16. Mathematics teachers' opinions about their professional development and lesson planning: Lesson study perspectives[1]

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Abstract

The lesson study is a teaching model that emerged from the needs for teachers' developments in their professions in Japan. This method allows teachers to work collaboratively in line with some common goals, (i) to plan their lessons, (ii) to eliminate their professional deficiencies, and (iii) to gain different perspectives by contributing to their professional development. In this context, the aim of the study is to determine elementary school mathematics teachers' opinions on how the lesson study activities contribute to their professional developments. In addition, determining how teachers plan the lessons with respect to lesson study activities is another goal of this study. The method of the research is action research, which is one of the qualitative research methods. The study, carried out in the form of three lesson cycles, was completed in six weeks. Content analysis method was used to analyze the data in this study. The coding process of the data is based on constant comparison method. The research results indicated that the collaboration among mathematics teachers using the lesson method contributed to their professional development in various ways, and that teachers prepared lesson plans by paying attention to different factors related to geometry lesson before instructions. Consequently, some suggestions were made on the results obtained.

Keywords: Lesson study, teachers' professional development, lesson plan, elementary school mathematics teachers

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Matematik öğretmenlerinin mesleki gelişim ve ders planlamalarına yönelik görüşleri: Ders imecesi perspektifleri[4]

Öz

Ders imecesi Japonya'da öğretmenlerin mesleklerindeki gelişim ihtiyaçlarından ortaya çıkan bir öğretim modelidir. Bu yöntem öğretmenlerin bazı ortak hedefler doğrultusunda işbirliği içinde çalışmalarına, (i) derslerini planlamalarına, (ii) mesleki eksikliklerini gidermelerine ve (iii) mesleki gelişimlerine katkıda bulunarak farklı bakış açıları kazanmalarına olanak sağlamaktadır. Bu bağlamda çalışmanın amacı, ders imecesi etkinliklerinin ortaokul matematik öğretmenlerinin mesleki gelişimlerine nasıl katkıda bulunduğunu tespit etmektir. Ayrıca öğretmenlerin dersleri nasıl planladıklarını belirlemek de bu çalışmanın diğer bir amaçtır. Araştırmanın yöntemi nitel araştırma yöntemlerinden biri olan eylem araştırmasıdır. Üç ders döngüsü şeklinde gerçekleştirilen çalışma altı haftada tamamlanmıştır. Araştırmada verilerin analizinde içerik analizi yöntemi kullanılmıştır. Verilerin kodlanma süreci sürekli karşılaştırma analizine dayanmaktadır. Araştırma sonuçları, matematik öğretmenleri arasında ders yöntemini kullanarak yapılan işbirliğinin mesleki gelişimlerine çeşitli yönlerden katkı sağladığını, öğretmenlerin öğretim öncesinde geometri dersi ile ilgili farklı faktörleri dikkate alarak ders planları hazırladıklarını göstermiştir. Bu doğrultuda elde edilen sonuçlara ilişkin bazı önerilerde bulunulmuştur.

Anahtar Kelimeler: Ders imecesi, öğretmenlerin mesleki gelişimi, ders planı, ortaokul matematik öğretmenleri

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Introduction

Countries need to keep up with the developments as the world is in a rapid development socially, culturally, and technologically**.** Such developments influence various fields including social, political, health and economic, it also influences the education. Within this context, different countries take special attentions to improve their education system by investing more on it by improving working conditions of teachers and learning environments for students. Considering the importance of teachers' professional developments and its potential benefits on education, mathematics researchers from different countries began studying different methods regarding teachers. One of the methods that contribute to teachers' professional developments is Japanese origin lesson study. Studying and appreciating lesson studies is crucial because, according to international comparative studies like the Organization for Economic Co-operation and Development (OECD) (2001) and Trends in International Mathematics and Science Study (TIMMS) (1999), the top countries are among those that use the lesson study method for their teacher training approaches (Clarke, 2013; Stigler & Hiebert, 1999).

