching, the other groups criticized your performance, your activity used, or your assessment methods. How did you feel about this critique?
    - Did you take into consideration this critique when you were preparing following lesson plans or performing microteaching? Why?
    - Can you give example?
24) How can you describe atmosphere in your group work?
    - As I observed, you were working relaxed environment. How did you manage this?
    - How did this environment influence your group work or preparation of lesson plan?
25) Do you find your group performance successful in lesson plan preparation?
    - Yes or No; why?
    - Compared to your situation in the second focus group interview, what kind of changes happened in your opinion?; if a change exits , what is reason of this change?
26) Do you believe that you can teach science effectively to middle school students?
    - Compared to your situation in the second focus group interview, what kind of changes happened in your belief?; if a change exits , what is the reason of this change?
    - If there is change, what is the reason of change of your opinion?
    - If not, why?
    - Which aspect(s) do you see yourself as satisfactory in teaching science? Why?
    - Which aspect(s) do you see yourself as unsatisfactory in teaching science? Why?
27) Do you believe that as a teacher you would make students understand science effectively and become successful?
    - Compared to your situation in the second focus group interview, what kind of changes happened in your belief?; if a change exits , what is reason of this change?
    - If there is change, what is the reason of change of your opinion?If not, why?

- Which aspects do you believe that you would be more helpful for students? Why?

APPENDIX D: OBSERVATION FORM

The purpose of this observation was to describe how the group was working in preparing lesson plans.

Observation Questions

The following specific questions will provide a guideline for the observation:

1) How do they communicate each other in group work?
2) How do they participate in process of group work such as selection topic, investigation discussion, negotiation, making decision?
3) How do they interact with each other in this group work?
4) What are the factors influencing their performance?
5) What do they show signs in terms of collective efficacy?

Data Collection

The group which was composed of 4 preservice science teachers was observed during nine week. Stream of behavior records approach was preferred for data collection. For this purpose, events, behavior or performance of the selected group were recorded and the researcher comment was added in this form as well. In addition, video camera was also used to record what is happening. These video-records were watched by the researcher each week and transcribed in the papers.

Observation Dimensions

Data were collected on following dimensions:

4) Physical environment
    c) Sitting position
    d) Equipment they possessed.
5) Process of group work:
    e) Investigation
    f) Discussion,
    g) Negotiation,
    h) Making decision.
6) Relationship and communication
    c) Conversation
    d) Interaction among each other

Observation Data Collection Instrument

Date: Method:	
Field Notes	
Description events, behavior, performance in this group	Comment of the researcher

APPENDIX E: CRITIQUE PAPER QUESTIONS

As a group, you will be asked to write a critique paper on your performance about lesson plans and teaching practice three times during semester. This paper should include the responses to the following questions:

1) So far, what do you think about your lesson plans and microteachings as a group?
2) What are your strengths concerning your lesson plans and microteachings?
3) As a group, what are your weaknesses concerning your lesson plans and microteachings?
    - What causes these weaknesses in your work?
    - How do you handle these weaknesses?
    - Why is it important to handle these weaknesses?
4) Considering your performance on lesson plans and microteachings what is your goal you would like to set for yourselves for next lesson plans and microteachings?
5) In the classroom, you watched other groups' teaching performances. What features of these performances do you like? Do you want to implement them in your own next lesson plan or microteachings? Why?
6) Do you think that critics of other groups about your performance are important to develop next lesson plan or microteachings? Why?
7) How do the feedback of course assistant influence your preparation on lesson plan?

APPENDIX F: LESSON PLAN FORMAT

Name:

Title/Topic:

Grade level:

Duration:

Instructional Resources, Materials or Technology:

Teaching method(s):

Objectives:

Introduction of the lesson

Teaching procedure

Closure of the lesson

Assessment:

References:

APPENDIX G: RUBRIC FOR LESSON PLAN EVALUATION

		LEVEL of QUALITY			
		4 = Excellent	**3 = Good**	**2 = Moderate**	**1-0 = Poor**
Objectives (2 points in total)	**1 point**	Objectives include 5/5 following criteria: • They are clear • They are measurable • They are related to intended results of the lesson, not process • They are specific than broad • They are related to curriculum	Objectives include 4/5 of all the following criteria: • They are clear • They are measurable • They are related to intended results of the lesson, not process. • They are specific than broad • They are related to curriculum	Objectives include 3/5 of all following criteria: • They are clear • They are measurable • They are related to intended results of the lesson, not process • They are specific than broad • They are related to curriculum	Objectives include 2/5 or less of all following criteria. • They are clear • They are measurable • They are related to intended results of the lesson, not process • They are specific than broad • They are related to curriculum
	0.5 point	• One objective related to NOS is stated and this objective is well-written as content-embedded.	• One objectives related to NOS is stated. This objective is content-embedded but content and NOS are integrated loosely.	• One objectives related to NOS is stated, but this objective is content-free.	• One objectives related to NOS is not stated.
	0.5 point	• Two objectives related to SPS are stated. They are designed to make students apply these skills on learning environment.	• Two objectives related to SPS are stated. One of them is application of SPS , the other one is associated with recalling knowledge or understanding about SPS.	• Two objectives related to SPS are stated. They are not at application level. Or, there is one SPS objective at application level.	• Two objectives related to SPS are not stated. Or there is one SPS objective related to recalling knowledge or understanding about SPS.
Instructional Resources,		A range of resources, materials or technology are	Resources, materials or technology are utilized,	Resources, materials or technology are listed only;	Use of resources, materials or technology is limited or

Materials or Technology (1 point)	effectively integrated into the context of the lesson, engaging to learners and provide for student learning.	appropriate for the learners and provide for student learning, but further explanation about integration of these to lesson would be helpful.	there is no explanation about how they are used in lesson.	absent. Materials fail to fully fit the context of the lesson and needs of the students.
Introduction (2 point)	Introduction includes sufficient description of instructional strategies for students used in this lesson such as a using strong motivational device, connection to prior learning, and/or and asking essential questions.	Introduction includes the instructional strategies but concerning usage of these strategies, further explanation is needed.	The lesson is only introduced by stating the instructional objective or focus.	A process for lesson introduction is limited or missing
Teaching Procedure **-Planning of Activity(s)-** *Piece(s) of work assigned to or expected from students* **(2 points)**	Activities are based on correct concepts, and relate directly to the objectives of the lesson. Activities engage students in application of previously learned knowledge. Activities promote students' conceptual understanding of the topics and disposition related to the topic. Activities are integrated with at least one nature of science aspects.	Activities are based on correct and engaging concepts and somewhat relate to the objectives of the lesson. Activities are used to engage students in application of previously learned knowledge but more detail about activities would be helpful. Activities include nature of aspects but they loosely related to this nature of aspect Activities include two science process skills but they are not explained how they are used in	Activities loosely relate to the specified standards/benchmarks or objectives of the lesson. Activities are limited to require practice. Nature of science aspects are placed but there are no integration with activities and these aspects. Science process skills are stated but they are not explained how they are used.	Activities do not relate to the specified standards/benchmarks or objectives of the lesson. Activities include unnecessary/inappropriate practice. Activities are not well explained Nature of science aspects are not used. Science process skills are not placed.

	Activities include two science process skills.	activities very well. Or they include one science process skill which is explained in detail.		
Usage of teaching method (3 points)	Lesson plan includes important characteristics of teaching method. This teaching method is integrated with activities appropriately.	Lesson plan includes some characteristics of teaching method and teaching method and activities chosen would be integrated very well.	Lesson plan includes by some characteristic of teaching method. But there is no integration of this teaching method and activities.	Usage of teaching method is inappropriately reflected or missing.
Closure (2 point)	Closing the lesson is specifically described, including a review of lesson concepts and/or essential questions, preview of future learning, application or extension of lesson concepts.	Lesson closure is somehow described and includes one of stated closing strategy, but more detail would be helpful.	The lesson is closed by only restating the instructional objective and focus.	A process for lesson closure is inappropriate or missing.
Assessment (2 point)	Assessment procedures are clearly stated and are related to all objectives of the lesson. Assessment strategies are described in detail to gather evidence of student learning explicitly.	Assessment procedures are stated and are related to the some objectives of the lesson. Assessment ideas are included, but they are vague.	Some assessment procedures are stated, but they are not related to the objectives of the lesson.	Assessment is inappropriate or missing.

APPENDIX H: ETHICAL APRROVAL

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

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17.02.2014

Gönderilen : Prof. Dr. Jale Çakıroğlu
İlköğretim Bölümü

Gönderen : Prof. Dr. Canan Özgen
IAK Başkanı

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz İlköğretim Bölümü öğrencisi Volkan Atasoy'un "Fen Öğretim Yöntemleri Dersi Kapsamında Fen Bilgisi Öğretmen Adaylarının Kolektif Yeterliği" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

17/02/2014

Prof.Dr. Canan Özgen
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkanı
ODTÜ 06531 ANKARA

APPENDIX I: CONSENT FORM

This study has been conducted by Research Assistant Volkan Atasoy under supervision of Dr. Jale Cakiroglu, teaching staff at Middle East Technical University. The purpose of this study is to investigate collective efficacy among preservice science teaches in science methods course. Participation in this study is voluntary. If you agree to participate in this study, information identifying your identity will not be requested. The information you will share will be kept completely confidential and it will be only used in scientific publications.

This study does not include any circumstance which causes disturbance to you. However, If you feel uncomfortable about any circumstance, you may withdraw from the study at any time. I have already thanked you for your cooperation. If you have any questions about the study, please contact Volkan Atasoy via email (vatasoy@metu.edu.tr)

I have read and understood explanation, as provided above and I voluntarily agree to participate in the study (I have been given a copy of this consent form).