In the current literature, there are various studies supporting and mentioning about teachers' professional developments. Among these, the lesson study method in mathematics education has become one of the most remarkable models among professional development methods (Bütün, 2015; Fernandez, 2002; Hourigan & Leavy, 2023; Murata, 2011). Considering the results of international comparative studies (OECD, 2001; 2019; 2023), Japanese students' achiements in mathematics took mathematics researchers' attentions and Japanese education system became a field of study for many of them (e.g., Lewis, 2016). As a result, it is understood that students' achiements in mathematics stemmed from teaching training approach of Japan, particularly from lesson study approach. This is because the goal of this method is for teachers to become better educators and to design and deliver lessons that will benefit students in a way that will make learning more meaningful (Murata, 2011). To do this, teachers are encouraged to put students at the center of all activities (Takahashi & Yoshida, 2004). With this method, teachers improve themselves in a way to make sense of students' thoughts, making teaching more useful (Murata 2011). Lesson study enables students to construct their own learning by structuring knowledge, to develop their thinking skills and to be active by being involved in the practices and thus to be more successful (Fernandez, 2002; Takahashi & Yoshida, 2004).

The lesson study method emerged for improving teachers' professional developments in Japan during the 1900s (Fernandez, Cannon & Chocksi 2003). This method is a model where teachers come together to plan the teaching processes and make evaluations together for a common purpose (Murata, 2011). This approach involves a group of activities that take place before, during and after the instructions so that teachers can perform more effective instructions in collaboration (Murata, 2011). In this context, it was observed that the instructions and teaching were more effective when teachers work in collaboration with their colleagues (İlğan, 2013). In this method, teachers can contribute to their professional development by solving their professional deficiencies and instructional problems (Günay, Yücel-Toy & Bahadır, 2016). In addition, it was also seen that the lesson study method improves teachers' critical thinking abilities (Sitton 2006; Yarema 2010) and broadens their perspectives in teaching profession (Lee 2008; Tepylo 2008).

The current studies have shown that the lesson study method allows teachers to perform group works for better instructional practices by benefiting from each other's experiences (Murata & Takahashi 2002; Lewis 2002; Meng & Sam 2011; Robinson & Leikin 2011; Fernandez 2002). Considering that teachers play the most crucial role in teaching and learning environments in classrooms (Altun, 2006; Murata,

2011; Asan & Güneş, 2005) and that students show achievements when their teachers make collaboration for better instructions (İlğan 2013), the lesson plans prepared by teachers before the instructions gains more importance. In these plans, teachers plan their instructions in a way that they present possible solutions for the common and/or newly appearing problems regarding the subject taught (Lee & Takahashi, 2011). In addition, teachers reconsider the crucial points in their plans before practicing the lesson. With the lesson plans, teachers can Therefore, they gave more attention to their lesson plans, which, in turn, positively influence the quality of the instructions and students' understanding of the subject taught (Fuiji, 2019; Lewis, 2009; 2016).

Lesson planning plays crucial role within the context of lesson studies. Lesson plans can be considered as a fundamental component of promoting effective teaching strategies and supporting students' learning experiences. Carefully prepared lesson plans can help learners achieve predetermined learning objectives in the instructions and meet the academic standards (Lee & Takahashi, 2011; Lewis, 2002). It also supports the use of different instructional strategies adapted to the various requirements of students, increasing resource use, and creating a positive learning atmosphere. A systematics lesson planning and design incorporates reflective practices, peer feedback, and collaborative inquiry by synthesizing ideas from lesson studies (Fuiji, 2019; Lee & Takahashi, 2011). It would be preferable for teachers to embrace lesson planning within the cooperative framework of lesson study, as it is a dynamic process that supports their professional development and the enhancement of their teaching practices (Fuiji, 2019).

Various researchers adopted different approaches regarding lesson study (i.e., Fernandez, 2008; Murata, 2011; Bütün, 2015). These approaches focus more on some teaching and collaboration cycles among teachers. Although each approach has some minor procedural and theoretical differences, each approach involves similar features and steps in these lesson study cycles. This study mainly focused on Murata's (2011) lesson study cycle summarized in Figure 1.