Name Date Signature

APPENDIX J: THE GROUP'S LESSON PLAN FOR DEMONSTRATION

Title/Topic: Light and Sound / Interaction Between Sound and Matter

Grade level: 6th grade

Duration: 30 min.

Instructional Resources, Materials or Technology: POE activity sheets, balloon, bowl, spoon, rice, rubber band, pot.

Objectives:

At the end of the lesson, students will be able to;

1. Explain how is sound created
2. Realize relationship sound and vibration

Introduction:

Teacher greets the students. (With the shoe box on the hand) Teacher starts the lesson by questioning to review previous lesson. Questions are 'How is sound created?' (Expected answer is; the vibration of particles creates sound.) Then, teacher says those 'please put your hand to your throat and speak or make some noise'. After that, teacher asks what students feel. After students' answers, (Expected answers are; moving, vibration and so on) if there is wrong explanations, teacher insists on students to find correct answers by questioning.

Teaching Procedure:

Afterwards teacher show the shoe box. Firstly, students observe the box. **(SPS, Observing)**. By the way teacher asks students' predictions for the inside of the box; it is permitted to touch the box or to weigh the box. **(SPS, Inferring and Predicting)** After that, teacher opens the box and shows the materials one by one; also say their names to student. Then, s/he gives the paper one to the students which is prediction paper. **(Appendix 1)** Teacher directs to students about prediction paper. Firstly, student predicts how demonstration will be done **(NOS, creativity)** and then teacher explains procedures of demonstration, then again students predict what the result of experiment is. Later, students write their predictions and teacher walk among the students. **(NOS, Creativity and Subjectivity**; because all students look at the same materials but their interpretations are different.) Then, teacher and students

share and discuss predictions. Later, teacher collects the students; it is suitable to locate U shape. Then, step by step teacher make demonstration, by the way s/he gives direction to observe. **(SPS, Observing)** Teacher firstly put balloon to the bowl and make sure it is stretched and fix with rubber band. Secondly, put some rice over the balloon. Thirdly, makes some noise around the bowl with different distances. After completing demonstration, students sit down and another paper which is observing paper will be given to students. **(Appendix 2)** While writing observations teacher again walk around the classroom. After that, again observations are shared and discussed. At the end of the demonstration, another paper which is explaining paper is given to the student. **(Appendix 3)** Students share their explanations and teacher never gives the right answer at this stage. **(SPS, Inferring)** Finally, teacher gives the right answer with the students' considerations.

Closure:

Teacher asks students to summarize demonstration and result of the demonstration. Then, teacher revises it briefly. Finally, teacher gives homework and writes it down to the board.

Assessment:

Teacher gives homework as an assessment:Please put a tea glass in front of the loudspeaker with high and fixed volume (such as computer speaker). Then observe the effects and write it down in a paper.

Reference:

Anita van, S. (2013). *Her güne bir deney*. İstanbul: YKY**.**

Ministery of National Education [MoNE]. (2013). İlköğretim fen ve teknoloji ders öğretim programı (6, 7 ve 8. sınıflar). Ankara.

Appendix 1

1) **What are we going to do with these tools?**

2) **What do you expect to happen?**

Appendix 2

1) **What happened to the balloon?**

2) **What happened to the rice?**

3) **What are your other observations?**

Appendix 3

1) **I observe moving of rice, it happened because…**

2) **When pot is near the balloon, rice moving is more because…**

APPENDIX K: THE GROUP'S LESSON PLAN FOR FIELD TRIP

Title/Topic: Human and Environment Relations/ Level of Organization in Ecosystem

Grade level: 7th grade

Duration: 35 minutes

Instructional Resources, Materials or Technology: Activity Sheets, Computer,

Objectives:

At the end of the lesson, students will be able to;

1. Explain the observation that is one of the SPS **(SPS)**
2. Clarify the differences between observing and inferring by looking species (Mine flower). **(NOS)**
3. Explain the importance of communicating among scientists. **(SPS)**
4. Give example of species that exist in the garden.
5. Give example of populations that exist in the garden.
6. Give example of habitat that exist in the garden.
7. Give example of ecosystem that exist in the garden.
8. Explain tentativeness that scientific findings subject to change in time. **(NOS)**

Introduction:

Teacher greets the students and by PowerPoint slide s/he shows the picture. **(Appendix 1)** After ensuring each student sees the picture, s/he starts to ask some questions related to the picture. "Previous lesson, we learnt some concepts related to living creatures. According to this information, what can you say about type of species, means that what species do you observe in this picture?''(Expected answers are; deer, frog, fungi, pine tree, carp fish, ladybird, daisy, vulture and so on) Teacher asks another question, which is ''Why do you think for example pine tree is species?'' (Expected answer is; because pine trees give productive seed together. For example, do not give productive seeds with apple trees. Species have more common characteristics in itself). Other question is ''Which populations do you observe?'' Meantime, teacher warns students just making observations with five senses. (**SPS,**

observing – because students just observe the populations in picture) (Expected answers are; carps fish, pine trees, lotuses and so on) **(Objective 1)** Then, teacher asks ‘‘Why do you think these are populations?’’ (Expected answers are; for example I see three carp fishes are same species that live together) Then, teacher continues with questions. ‘‘Can you give examples to habitat of species that you say?’’ (Expected answers are; lake for carp fishes, lake and near the lake for frog, forest for deer and so on) ‘‘Up to know we talk about living things/creatures but there exist nonliving things, right? What are nonliving things in the picture?’’ (Expected answers are; stones, billet) ‘‘Are there nonliving things nonfunctional?’’ (Expected answer is no) ‘‘What are their functions in the picture?’’ (Expected answers are; for example, stone give shape to the lake floor, if it is not exist there may not exist lake like this or turtles climb over the billet, they may protect themselves) ‘‘Right we gave name these interactions among the living and nonliving things as an ecosystem’’

Teaching Procedure:

After the brief introduction about the previous lesson, teacher talks about today's lecture. S/he says 'today we will go to school garden to examine our environment like in a science laboratory as scientists do.’ Teacher continues with giving information about safety policy to the children in a PowerPoint slide. **(Appendix 2)**. S/he chooses a student to read all rules of the policy to his/her friends and s/he says 'you can ask me whether there is a misunderstanding or not'. After that, teacher distributes question papers which will be written during the field trip by students. **(Appendix 3)**. Teacher says ' please read carefully all questions and ask me if there is a misunderstanding or not'. Before going to garden, teacher takes first aid kit. Teacher and students go to school garden and teacher directs them 'please obey the safety rules, follow the paths and do not go outside of the garden’. Teacher warns them ‘‘well we will make both observing and inferring, however, they are different things as you remember. When you observe with 5 senses like color, smell, it is observing, however when you interpret with your prior knowledge, it is inference. For example, you observe footprints with 3 fingers, but when you name it these footprints belongs to chicken you make inference. **(NOS, differences between observing and inferring) (Objective 2)** Well, when I say this flower’s color is

purple, did I make inferring or observing? (Expected answer is observing.) When I say this flower name is Mine flower, did I make inferring or observing? (Expected answer is inferring, because we know characteristic of Mine flower.) Then, teacher gives directions to student that is 'please follow the arrows, while doing this also answer the questions on the paper and give examples of species, populations, habitat and ecosystem.' **(Objective 4, 5, 6, 7)** While students discover their environment, teacher controls whether students answer the questions and they have problems or not. After the discovery part and all students try to find the answer of the questions, teacher and students come together in amphitheater. They communicate about their findings and compare what they found with their friends. Teacher says 'while you are communicating, you can recognize your wrong aspects or your friends' and you can correct each other or yourself's.' **(Objective 3)** 'According to this information, can you explain the importance of communicating?' (Expected answer is, by communicating we can correct our wrongs or we can learn new things) Teacher says ' For example, scientists make observation and inferences, after that, they communicate with each other about what they found as you do. **(SPS, communicating)**. Then, s/he asks 'can you say me how scientists communicate with each other?' (Expected answers: By writing essays, saying each other, publishing written papers, discussing and so on.) After the communicating part, teacher and students again follow the paths to be sure about their answers, which means students reinforce and overcome to deficiencies about types of species, populations and so on with the guidance of teacher. (For example some students may miss the names of some species, so teacher shows to students)

Closure:

After finishing the trip, teacher collect students a place that can make a clear conclusion. "Today, we observe the living species in our school's garden which are bilberries, mine flowers, grasses, yellow flowers, dandelion, tulips, violets, wild flowers, clovers, pine trees, apricot trees, bushes, bees, ladybirds, butterflies, mayflowers and ants, and their populations which are mine flowers' population, yellow flowers' population, violets' population, wild flowers' population and mayflowers' population. Then we observe their habitats that land and also we study our school garden' ecosystem. In addition to that, as scientists do, today we made a

scientific research in our school's garden. We understand that scientists not only use laboratories, but also use nature for making science. Finally teacher asks students that 'when you consider 50 years ago, scientists made observations related to species, populations, habitat and ecosystem like you. Do you think that their findings completely similar to yours?' (Expected answer is no) Then, teacher asks why? (Expected answer is; because we learnt scientific knowledge subject to change, when we consider this issue, we say that the species, populations and so on also change, because also there exist time difference. (**NOS; Tentativeness** – because students explain that the scientific knowledge and findings can be changed over time)

Assessment:

For the objective 1; teacher asks question ''which populations do you observe?'' the answer of this question will be used as an assessment, because if more than 90% of students can give expected answers, objective 1 is gained by students. For the objective 2; teacher asks 2 questions related to "Mine flower". As a result of these questions' answers, teacher assesses objective 2 and if more than 90% students give expected answers, the objective is gained by them. Also, for the objective 3 teacher again asks the importance of communication, if more than 90% students give expected answers, objective 3 is gained by them. Moreover, for the objectives 4, 5, 6 and 7 teacher assess the objectives by activity sheet, but she does not collect activity sheet instead she asks answers verbally. If more than 90% of students give correct expected answers, these objectives are gained by students. Finally, for the objective 8 teacher asks questions related to tentativeness and if more than 90% students give expected answers, objective is gained by students.