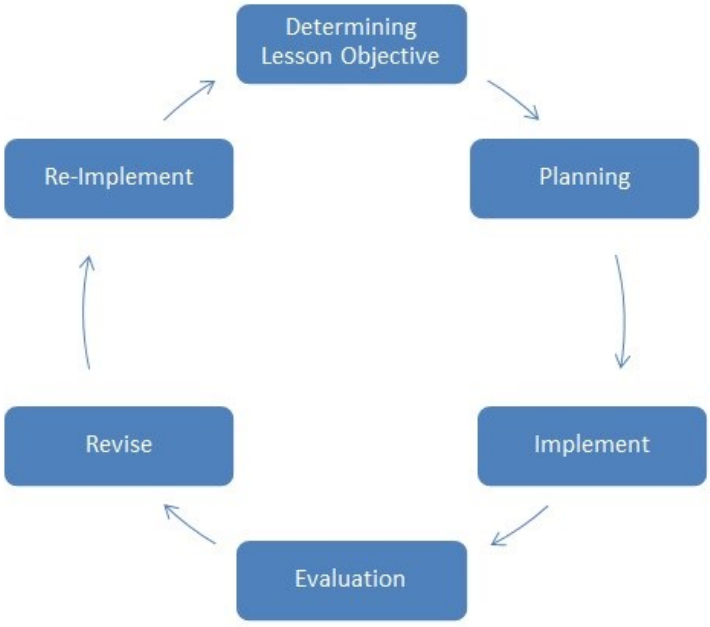

Figure 1. Lesson study cycles adapted from Murata's (2011) study

First of all, teachers determine a lesson objective. This objective can be a specific one or a general lesson goal. According to Murata (2011), the purpose of this step is not to make a structurally or visually very good plan, but to make a plan that contributes to make students understand the subject better. After preparing the lesson plan, all teachers in the lesson study group attends each other's lesson and takes notes. Then, they come together again and evaluate students' learning process by discussing the lessons followed. After the discussions, the same procedure is repeated, and teachers continue planning and implementing the lessons with new objectives. During this process, they also benefit from their previous experiences gained during the lesson study periods. Murata (2011), who defines lesson teaching as live instruction, stated that this method is a unique opportunity for teaching.

There are some studies conducted by Fernandez (2008) and Bütün (2015) explaining the lesson study procedures. The process of Fernandez's (2008) lesson study approach was composed of the following phases: *planning the lesson*, *obverving the lesson*, *evaluating the process*, and *revising the process*. First of all, teachers come together and begin to design the most influencial lesson plan for the specific subject or objective. One teacher makes the instruction in accordance with the lesson plan prepared, while the other teachers observe it. Then, they come together again and share their observations. If needed, this process is repeated. On the other hand, Bütün's (2015) approach regarding the lesson study involves *the preparation of the lesson plan, pre-evaluation report, and post-evaluation report for the instruction* phases. Accordingly, teachers prepare a detailed lesson plan. After its preparation, teachers propose a pre-evaluation report and go to the third phase, which is the application of the lesson plan. In this phase teachers participate to the instruction and one teacher completes the instruction in line with what the lesson plan proposes. Lastly, they prepare a post-evaluation report regarding the instruction and lesson plan. This report includes what can be improved or revised in the repetition of the lesson by looking at how far the goals of the lesson have been achieved in accordance with the plan.

As seen, all these lesson study approaches share some similarities (e.g., cycles) in the cycles of applying the method. All have planning, application and, when needed, revision phases. In this study, Murata's (2011) theoretical framework was used since utilizing it is more approriare with the purpose of this study.

Nowadays, the studies regarding lesson study method are rapidly increasing (Günay, Yücel-Toy & Bahadır, 2016; Lewis, 2016; Hourigan & Leavy, 2023). However, the studies particularly focusing on geometry is very limited (e.g., Moss, Howes, Naqvi & Caswell, 2015). In fact, teachers generally follow similar procedures in teaching geometry subjects. However, teacher may benefit from other teachers' experiences and ideas about teaching them by means of observations of others' teaching practices and discussions regarding them. Therefore, they can provide richer learning environments for students via lesson study method. Moreover, correctly constructing the geometry knowledge is very important for students and this brings students to improve their association, reasoning, and problem-solving skills (National Council for Teachers of Mathematics [NCTM], 2000). The lesson study method is beneficial for achieving them. With the lesson study method, the teachers come together to make plans for training these students. Moreover, it contributes to teachers' professional development. The lesson study method was utilized in teaching angles subject in this study. In this context, the purpose of this study is to determine the possible contributions of lesson study activities to elementary school teachers' professional developments about angles based on their opinions. In addition, how teachers prepare their lesson plans is another purpose of this study. In line with these purposes, the followings are the research problems of this study.

- Based on teachers' opinions, how does the lesson study method contribute to teachers' professional developments?
- What are the factors that elementary school mathematics teachers pay attention when preparing their lessons in lesson study processes?