Appendix 1

Appendix 2

- **Do not go outside of the garden.**
- **Do not run.**

- **Do not pick flowers.**

- **Do not kill insects.**

- **Follow the path**

- **TRY TO FIND ANSWERS OF ALL QUESTIONS.**

Appendix 3

1. Please give example of eight species in the garden and write their names on the paper. **(Objective 4)**

1	
2	
3	
4	
5	
6	
7	
8	

2. Please give three examples of populations in the garden. **(Objective 5)**

1.
2.
3.

3. Where do these species live in? What is their habitat? **(Objective 6)**

4. Besides of the living things (species, populations), what are the non-living things in the garden? Please give at least three examples.

5. Is there an ecosystem in the garden? If you say 'yes', why do you say yes? If you say 'no', why do you say no? **(Objective 7)**

Expected answers:

1- Students write 8 of species which are bilberries, mine flowers, grasses, yellow flowers, dandelion, tulips, violets, wild flowers, clovers, pine trees, apricot trees, bushes, bees, ladybirds, butterflies, mayflowers and ants.

2- Students write 3 of populations which are mine flowers' population, yellow flowers' population, violets' population, wild flowers' population and mayflowers' population.

3- Students say that they live on land and in air. Their habitats are territory and air.

4- Students say that the nonliving things are asphalt, banks, picnic table, recycle bin and stones.

5- Yes, there is. Because, we sad that ecosystem contains living and nonliving species, and in our garden we have both of them. So that our garden is also a ecosystem.

APPENDIX L: EXTENDED TURKISH SUMMARY

Giriş

Günümüzde grup çalışması birçok alanda insanlardan istenen bir beceridir. Bu bağlamda; çalışanlardan birlikte çalışmak, problem çözmek, rahat iletişim kurmak ve ortak bir karara ulaşmak gibi konularda deneyimli olmaları istenmektedir (Litchfield, Frawley, & Nettleton, 2010).

Grup çalışması, aynı zamamda eğitimsel amaçlar doğrultusunda zorunlu eğitimden, yüksek öğrenime kadar uygulanabilen bir yaklaşımdır. Yapılan çalışmalar grup çalışmasının kişilerin bilişsel öğrenmesinin yanısıra duygusal ve sosyal gelişimlerinde de önemli bir rolü olduğunu göstermiştir (Järvelä, Volet, & Järvenoja, 2010). Daha açık söylemek gerekirse, grup çalışmasının; öğrencilerin öğrenmesine, muhakeme yapabilmesine, yüksek bilişsel stratejiler kullanmasında, kritik düşünme becerilerinin gelişiminde, sosyal becerilerin artmasında ve öz saygı, tutum gibi motivasyon öğelerinin gelişmesinde etkili olduğu görülmüştür (Johnson & Johnson, 1998, 1999; Johnson, Johnson, & Smith, 1991; Ragan, 1993; Rutherford, Mathur, & Quinn, 1998; Slavin, 1990; Zurita & Nussbaum, 2004). Bunun yanında bazı çalışmalarda insanlar grup çalışmasını öğrenme açısından etkili olmadığını belirtmişlerdir (Chiriac, 2014; Hansen, 2006; Peterson & Miller, 2004). Bu ifadeyle aynı doğrultuda, Johnson ve Johnson (1999) her grup çalışmanının verimli olmadığını vurgulamiştır. Bu durumun grup üyelerinden kaynaklanabileceği düşünülmüştür (Blumenfeld, Marx, Soloway & Krajcik, 1996). Ennen, Stark, ve Lassiter (2015) grup üyelerinin motivasyonun etkili grup çalışmasının oluşmasından önemli bir rol oynadığını iddia etmiştir. Özellikle, grup üyelerinin inançları, değerleri, ve tutumları gruptaki etkileşimi etkileyen faktörler olarak verilmiştir (Goodman & Dabbish, 2011; Harrington & Fine, 2006). Ayrıca, içsel ve dışsal motivasyon öğelerininde group çalışmasına positif bir etki yaptığına dair çalışmalar vardır (Cooper & Jayatilaka, 2006). Belirtilen bu kişi bazındaki motivasyon öğelerinin yanında, grup motivasyon faktörleri de grup çalışmalarını etkilemektedir. Bu grup motivasyon faktörlerinin başında kolektif yeterlik gelmektedir (Bandura,

1997). Bunun nedeni, kolektif yerterliğin grup performasında önemli bir yordayıcı olarak görülmesidir (Goddard, 2001; Peterson, Mitchell, Thompson, & Burr, 2000).

Bandura (1997) kolektif yeterliği, bir grubun belirli düzeyde başarı elde edebilmek için gerekli olan eylem aşamalarını düzenleme ve yönetme yeteneklerine ilişkin paylaştıkları ortak inançlar olarak tanımlamıştır. Buradan hareketle, kolektif yeterlik; grubun amaçlarına, stratejilerine, planlarına, kaynak kullanımına, ve gösterdiği çaba ve kararlılığa etki etmektedir (Bandura, 2002; Durham, Knight, & Locke, 1997).

Kolektif yeterlik, Bandura'nın (1986) sosyobilişsel kuramından türemiş bir kavramdır. Bandura (1986) bu kuramdan yola çıkarak öncelikle öz yeterlik kavramını ortaya koymuştur. Öz yeterlik, bireyin belirli düzeyde başarı elde edebilmek için gerekli olan eylem aşamalarını düzenleme ve yönetme yeteneğine geliştirdiği inancı olarak ifade edilmiştir (Bandura, 1997). Öz yeterlik, bireyin davranışını yordayan önemli bir faktördür çünkü bireyin bilişsel, güdüsel, duyuşsal ve seçim süreçlerini etkilemektedir (Bandura, 1993). Bandura insanların tek başına çalışan bir varlık olmadığını, birçok yerde diğer insanlarla etkileşime girmek zorunda olduğunu belirterek, insanın ait olduğu gruba karşı da bir inanç geliştirebileceğini iddaa etmiştir. Bu sav doğrultusunda kolektik yeterlik kavramı doğmuştur.

Bandura (1997) yeterlik olgusunu besleyen dört önemli kaynağın olduğunu belirtmiştr. Öz yeterlik ve kolektif yeterlik aynı kurama bağlı olarak ortaya atıldığı için bu dört kaynak her ikisi için de geçerlidir. Bu kaynaklar, doğrudan yaşantı, dolaylı yaşantı, sözel ikna ve psikolojik ve duygusal durumlar olarak ifade edilmiştir (Bandura, 1997).

Bu kaynaklardan en etkili olanı doğrudan yaşantılardır. Bu yaşantılar başarılı veya başarısız bireyin kendi deneyimleridir (Bandura, 1997). Kolektif yeterlikte, bu durum grubun kendi deneyimleri olarak vurgulanmıştır (Myers, Feltz, & Short, 2004). Bir diğer kaynak olan dolaylı yaşantı ise diğer başarılı insanları gözlemleyip model almakla ilgilidir (Bandura, 1997). Kolektif yeterlikte, bu kaynak diğer grupları veya diğer insanları gözlemleyip, gördüklerini grubun kendi yaşantılarına uygulaması olarak açıklanmıştır (Goddard, Hoy, & Woolfolk Hoy, 2004). Sözel ikna olan bir diğer kaynak ise danışmanın, öğretmenin, ailenin veya arkadaşların sözel dönütlerinin bireyin yaşantısını etkilemisidir (Bandura, 1997). Diğer grubların veya

kendi profesyonel alanında görev yapan kişilerin grubun performasına yapılan sözel dönütler ise kolektif yeterlik için kaynak oluşturmaktadır (Sorlie & Torsheim, 2011). Son olarak, bireyin yaşadığı heyecan, gerginlik, korku vb. gibi psikolojik ve duygusal durumlar öz yeterliğin gelişmesinde önemli görülmektedir (Bandura, 1997). Grubun kendi içinde bulunduğu psikolojik ve duygusal durumlar ise kolektif yeterliğin gelişmesinde önemli bir rol oynamaktadır (Goddard vd., 2004).

Problem Durumu

Fen okuryazarlığı, fen eğitiminin daimi amaçlarından biridir (American Association for the Advancement of Science, 1990). Bu amaca ulaşmak için anlamlı öğrenme, en önemli etken olarak görülmektedir. Anlamlı öğrenme, öğrenciye analiz, araştırma yapabilme, ulaşılan bilgileri eski bilgilerle birleştirerek açıklama ve kendi öğrenme sürecinin farkında olma gibi imkanlar sunar (Ashburn & Floden, 2006; Biggs & Tang 2007; Chin & Brown 2000). Bir başka ifadeyle, öğrenci öğrenme sürecinde aktif olup bilgileri kendi yapılandırmaktadır (Kember 2009; Lammers & Murphy 2002). Bu anlamlı öğrenmede, işbirliği yapmak yapılandırıcı fen eğitiminin de önemli bir parçasıdır (Ford & Forman 2006). Bu konu hakkında, The National Research Council [NRC] (2008) işbirliğinin fen öğretiminde ciddi bir değişken bir olduğunu belirtmiştir. Dolayısıyla, işbirliğinin bütün sınıf düzeylerinde istenen bir etkinlik olduğu vurgulanmıştır (Richard & Bader 2010; Windschitl, Thompson, & Braaten, 2008). Aynı şekilde, Türk fen öğretim programında birlikte çalışmanın öğrencilerin feni etkili şekilde öğrenmesine yardımcı olduğundan bahsedilmiştir (Ministry of National Education [MoNE], 2013).

Birlikte çalışma bir diğer ifadeyle grup çalışması yüksek öğrenimde de etkin öğrenme stratejilerinden biridir. Bu grup çalışmalarının amacı öğrenciler arasındaki ilişkiyi güçlendirmek, ilgi uyandırmak ve daha iyi öğrenme çıktıları elde etmektir (Cabrera vd., 2002; Summers & Svinicki, 2007; Yi & Luxi, 2012). Bu amaçlara ulaşmak adına üniversitedeki eğitimciler grup çalışmalarını derslerine adapte etmeye başlamışlardır (NRC, 2012).

Öğretmen adaylarının eğitiminde de grup çalışması uygulanan bir tekniktir (Penuel, Fishman, Yamaguchi & Gallagher, 2007; Simmie, 2007). Bu fikre parallel olarak, fen öğretmen adaylarıyla yapılmış bazı çalışmalar bulunmaktadır (Soprano &Yang, 2013; Watson, Miller, & Patty, 2011, Watters & Ginns, 2000). Bu çalışmalar

grup çalışmasının, fen öğretmen adaylarının fen öğretim yeterliğinin, fen alan bilgisinin, öğretim deneyiminin ve pedagojik becerilerinin gelişiminde önemli bir rol oynadığını göstermiştir.

Alanyazında fen öğretmen adayları ile yapılmış grup çalışmasını inceleyen az sayıda çalışma olduğu için grup çalışmalarını etkileyen faktörlerinde geniş ölçüde çalışılmadığı görülmektedir. Bu konu hakkıında Johnson ve Johnson (1999) her grup çalışmasının etkili sonuçlar vermediğini birçok faktörün grup çalışmasına önemli rol oynadığını ifade etmiştir. Özellikle kolektif yeterlik, grup çalışmasının işleyişini etkileyen grup inancı olarak ortaya atılmıştır (Bandura, 1997).

Kolektif yeterlik; okul, organizasyon, spor takımları ve üniversite gibi birçok alanda bir takım konular açısında incelenmiştir. Bununla birlikte, kolektif yeterliğin kaynakları ile ilgili sınırlı sayıda çalışma bulunmaktadır. Bu çalışmalardan bazıları doğrudan yaşantıların, kolektif yeterliği etkileyen önemli bir etken olduğunu göstermiştir (Goddard, 2001; Goddard vd., 2004; Goddard, Logerfo, & Hoy, 2004; Katz-Navon & Erez, 2005; Ross, Hogaboam-Gray, & Gray, 2004). Ayrıca, dolaylı yaşatı ve sözel ikna ile ilgili bazı çalışmalarda bulunmaktadır (Baker 2001; Bruton, Mellalieu, & Shearer, 2014). Diğer yandan, kolektif yeterlik birçok değişkenle beraber de araştırılmıştır. Bu değişkenlerden bazıları mesleki tükenmişlik, meslek memnuniyeti, grup kohezyonu, grup performansı ve öz yeterliktir. Özellikle, kolektif yeterliğin, grup performansı ve öz yeterlikle ilişkisi geniş ölçüde araştırma konusu olmuştur. Yapılan çalışmalar, kolektif yeterliğin grup performansı ve öz yeterlikle güçlü bir şekilde ilişkili olduğunu göstermiştir. (Bandura, 1997; Fernandez-Ballesteros, Diez-Nicolas, Caprara, Barbaranelli, & Bandura, 2002; Fives & Looney, 2009; Goddard, 2001; Goddard & Goddard, 2001; Greenlees, Graydon, & Maynard, 1999; Gully, Beaubien, Incalcaterra, & Joshi, 2002; Hasan & Ali, 2007; Hodges & Carron, 1992; Klassen & Krawchuk, 2009; Lent, Schmidt, & Schmidt, 2006; Myers vd., 2004; Lev & Koslowsky, 2009; Peterson et al., 2000; Skaalvik & Skaalvik, 2010; Viel-Ruma, Houchins, Jolivette, & Benson, 2010; Wang, Hsu, Lin, & Hwang, 2014).

Bandura'nın (1997) kolektif yeterlik tanımına bağlı olarak, kolektif yeterliğin öğretmen adaylarının grup çalışmasını etkileyen önemli bir faktör olabileceği düşünülmüştür. Fakat, öğretmen adaylarını kolektif yeterlik açısından inceleyen

çalışmalar oldukça sınırlı sayıdadır. Bu çalışmalar da kolektif yeterliğin zaman içinde geliştiğini, grup tartışmalarında ve grup performansında önemli bir rol oynadığını göstermiştir (Wang & Lin, 2007, Webster, Erwin, & Parks, 2013). Bununla beraber, hala alanyazında, kolektif yeterliğin nasıl oluştuğu, süreç içinde nasıl değiştiği, kolektif yeterlik kaynaklarının grup davranış oluşumunda nasıl rol oynadığı ve kolektif yeterliğin grup başarısına ve öz yeterliğe nasıl etki yaptığı yönünde eksiklikler vardır. Alanyazındaki bu boşlukları doldurmak adına, bu çalışmada fen bilgisi öğretmen adaylarının kolektif yeterlikleri bir dönem boyunca yürütülen özel öğretim yöntemleri dersinde incelenmiştir.

Bu çalışmanın amacı, fen bilgisi öğretmen adaylarını özel öğretim yöntemleri dersinde kolektif yeterlik açısından incelemektir. Ayrıca, kolektif yeterlik kaynaklarının grup davranışına etkisini ve kolektif yeterliğin grup performansına ve öz yeterliğe nasıl etkilediğini incelemek, bu çalışmanın diğer amaçlarıdır. Bu amaçlar doğrultusunda, araştırma soruları aşagıdaki gibidir:

1) Fen bilgisi öğretmen adayları, özel öğretim yöntemleri dersinde yaptıkları grup çalışmasını nasıl tarif etmektedirler?
2) Fen bilgisi öğretmen adayları, özel öğretim yöntemleri dersinde kolektif yeterliği nasıl geliştirdi?
3) Fen bilgisi öğretmen adaylarının, özel öğretim yöntemleri dersindeki kolektif yeterliği süreç içinde nasıl değişti?
4) Özel öğretim yöntemleri dersinde, kolektif yeterlik kaynakları grubun davranışını nasıl etkiledi?
5) Özel öğretim yöntemleri dersinde, fen bilgisi öğretmen adaylarının kolektif yeterliği grup performansını nasıl etkiledi?
6) Özel öğretim yöntemleri dersinde, fen bilgisi öğretmen adaylarının kolektif yeterlikleri fen öğretimine yönelik öz yeterliklerini nasıl etkiledi?

Yöntem

Çalışmada nitel ve nicel araştırma yöntemleri beraber kullanılmıştır. Araştırmanın nitel boyutunu durum çalışması deseni kapsamaktadır. Durum çalışmasında özel öğretim yöntemleri dersinde dersin gereklerini yapmak üzere oluşturulan gruplardan biri durum olarak seçilmiştir. Seçilen bu grup, grup çalışması, kolektif yeterliğin oluşumu ve süreç içinde değişimi, kolektif yeterlik kaynaklarının

grup davranışına, grup başarısına ve fen öğretimine yönelik öz yeterliğine etkisi açısından bir dönem boyunca incelenmiştir.

Araştırmanın nicel boyutunda ise kolektif yeterliğin grup üyelerinin fen öğretimine yönelik öz yeterliğine etkisi nitel çalışmayla beraber olarak yürütülmüştür. Bunun için seçilen dizayn öntest sontest deneysel çalışmadır. Seçilen grupun üyeleri öğrenim dönemi öncesi ve sonrasında fen öğretimine yönelik öz yeterlilik açısından anket doldurmuştur. Böylece, kolektif yeterliğin, grup üyelerinin fen öğretimine yönelik öz yeterliğinde bir farklılılık yaratıp yaratmadığı incelenmiştir.

Çalışmanın katılımcıları aynı grupta çalışan dört fen bilgisi öğretmen adayından oluşmaktadır. Katılımcılar gönüllülük esasına dayalı olarak seçilmişlerdir. Bu katılımcılardan ikisi erkek ikisi kadın olup, genel not ortalaması, fen öğretimine yönelik öz yeterlik ve öğretim deneyimleri süreleri açısında farklılık göstermektedirler.