Method

The research design

This study aimed to investigate mathematics teachers' opinions about the possible benefits and influences of implementation of lessons study method on their professional developments and to determine how they prepare their lesson plans after its implementation in the subject of angles. In line with the nature of the aims of this study, it utilized qualitative research approach (Creswell, 2014; Kanpolat, 2015). First, this study investigated teachers' current situations of preparing lesson plan and implementing it. After determining existing deficiencies, this study tried to improve these procedures and contribute to teachers' professional developments. From this point of view, the action research method was adopted for this study. In education studies, action research is typically utilized to identify a problem, carry out study, and simultaneously take appropriate action. (Creswell, 2014). In addition, the similar cycles to be followed in both lesson study method and action research method also supported the choice of the research design. For example, both involves the determination of weaknesses (in current situation and in lesson), an implementation (of instructions/training for remedying/improving the situation or of the lesson plan) and evaluation of the implementations. For this study, ethical permission was granted by Ağrı İbrahim Çeçen University Ethics Commission with the decision dated 25.01.2019 and numbered E.2500.

Participants

The participants were composed of three mathematics teachers (Leman, Melih and Nalan in psydonyms) who were actively working in elementary school in Ağrı province of Turkey. Purposive sampling method was used in the selection of the participants (Creswell, 2014). The main criteria were as follow; (i) teachers should have at least three-year teaching experiences in elementary schools, (ii) they should not be aware of lesson study method, and (iii) they should be voluntarily participating the study. Accordingly, Leman, Melih and Nalan's teaching experiences in year were 5, 3, and 4, respectively. In the initial unstructured interviews, they all stated that they did not know lesson study method or participant any activity regarding lesson study approach. After they were informed about purposes and the procedures of the study, they all agreed on participating to the study.

Data collection tools and procedure

Two main data collection tools were used in this study. First data collection tool was the lesson plans that mathematics teachers prepare during the lesson study cycles. Each cycle concluded with the preparation of an enhanced lesson plan by the teachers. The researchers and teachers used Murata's lesson study cycles (2011) in this study, which were as follows: all teachers were informed about the purpose of the study and procedures during implementing the lesson study. The research procedures were completed in three cycles within six weeks. In the first cycle, the objective of the following lesson regarding angles was presented and teachers prepared a lesson plan together. At this point, one of the researcher video-recorded the teachers' discussions in a complete-observer role. In the second phase of

the first cycle, each teacher used this lesson plan and implemented in their lesson, while the others were observing it and taking notes. After the lessons were completed, first focus group discussion was performed. The main goal of this discussion was about how to improve quality of the lesson, so students could better comprehend the lesson. At the end, a new lesson plan was prepared. With the new lesson plan, each teacher implemented it to a new classroom again, while the other teachers were observing. At the end of the first cycle, teacher evaluated their lessons and prepared a new lesson plan for the second objective regarding angles. This procedure continued and completed in three cycles. One of the researcher video-recorded all the focus group discussions and observation. Second main data collection tool was interviews with teachers. At the end of the lesson study cycles, each teacher was inverviewed individually. Teachers were asked two main questions. The researchers created the semi-structured interview questions with the goal of the study in mind. These questions were as follows; (i) What are the benefits of the lesson study approach on your professional developments? and (ii) What are the factors affecting you to prepare lesson plans? Therefore, the data collection tools were composed of semi-structured inverviews with teachers, classroom observations, focus group interviews, and field notes. During the data collections, the interviews (individual and focus group) were audio recoreded and the classroom observations were video recorded.

Data analysis

Data gathered from observations, interviews and field notes were analyzed according to content analysis method. The purpose of the content analysis is to analyze the data that have similar manners to each other in-depth and to combine them within the framework of certain concepts and themes and interpret these data in a way that the reader can understand (Yıldırım & Şimşek, 2013). Accordingly, the data were interpreted under two main themes; (i) the benefits of lesson study approach to teachers' professional developments and (ii) factors that teachers pay attention to in planning the lesson. In addition, the data analysis process was carried out in line with the procedures that Goetz and LeCompte (1982) proposed. So, constant comparison method was utilized in data analysis. In the process that starts with the analysis of the first observations, continuous improvements are made throughout the data collection and analysis process. The codes appeared are continuously compared with the previous ones. Therefore, new relations are explored with typological dimentions (Goetz & LeCompte, 1982). In this study, the main themes were determined before gathering data from the interviews conducted to the teachers. The first theme was the professional development. Some codes, on the other hand, appeared after analysing teachers' inverview scripts and observations. In the study, the second theme was the factors for preparing lesson plans. Similar procedure was applied to the second research problem of the study.