Bu çalışma özel öğretim yöntemleri dersinde gerçekleşmiştir. Bu ders, dersin hocası ve araştırmacının içinde olduğu dört asistanla beraber haftada dört saat olmak üzere bir öğrenim dönemi boyunca yürütülmüştür. Dersin genel amacı, fen bilgisi öğretmen adaylarının yeni fen öğretim metotlarını öğrenmeleri sağlamaktır. Bu amaç doğrultusunda, fen bilgisi öğretmen adaylarına her hafta yeni bir fen öğretim metotu anlatılmış, bu metotlar çerçevesinde ders planları ve ders anlatımları yapmaları beklenmiştir. Toplamda dokuz fen öğretim metotu anlatımı yapılmış ve öğretmen adayları dokuz adet ders planı hazırlanmıştır. Ayrıca, çalışmanın dördüncü araştırma sorusuna cevap bulmak üzere derse kolektif yeterlik kaynakları ile ilgili etkinlikler adapte edilmiştir. Örneğin, doğrudan yaşantı için her hafta ilgili metota yönelik grup ders planı hazırlamaları istenmiştir. Dolaylı yaşantı için ise dersin hocası her hafta ilgili metotla ilgli örnekler, materyaller ve etkinlikler göstermiştir. Daha sonra, dersin asistanları gösterilen metotla ilgili örnek ders anlatımı gerçekleştirmiştir. Ayrıca, diğer grupların hazırladıkları ders anlatımlarını dinleme imkanı sunulmuştur. Kolektif yeterliğin bir diğer kaynağı olan sözel ikna içinse, seçilen grubun ders anlatımı sonrası diğer gruplardan yorum yapmaları istenmiştir. Dersin asistanları da ders anlatımı sonrası seçilen gruba geri dönüt vermişlerdir. Sonuç olarak dersin işleyişi şu şekilde gerçekleşmiştir: Dersin haftada dört saat olduğu göz önüne

alındığında ilk saat dersin hocası tarafından yeni bir fen öğretim metotunun karakteristik özellikleri anlatılmıştır. İkinci saatte, dersin asistanları tarafından örnek ders anlatımı yapılmıştır. Daha sonra öğretmen adaylarına bir hafta süre verilerek ilgili metota uygun ders planları hazırlamaları ve son iki saatte de hazırladıkları ders planına göre ders anlatımında bulunmaları (mikroöğretim) istenmiştir.

Bu çalışmada; ön görüşme, son görüşme, odak grup görüşme, öğretmen adaylarının birlikte oluşturduğu değerlendirme kâğıtları, ders planları ve STEBI-B veri kaynağı olarak kullanılmıştır. Görüşmeler ve gözlemler kamera ve ses kayıt cihazı ile kaydedilmiştir. Ön görüşme; öğrenim dönemi başlangıcında, katılımcılar ile ilgili demografik bilgilere ulaşmak, geçmişte yapmış oldukları grup çalışmaları hakkında bilgi edinmek ve fen öğretimine yönelik öz yeterlik düzeylerini öğrenmek için yürütülmüştür. Son görüşmeler ise öğrenim döneminin sonunda bütün araştırma sorularına cevap bulmak için uygulanmıştır. Odak grup görüşmesi de ilk üç ders planı ve sonraki üç ders planı sonrasında gerçekleşmiştir. Bu görüşmelerde grup çalışması, kolektif yeterliğin gelişimi ve süreç içinde değişimi, kolektif yeterliğin grup başarısına ve fen öğretimine yönelik öz yeterliğe etkisi sorgulanmıştır. Ayrıca, öğretmen adaylarından birlikte, öğrenim dönemi boyunca her üç ders planından sonra değerlendirme kâğıtı oluşturmaları istenmiştir. Bu kağıtlarda, kolektif yeterlik kaynaklarının grubun davranışlarını nasıl etkilediğine yönelik sorulara cevap aranmıştır. Daha önce de belirtildiği gibi, öğrenim dönemi boyunca, seçilen grup toplamda dokuz ders planı hazırlamıştır, bu ders planları grubun performasını incelemek için kullanmıştır. Son olarak STEBI-B, kolektif yeterliğin fen öğretimine yönelik öz yeterliğe etkisini görmek için öğrenim dönemi başlangıcında ve sonunda olmak üzere iki defa uygulanmıştır.

Toplanan nitel veriler Merriam'ın (2009) önerdiği nitel analiz şemasına göre analiz edilmiştir. Daha açık ifade etmek gerekirse, görüntü ve ses kayıtları önce yazıya dökülmüş, verilerde kodlama yapılmıştır. İlgili kodlar aynı tema altında birleştirilmiştir. Daha sonra verilerin kodlara ve temalara gore düzenlenmesi ve tanımlanması yapılmıştır. Son olarak ise bulgular yorumlanarak analiz süreci tamamlanmıştır. Ders planları ise döküman analiz yöntemi ile analiz edilmiştir (Merriam, 2009). Çalışmanın araştırmacısı ve deneyimli dört uzman eşliğinde hazırlanan rubrik doğrultusunda seçilen grubun öğrenim dönemi boyunca nasıl bir

performans gösterdiği incelenmiştir. Son olarak, STEBI-B'den elde edilen veriler bağımlı örneklem t-testi ile analiz edilmek istenmiş fakat testin varsayımları karşılanmadığı için alternatifi olan Wilcoxon Signed Rank test uygulanmıştır.

Çalışmanın nitel boyutunda elde edilen verilerin güvenilir ve geçerli olması için bazı yöntemler uygulanmıştır. Bu yöntemler; uzun sureli etkileşim, sürekli gözlem, veri toplama aracında çeşitleme, uzman incelemesi ve ayrıntılı betimlemedir (Merriam, 2009). Bunlardan ilki, uzun sureli etkileşimdir. Araştırmacı; katılımcılarla arasındaki ilişkiyi güçlendirmek, onların güvenini kazanmak üzere onlarla belli bir vakit geçirmiştir. Diğer bir yöntem olan sürekli gözlemde ise araştırmacı, araştırma sorularında doğru ve gerçek verilere ulaşmak için dokuz hafta boyunca grubun ders planları hazırlama aşamalarında gözlem yapmıştır. Yine doğru ve gerçek verilere ulaşmak için veri toplama yöntemlerini çeşitleme kapsamında, araştırmacı süreç boyunca birçok veri toplama aracı kullanmıştır. Uzman incelemesinde ise bulunan kodlar ve temalar nitel çalışmada uzman bir araştırmacının eşliğinde kontrol edilmiştir. Çalışmanın diğer araştırmacılar tarafından transfer edilebilmesi adına araştırmacı çalışmanın yöntemini ve ulaşılan sonuçları ayrıntılı bir şekilde betimlemiştir. Son olarak, çalışmanın güvenilir olması için ikinci bir araştırmacı ile çıkarılan kodlar, temalar ve ders planları analizleri kontrol edilmiştir. Oluşan farklılıklar tartışılarak en aza indirilmeye çalışılmıştır. Ayrıca, ulaşılan sonuçlar katılımcılarından elde edilen alıntılarla desteklenmiştir. Dolayısıyla, araştırmacının önyargıdan uzak yorum yapması sağlanmıştır.

Çalışmanın bazı sınırlılıkları vardır. Bunlardan ilki, veri toplamak üzere birçok kez kamera ve ses kayıt cihazı kullanmıştır. Bu tarz ekipmanların kullanımı katılımcıların konuşmalarını ve davranışlarını etkilemiş olabilir. Örneğin, görüşmelerde ve gözlemlerde gerçek görüşlerini davranışlarını yansıtmamış olabilirler. Bir diğer sınırlılık ise, fen metotları dersi ile ilgilidir. Bu derste sadece dokuz fen öğretim metotu ele alınmıştır. Diğer yandan bu metotlar birbirinden farklı özellikleri barındırmaktadır. Bazılarının ders planına diğerlerine göre daha kolay entegre edildiği düşünülmesine rağmen ders planı analizlerinde bu konu ihmal edilmiştir. Son olarak, katılımcılar ders planı hazırlarken ana dilleri yerine üniversitenin resmi dilini kullanmışlardır. Bu durum çalışmanın bulgularını etkilemiş olabilir.

Araştırmacı katılımcıların gerçekleştirdiği grup çalışmasına müdahil olmayıp dışarıdan gözlemci gibi hareket etmiştir. Bunun dışında görüşme yapmak için katılımcılar ile araştırmacı belli zamanlarda bir araya gelmiştir.

Araştırmacı, etik konulara da özen göstermiştir. Öncelikle, çalışmanın etik açıdan uygun olduğuna dair yazılı onay aldıktan sonra çalışma başlatılmıştır. Katılımcılara sözel olarak bu çalışma kapsamında zarar gelmeyeceği vurgulanmıştır. Bununla birlikte, gerçek isimlerinin çalışmada kullanılmayacağı söylenip, görüşme sorularına verdikleri yanıtların ve diğer elde edilen verilerin gizli tutulacağı belirtilmiştir.

Bulgular ve Tartışma

Çalışmada ilk olarak katılımcıların nasıl bir grup çalışması yaptığı sorgulanmıştır. Grup üyeleri, ders planını parçalara bölerek yapmak yerine, her bölümünü grup ile beraber yaparak oluşturduklarını belirtmişlerdir. Bu tarz grup çalışması yapma nedenlerinin geçmiş deneyimleri olduğu düşünülmektedir. Grup üyeleri geçmişte yapmış oldukları grup çalışmalarında grup ödevini parçalara bölerek yaptıklarını belirtip, öğrenme açısından çok verimli olmadığını dile getirmişlerdir. Ayrıca Chiriac (2014), grup üyelerinin yaptığı, bu tarz grup çalışmasının gerçek ve anlamlı öğrenmeye yol açtığını söylemiştir. Chiriac'ın (2014) söylediğinden hareketle, grup üyeleri yaptıkları grup çalışmasında etkili öğrenmeyi istemiş olabilirler, çünkü fen öğretim metotları dersinde verilen bilgilerin öğretmeyi öğrenmek açısından önemli olduğunu vurgulamışlardır. Dolayısıyla, ders planlarının her bölümünü beraber yaparak bu konudaki eksikliklerini gidermeye çalışmış oldukları söylenebilir. Grup üyelerinin bu tarz grup çalışması yaptıkları sonucuna, beş önemli noktaya yoğunlaştıkları neticesinde ulaşılmıştır. Öncelikle, grup üyeleri birbirlerine pozitif bağımlı oldukları belirtmişlerdir. Daha açık ifade etmek gerekirse, ders planları hazırlama sürecinde birbirlerine ihtiyaç duymuşlardır. İkinci olarak, gruba karşı bir sorumluluk bilinci geliştirmişlerdir. Her grup üyesi grup çalışmasına katılıp, gruba katkıda bulunmuştur. Bir diğer önemli nokta da ise, grup üyeleri ders planlarını hazırlamak için her hafta belli bir mekanda toplanarak yüz yüze etkileşimde bulunmuşlardır. Ayrıca, bu çalışma ortamında herkesin fikrini kolayca söylediği ifade edilmiştir. Son olarak grup üyeleri, grup çalışmasını her hafta belli bir döngü çerçevesinde yapmışlardır. Örneğin ilk olarak ders planı hazırlamak için

gerekli bilgileri toplamışlar, bu bilgiler ışığında fikir alışverişi yapmışlardır. Daha sonra, bu fikirler masaya yatırılıp herkes tarafından değerlendirilerek ortak bir fikre ulaşılmaya çalışılmıştır. Döngünün son safhasında ise seçilen ortak fikir, grup üyeleri tarafından geliştirilmiştir. Yukarıda bahsedilen bu beş önemli nokta Johnson vd.' nin (1991) ifade ettiği başarılı grup çalışmasının dinamikleri ile paralellik taşımaktadır.

Çalışmanın bir diğer önemli bulgusu ise kolektif yeterlik ile ilgilidir. Grup üyeleri ders planı hazırlama konusunda gruplarına inandıkları söylemişlerdir. Bu bulgu Bandura'nın (1997) kolektif yeterliğin tanımıyla örtüşmektedir. Bu kolektif yeterliğin oluşumu etkileyen dört önemli faktör olduğu saptanmıştır. Bu faktörlerden ilki, ders planı hazırlarken yapılan grup çalışmasıdır. Bu grup çalışmasında, daha önce belirtildiği gibi, grup üyeleri ders planının her bölümünü beraber yaparak hazırlamışlardır. Bu bulgu, Lent vd.'nin (2006) kolektif yeterlik grup içinde bir birlik halinde hareket edilirse gelişir düşüncesi ile uyumludur. Diğer bir faktör, aynı amaç doğrultusunda grup çalışmasının yürütülmesidir. Grup üyeleri amaçlarının, fen öğretim metotlarını en iyi şekilde öğrenmek ve bunu ders planlarına yansıtmak olduğunu dile getirmişlerdir. Bu bulguya parallel olarak Bandura (2000); kolektif yeterlik, grup üyelerinin belli bir amaç doğrultunda çalışması sonucu oluşur demiştir. Üçüncü faktörde ise, grup üyeleri grup çalışmasına karşı positif tutum geliştirmişlerdir. Özellikle, grup çalışmasının; öğrenmede, sorumluluk bilincinin, sosyal ilişkilerin ve kritik düşünme becerilerinin gelişiminde etkili olduğunu söylemişlerdir. Bu bulgu Jones ve Carter'ın (2007) çalışmasının sonucu ile benzerlik göstermektedir. Jones ve Carter; çalışmalarında tutumun inançların gelişiminde etkili olabileceğini belirtmişlerdir. Kolektif yeterliğin gelişimini etkileyen son faktör ise grup uyumudur. Grup üyeleri, grupta belli bir uyumla ders planı hazırladıkları konusunda hem fikir olmuşlardır. Bu konu hakkında, Lee ve Farh (2004) grup uyumunun kolektif yeterlikle yakın bir ilişkide olduğunu bulmuşlardır.

Baker (2001) kolektif yeterliğin dinamik bir yapıda olduğunu ve zaman içinde geliştiğini iddia etmiştir. Bu iddiadan yola çıkarak, bu çalışmada da kolektif yeterliğin gelişimi izlenmiştir. Grup üyeleri her üç ders planından sonra kolektif yeterlik açısından araştırılmıştır. Baker'ın (2001) iddasına parallel olarak, ilk üç ders planından sonraki üç ders planına kadar olan süreçte ders planı hazırlamaya yönelik kolektif yeterliğin arttığı bulunmuştur. Bu durumun, grup üyelerinin ilk üç ders

planında gösterdikleri endişe ve stresin azalması sonucu oluştuğu düşününülmektedir. Ayrıca, ders planını hazırlamada tecrübe edinmeleri, bu işe alışmaları ve gruba daha çok güven gelmesi de kolektif yeterliğin gelişmesinde rol oynamış olabilir. İkinci üç ders planından son üç ders planına kadar süreçte, grup üyeleri arasında kolektif yeterliğin durumu hakkında bir belirsizlik olduğu gözlemlenmiştir. İki grup üyesi kolektif yeterliğin geliştiğini söylerken, diğer ikisi değişiklik olmadığını veya biraz azalma olduğu yönünde bildirimde bulunmuşlardır. Bu iki üyenin kolektif yeterlik anlayışının artmamasının bazı sebeplerden dolayı olduğu söylenebilir. Bu sebeplerden bazıları öğrencilerin aldıkları diğer derslerin ağır olması, ailedeki sorunlar neticesiyle yaşanan problemler, sürecin uzun olması gösterilebilir.

Bandura (1997) doğrudan yaşantı, dolaylı yaşantı, sözel ikna ve psikolojik ve duysusal durumlar olmak üzere kolektif yeterliğin dört adet kaynağı olduğunu belirtmiştir. Doğrudan yaşantı hakkında önceki deneyimlerin kolektif yeterliğin gelişiminde önemli rol oynadığı bulunmuştur (Goddard, 2001, Goddard vd., 2004, Lee & Farh, 2004). Ayrıca, Bandura (1997) ve Myers vd. (2004) grubun başarılı deneyimlerin daha etkili ürünler elde etme yönünde grubu teşvik ederken, yaşadıkları başarısız deneyimlerin grubu olumsuz etkileyip daha az efor sarfetmesine ve daha az kararlılık göstermesine neden olduğunu söylemişlerdir. Bandura'nın (1997) ve Myers vd.'nin (2004) iddialarına paralel olarak, bu çalışmada grubun başarılı ders planı hazırlaması grubu motive etmiş olup sonraki ders planlarınını daha nitelikli üretmelerine neden olmuştur. Diğer yandan, bütün grup üyeleri başarısız ders planı hazırlama deneyimlerininde kendilerini aynı şekilde etkilediklerini, daha çok çalışıp eksikliklerini gidererek nitelikli ders planı hazırladıklarını belirtmişlerdir. Başarısız deneyimlerin gruba etkisi, Bandura (1997) ve Myers vd.'nin (2004) iddialarıyla çelişmektedir. Bu durumun oluşmasında, diğer motivasyon öğelerinin etkili olabileceği yönünde bir çıkarım yapılmıştır. Bu konu hakkında Cooper ve Jayatilaka (2006), içsel ve dışsal motivasyonun grup çalışmasını etkileyen önemli kavramlar olabileceğini dile getirmiştir. Bu fikirden hareketle, grup üyeleri içsel motive olmuş olabilirler. Başarısız deneyim yaşamalarına rağmen fen öğretim metotlarını en iyi şekilde öğrenmek adına daha çok efor sarf edip, kararlılık göstermiş olabilirler. Diğer yandan, dışsal motivasyon onları daha çok çalışmaya itmiş olabilir. Daha önce

de belirtildiği gibi, grup hazırladıkları ders planı üzerinden değerlendirilmişlerdir. Dolayısıyla, öğrenim dönemi sonunda yüksek not almak adına başarısız durumlara rağmen daha çok çalışarak nitelikli ders planı hazırlamış olabilirler.

Çalışmanın bir diğer bulgusu, diğer kolektif yeterlik kaynağı olan dolaylı yaşantı ile ilgilidir. Bruton vd. (2014) diğer grupların model alınmasının, grubun kolektif yeterliğini geliştirdiğini belirtmiştir. Bandura (1997) ve Goddard vd. (2004), bu iddiayı geliştirerek benzer amaçları, fırsatları ve hatta benzer kısıtlamaları olan grubların veya diğer insanların model alınmasıyla kolektif yeterliğin gelişebileciğini ileri sürmüştür. Buradan hareketle, mevcut çalışmaya bazı etkinlikler adapte edilmiştir. Örneğin, dersin hocası her hafta bir fen öğretim metotunu anlatıp, metotla ilgili etkinlikler göstermiştir. Daha sonra; dersin asistanları, ilgili metotla ders anlatımı gerçekleştirmiştir. Ayrıca, grubun diğer grupların ders anlatımını izlemesi istenmiştir. Yapılan analizler, Bruton vd.'nin (2014), Bandura'nın (1997) ve Goddard vd.'nin (2004) iddialarını desteleyerek grubun ders planı hazırlarken, dersin hocasının, diğer grupların ve ders asistanların ders anlatımlarını model aldıklarını göstermiştir. Model almalarının nedeni olarak grup üyelerinin etkili ders planı hazırlama konusunda eksikliklerin olması ileri sürülebilir. Bu metotların uygulanması yönündeki eksikleri onları model alarak kapatmak istemiş olabilirler.