The interrater reliability scores were calculated to ensure the reliability of the findings (Miles & Huberman, 1994). Accordingly, two researchers discussed and agreed upon the main criteria to analyse the data gathered. Each researcher analyzed them separately. At the end, they come together and compare the codes. Totally, the interrater reliability score was 93%, which is considered a high level, for all findings. They discussed and came to a consensus on the uncommon codes, and the findings were presented accordingly.

Findings

During the study, each teacher observed six lessons. At the end of the lesson study cycles and the observations, all teachers were interviewed. After teachers' classroom observations, teachers were asked to give evidence about the effect of lesson study method on their professional developments. Some data

were also gathered through the classroom observations, which were video recorded. The data gathered were summarized in Table 1 according to teachers' observations and opinions.

Table 1: The factors that lesson study affects teachers to improve their professional developments based on their opinions.

Themes	Categories	Codes	Leman*	Melih	Nalan
Professional development	Professional requirements	Eliminating professional deficiencies			√
		Professional competence			√
	Subject teaching	Subject knowledge benefits		√	
		Not being dependent on other sources	√	√	√
	Experience	Gaining teaching experience	√		
		Opportunity to make comparison with previous years	√		
	Student	Developing better relationship with students	√		
		Predicting students' responses	√	√	
	Teacher characteristics	Experienced teacher		√	
		Equipped teacher		√	
		Researcher teacher identity		√	
		Innovative teacher identity		√	

*Teacher names are in psydonym

Based on teachers' opinions, Table 1 presents the effects of lesson study method on their professional developments. Teachers were asked to state the possible opportunities and benefits of lesson studies on their professional developments. Analyses of the interviews showed that five categories appeared for teachers' professional developments: *professional requirements, subject teaching, experience, students, and teacher characteristics*. Under these categories, Leman mentioned about *not being dependent on other sources, gaining teaching experiences, opportunitites to make comparison with previous years, developing better relationship with students, and predicting students' responses* as the contributions of lesson studies. Some of the direct quotations regarding her opinions were as follows.

On the other hand, Melih mentioned about *subject knowledge benefits, not being dependent on other sources, predicting students' responses, experienced teacher, equipped teacher, researcher teacher identity, and innovative teacher identity*. Lastly, Nalan indicated that lesson study helped to improve her professions developments by giving evidence for the codes *eliminating professional deficiencies, professional competence, and not being dependent on other sources*. Regarding the first two categories (i.e., *eliminating professional deficiencies, professional competence*) that appeared from the interviews with Nalan, some of the direct quotations were as follow.

> The researcher: What are the possible contributions that lesson study method possess for you? What are its advantages?

> Nalan: In the preparation of the lesson, some of the advantages are; at least following a plan, managing time by following it, and making preparation for what I'm going to teach. Sometimes we stuck in some part of the lessons. After the application lessons, I'm clearly observing this situation. This method eliminated such situation (post-interview with Nalan, for eliminating Professional deficiencies).

Nalan expressed her deficiencies in her teaching profession by saying "we sometimes stuck" some of the deficiencies she experienced and that she started to use time more effectively. This code was created because we understood that some of these deficiencies were eliminated by means of the interview with Nalan. Nalan also indicated that she benefitted from the group discussions by sharing and discussing their opinions regarding professional development, which, in turn, provided positive contribution to their professional competence. An interview script regarding this code is as follows;

> We shared and discussed our opinions together with my colleague. I realized my deficiencies and I learnt how to make them better (post-interview with Nalan, for professional competence).

Some of the interview or observation scripts regarding the other categories are as follow. These scripts are given in the order as presented in Table 1. These scripts were mainly gathered from post-interviews and observations of group discussions.

> I saw the necessary sequence of how to better teach any subject. I understood the sequence of presenting the concepts and related questions, applications. And I saw the limits of the subject, so I did not go beyond what I have present in the lesson (post-interview with Melih, for subject knowledge benefits)
>
> I planned what I'm going to do in each step of instructions for students before the lessons. I did not always stick on course book and made the lesson more beneficial for students (Nalan, observation of group discussion, for not being dependent on other sources).
>
> Since I prepared the plan, knowing the sequences of when and what to do made it easier for me to complete the instructions (post-interview with Melih, for not being dependent on other sources).
>
> With the lesson plans, all the things I would teach were in order. So, I did not become dependent on other things by means of the lesson plan I prepared (post-interview with Nalan, for not being dependent on other sources).