Bu çalışma kapsamında; grup üyeleri hazırladıkları bazı ders planlarının ders anlatımını gerçekleştirmiştir. Sınıf içinde bulunan diğer gruplar grubun performansı hakkında dönütte bulunmuşlardır. Aynı şekilde, dersin asistanları da gruba eksik ve güçlü yönlerini belirten eleştirilerde bulunmuşlardır. Ayrıca dersin asistanları her hafta grubun hazırladıkları ders planı hakkında detaylı bir dönüt vermişlerdir. Asistanlar ve diğer gruplardan verilen olumlu geri dönütlerinin onları daha nitelikli ders planı hazırlamaya teşvik ettiği bulunmuştur. Bu bulgu, Bandura'nın (1997), ve Sorlie ve Torsheim'nın (2011) olumlu geri dönütler grubun daha başarılı olmasına katkıda bulunur iddiasını onaylamaktadır. Diğer yandan, grup üyeleri olumsuz eleştirilerin de onların hatalarını düzeltmesinde etkili rol oynadığını belirtmişlerdir. Bu bulgu Bandura'nın (1997), and Sorlie ve Torsheim'nın (2011) olumsuz eleştiriler grubun çalışmasının negatif yönde etkiler fikri ile çelişmektedir. Böyle bir durumun ortaya çıkmasında, doğrudan yaşantıda olduğu gibi diğer motivasyon öğelerinin (içsel ve dışsal motivasyon) etkisinin olabileceği düşünülmektedir. Ayrıca, gruba

yapılan olumsuz eleştirilerinde az sayıda olduğu grup üyeleri tarafından belirtilmiştir. Dolayısıyla, olumsuz eleştirilerin gerçek etkisi ortaya çıkmamış olabilir.

Psikolojik ve duygusal durumlar kolektif yeterliğin diğer kaynağıdır. Bandura (1997) ve Goddard vd. (2004) korku, stres ve endişe gibi olumsuz durumların grubun kendine olan güvenini azaltıp, olumlu psikolojik ve duygusal durumların ise grubun performansını artıracağını belirtmişlerdir. Bu fikre paralel olarak, grup üyeleri grubun yaşadığı stresi azaltmak için komik hikayeler anlatıp ve müzik dinlediklerini söylemişlerdir. Bu durum sayesinde ders planı hazırlamaya yoğunlaşabildiklerini savunmuşlardır.

Bu çalışmanın bir diğer bulgusu grubun ders planını hazırlamakta gösterdikleri performansla ilgilidir. Öğrenim dönemi boyunca oluşturulan ders planlarının nitelikleri artmıştır. Özellikle, dersin kapanışını yapmada, dersin değerlendirilmesinde ve öğretim metotunun doğru kullanımında ilerleme kaydedildiği saptanmıştır. Diğer yandan, grubun kazanım yazmada ve öğretimin anlatımında hatalar yaptıkları gözlenmiştir. Kazanım yazmadaki görülen eksiklerin, fen öğretmen adaylarının bu konu hakkındaki kısıtlı deneyimden kaynaklanması sonucu oluştuğu düşünülmektedir. Fen öğretmen eğitimi programının, ikinci yılında gösterilen bir derste kazanım yazmanın incelikleri gösterilmesine rağmen, bu konuda öğretmen adayları yeterli pratik yapmamış olabilirler. Öğretimin anlatılmasında görülen eksikler ise etkinliğin ayrıntılı anlatılmamasından kaynaklanmaktadır. Bu durumun nedeni, fen öğretmen adaylarının ders planı yazmada kendi ana dilleri yerine, üniversitenin resmi dili olan İngilizce kullanmasından dolayı kendileri yeterince ifade edemedikleri olarak gösterilebilir.

Ders planlarında gelişmeye paralel olarak grup üyeleri grubu ders planı hazırlamada başarılı gördüklerini belirtmişlerdir. Bu başarının sebebi olarak, kolektif yeterlikten doğrudan veya dolaylı olarak bahsetmişlerdir. Daha açık ifadeyle, bazı grup üyeleri kolektif yeterliğin doğrudan grubun performansını artırdığını söylemiştir. Bu bulgu, alanyazında bulunan önceki çalışmaların kolektif yeterlik grup performası ile yakından ilgilidir bulgusuyla uyumludur (Bandura, 1997; Goddard, 2001; Greenlees vd., 1999; Gully vd., 2002; Hasan & Ali, 2007; Hodges & Carron, 1992; Klassen & Krawchuk, 2009; Lent vd., 2006; Myers vd., 2004; Peterson vd., 2000; Wang vd., 2014). Diğer yandan; diğer grup üyeleri, kolektif yeterlik

kaynaklarının grup performansının artmasında etkili olduklarının altını çizmişlerdir. Bu bulgu, Junqueira and Matoti'nin (2013) insanlar yaptıkları işin sonucu yorumladıktan sonra, bu işte yetkin olup olmadığı kararına ulaşabilir iddiasıyla açıklanabilir. Bu fikir öz yeterlik için söylenmiş olsa da aynı teoriden türetilmiş olan kolektif yeterliğe uygulanabilir. Dolayısıyla, grup üyeleri grubun başarı olma sebebini grup içinde yaşadıkları kolektif yeterlik kaynakları ile ilgili olan deneyimlere dayalı açıklamış olabilir. Diğer yandan, hiçbir grup üyesi dolaylı yaşantı kaynağını grup performasındaki gelişmenin sebebi olarak vermemiştir. Dolaylı yaşantı ile ilgili olarak, Bandura (1997) model alınacak kişinin veya kişilerin aynı özellikleri göstermesi gerektiğini belirtmiştir. Buna dayanarak, mevcut çalışmada grup üyeleri diğer grupları yetenek, yetkinlik ve motivasyon açısından gerçekten eşit olarak görmeyip, grup performansındaki gelişimde, bu kaynağın etkisinden hiç bahsetmemiş olabilirler.

Bu çalışmanın önemli bir diğer bulgusu ise, kolektif yeterlik kaynaklarının grup üyelerinin fen öğretim yeterliğinin ve sonuç beklentilerinin gelişiminde önemli rol oynadığıdır. Bu bulgu, alanyazında yer alan çalışmalarda belirtilen kolektif yeterlik öz yeterlik ile yakından ilgilidir sonucunu desteklemektedir (Fernandez-Ballesteros vd., 2002; Fives & Looney, 2009; Goddard & Goddard, 2001; Lent vd., 2005; Lev & Koslowsky, 2009; Skaalvik & Skaalvik, 2010; Viel-Ruma vd., 2010). Grup üyeleri, kolektif yeterlikten doğrudan bahsetmek yerine, kolektif yeterlik kaynaklarının fen öğretim yeterliğinin ve sonuç beklentilerin gelişiminde etkili olduğunu dile getirmiştir. Bu durum yine Junqueira and Matoti'nin (2013) iddiası olan yaşanılan deneyimlerin yeterlik olgusunu oluşturacağı iddiasıyla açıklanabilir. Daha açık bir ifadeyle, fen öğretim yeterliğinin ve sonuç beklentilerin gelişimi grubun yaşadığı kolektif yeterlik kaynakları ile ilgili olan deneyimler doğrultusunda açıklanmıştır. Bu her iki konudaki gelişimi daha ayrıntlı şekilde anlatırsak, grup üyeleri feni etkili bir şekilde öğretecekleri inancının her üç ders planından sonra sürekli olarak arttığını dile getimişlerdir. Birbirlerinden bağımsız olarak doğrudan yaşantı, dolaylı yaşantı ve sözel ikna olan kolektif yeterlik kaynaklarını bu gelişimin sebebi olarak vermişlerdir. Bu farklılık kişilerin algılarından kaynaklanmış olabilir. Ayrıca doğrudan yaşantı, grup üyelerince en çok vurgulanan sebep olmuştur. Bu, Bandura'nın (1997) ve Palmer'ın (2006a) doğrudan yaşantı yeterlik algısının en

güçlü kaynağıdır savını onaylamaktadır. Ayrıca, grup üyelerinin fen öğretim yeterliğinin gelişiminde sebep olarak verdikleri bu kaynakları zamanla değiştirdiği görülmüştür. Daha açık ifade etmek gerekirse; bir grup üyesi, ilk üç ders planında sözel iknadan bahsederken, ikinci üç ders planında doğrudan yaşantıların fen öğretim yeterliğin gelişiminde etkin olduğunu söylemiştir. Bu durumun sebebi, fen öğretim yeterliğin gelişiminde kolektif yeterlik kaynaklarının belli bir zaman diliminde eşit bir şekilde rol oynamaması olarak düşünülmektedir. Sonuç beklentisinde ise, grup üyeleri öğrencilerinin fen de başarılı olmasını sağlayacaklarına inandıklarını belirtmişlerdir. Bu inaçları sürekli olarak artmıştır. Bu artışın sebebi olarak bütün grup üyeleri doğrudan yaşantıdan bahsetmişlerdir. Bu bulgu da Bandura'nın (1997), Palmer'ın (2006a) doğrudan yaşantının güçlü bir kaynak olması iddiası ile uyumludur. Grup üyelerinin sonuç beklentisinin gelişiminde sürekli olarak doğrudan yaşantıyı sebep olarak vermesi, grup üyelerinin algısıyla açıklanabilir. Grup üyeleri grup çalışmalarında ders planı hazırlarken sürekli bazı konular üzerinde durduklarını dile getirmişlerdir. Örneğin, hitap ettikleri öğrenci seviyelerini ve ilgi alanlarını düşünerek ders planları hazırladıklarını aktarmışlardır. Bu tür noktalar, grup üyelerince öğrencilerin fen'i etkili öğrenmesinde ve fen'e positif tutum geliştirmesinde önemli olarak algılanmış olabilir. Dolayısıyla, grup çalışmalarında kendilerini bu noktalar doğrultusunda geliştirmiş oldukları düşünülebilir.

Öneriler

Bu çalışmadan elde edilen bulgular ışığında fen öğretmen eğitimcileri ve fen öğretmenlerine bazı önerilerde bulunulmuştur. Öncelikle, kolektif yeterliğin grubun davranışında olumlu bir etki yarattığı ve grubun performansını etkilediği görüldüğünden, fen öğretmen eğitimcilerinden kolektif yeterliği, öğretmen adaylarının yaptıkları grup çalışmalarını geliştirmek adına göz önünde bulundurması istenmiştir. Mevcut çalışma özel öğretim yöntemleri dersinde geçtiği için özellikle bu alanda ders veren eğitimciler derslerini kolektif yeterliği oluşturmaya göre dizayn etmelidirler. Çalışmanın bulgusu olan kolektif yeterliğin oluşumunu sağlayan dört önemli faktörün bu derse entegre edilmesi gerekmektedir. Daha açık ifade etmek gerekirse, bu dersin gereklerini yapmak için fen öğretmen adayları grup çalışmasına özendirilmelidir. Bu grup çalışmalarında görevi paylaşmak yerine, grup ile beraber görevin her bölümünde çalışmanın önemi vurgulanmalıdır. Diğer yandan, benzer

amaçları olan ve birbirleriyle iyi ilişkilerde bulunan kişilerin birlikte çalışması istenmelidir. Ayrıca, grup çalışmasına karşı positif bir tutum geliştirmek adına başarılı grup çalışması örnekleri fen öğretmen adaylarına gösterilmedir. Bu dört önemli faktörün dışında kolektif yeterliğin gelişimini sağlayan kaynakların da fen öğretim metotları dersine entegre edilmesi düşünülmelidir. Doğrudan yaşantı için fen öğretmen adaylarından birçok kez grup ile beraber ders planları yapmaları istenmelidir. Grupların, diğer grupların yaptığı ders anlatımlarını incelemesine izin verilmesi de dolaylı yaşantı için yapılacak bir etkinlik örneğidir. Ayrıca; kolektif yeterliğin, sözel ikna kaynağı için gruplara ders anlatımı veya ders planları için geri dönüt verilerek artıları ve eksileri anlatılmadır. Son olarak, kolektif yeterlik kaynağı olan psikolojik ve duygusal durumlar için ise stresten, korkudan ve endişeden uzak bir otamda grupların çalışılması sağlanmalıdır. Fen öğretmen eğitimcileri, bu tür önerileri sadece fen öğretim metotları dersinde değil, programda yer alan diğer derslerde de dikkate almadırlar.

Fen öğretmen eğitimcilerin yanı sıra, fen öğretmenleri içinde önerilerde bulunulabilir. Alan yazında öğretmenlerin grup çalışmasına ile ilgili olumsuz deneyimleri oldukları söylenmektedir. Örneğin, sınıf ve zaman yönetiminde yaşanan zorluklar, bazı grup üyelerinin sorumsuzluğu ve kötü davranışları, iletişimde ve öğrenmede eksikliğe neden olması gibi grup çalışmasının bazı olumsuzluklarından bahsedilmiştir (Gillies & Boyle, 2010). Buna dayalı olarak, fen öğretmenlerin öğrencilerine grup çalışması yaptırmaktan kaçındıkları bulunmuştur. Mevcut çalışmada, bütün grup üyeleri grup çalışmasının öğrenmeyi kolaylaştırdığını, sorumluluk duygusunu, kritik düşünme becerilerinin ve sosyal ilişkilerini kuvvetlendirdiğini ifade etmiştir. Bu açıdan, fen öğretmenleri öğrencilerinin fen'i etkili öğrenmesi, kişisel ve sosyal becerilerinin gelişmesi için grup çalışmalarını sınıflarında uygulamaya daha istekli olmalıdırlar. Bu çalışmada ayrıca, grup üyelerinin grup çalışmasına karşı pozitif bir tutum geliştirdiği bulunmuştur. Yaşam boyu öğrenme adına; işbirliğinin 21. yüzyıl becerisi olarak kabul edildiğini de düşünürsek, fen öğretmenleri öğrencilerine birlikte çalışmayı erken yaşlarda kazandırıp, grup çalışmalarına pozitif bir tutum geliştirmeyi sağlamalıdırlar.

Fen öğretmenleri kolektif yeterlik kaynaklarını da derslerine entegre etmeyi düşünmelidir, çünkü kolektif yeterlik kaynaklarının grup üyelerinin fen öğretimine

yönelik öz yeterliklerini artırdığı bulunmuştur. Bu çerçevede, fen öğretmenleri kendi öğrencilerinin fen'e karşı öz yeterliklerini geliştirmek adına kolektif yeterlik kaynakları ile ilgili etkinler düzenlemeyi seçmelidir. Son olarak, bu çalışmada kolektif yeterlik kaynaklarının grup performansının gelişiminde etkili olduğu saptanmıştır. Fen öğretmenleri de öğrencilerden etkili projeler elde etmek için öğrencilerini grup çalışmasına teşvik edip, kolektif yeterlik kaynakları ile ilgili etkinlikleri derslerine eklemelidirler.

Yukarıda belirtilen öneriler dışında gelecek çalışmalar içinde bazı tavsiyelerde bulunabilir. Örneğin, Klassen ve Krawchuk (2009) kolektif yeterliğin etkisinin ortaya net bir şekilde çıkabilmesi için daha uzun süreli çalışmalara gerek olduğunu söylemiştir. Bu kapsamda, uzun vadeli çalışmalar yapılabilir.

Alanyazında fen öğretmen adayları ve fen öğretmenleri arasında yapılan grup çalışmasını inceleyen araştırmalar vardır (Kenny, 2010; Zhou vd., 2011). Bu tarz araştırmaların kolektif yeterlik açısından incelenmesi alanyazına katkı yapabilir.

Bunun dışında, alanyazında kısıtlı sayıda kolektif yeterliği hedef alan araştırma olduğu düşünülürse (Bandura, 1997), fen öğretmen adayları kolektif yeterlik açısından programda yer alan diğer derslerde de incelenmelidir. Buna ek olarak, zorunlu eğitimde yer alan öğrencilerin kolektif yeterlik açısından daha çok araştırılması alanyazına büyük bir katkıda bulunacaktır.

Son yıllarda, fen öğretim yeterliği konu bazında araştırma konusu olmuştur. Örneğin, fen öğretmen adaylarının evrimi, kuvvet ve hızı öğretmeye karşı yeterlikleri ölçülmüştür (Akyol, Tekkaya, Sungur, & Traynor, 2012; Tanel, 2013). Kolektif yeterlik ve öz yeterlik aynı teoriden türetildiği için kolektif yeterliğin öğrencilerin fen konularını öğrenmedeki etkisi yeni bir araştırma konusu olabilir.

Gelecek çalışmalar için verilen bir diğer tavsiye ise fen eğitiminde yapılan çalışmaların daha genişletilmesi ile alakalıdır. Örneğin, argümantasyon, sosyobilimsel konular, çevre eğitimi ve STEM eğitimi gibi gelişen alanlarda kolektif yeterliğin entegte edilmesi çalışmalara yeni bir boyut kazandırabilir.

APPENDIX M: CURRICULUM VITAE

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HOBBIES

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PUBLICATIONS

Articles

Atasoy, V. (2015). The role of achievement goal orientations and interest on metacognitive strategy use of preservice science teachers. *Turkish Journal of Education, 4*(3), 4-15.

Conference Papers

Atasoy, V. (2014, October). *Examining new fifth grade Turkish science textbook with respect to nature of science.* Paper presented at the meeting of International Society of Educational Research, Cappadocia, Turkey.

Atasoy, V. (2014, Eylül). *5. sınıf yeni fen bilimleri dersi kitabının argümantasyon örnekleri açısından incelenmesi* [*Examining new fifth grade Turkish science textbook with respect to example of argumentation]*. XI. Ulusal Fen bilimleri ve Matematik Eğitimi Kongresinde sunuldu, Adana, Türkiye.

Atasoy, V., & Cakiroglu, J. (2015, September). *Preservice science teachers' common mistakes in lesson plans.* Paper presented at the meeting of 11th Conference of European Science Education Research Association (ESERA), Helsinki, Finland.

Atasoy, V. (2015, June). *Examining new fifth grade Turkish science textbook with respect to science process skills.* Paper presented at ISER 2015 World Conference on Education, Istanbul, Turkey.

Atasoy, V., & Cakiroglu, J. (2015, June). *Effect of science methods course on science teaching efficacy beliefs of Turkish preservice science teachers.* Paper presented at IInd International Eurasian Educational Research Congress (EJER), Ankara, Turkey.

Atasoy, V., & Cakiroglu, J. (2015, June). *The common strengths and weaknesses of preservice science teachers in microteaching.* Paper presented at ERPA 2015 International Congress on Education, Athens, Greece.

Atasoy, V. (2015, September). *Investigation self-regulation and self-efficacy of Turkish preservice teachers towards teaching science with respect to gender and grade level.* Paper presented at the meeting of European Conference on Education Research (ECER), Budapest, Hungary.

Atasoy, V.(2015, June). *Experiences of two groups of preservice science teachers regarding collaborative learning and collective learning.* Paper presented at 4th International Conference on Education, St. Petersburg, Russia.

Atasoy, V. (2015, April). *Effect of group composition on motivation of students in group.* Paper presented at the International Organization for Science and Technology Education (IOSTE), Istanbul, Turkey.

Atasoy, V., & Cakiroglu, J. (2015, April). *Experiences of preservice science teachers regarding group work in science methods course.* Paper presented at the International Organization for Science and Technology Education (IOSTE), Istanbul, Turkey

APPENDIX N: TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ■

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : Atasoy
Adı : Volkan
Bölümü : İlköğretim

TEZİN ADI (İngilizce) : Analyzing Collective Efficacy of Preservice Science Teachers in Science Methods Course

TEZİN TÜRÜ : Yüksek Lisans ☐ Doktora ■

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
3. Tezimden bir bir (1) yıl süreyle fotokopi alınamaz. ■

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: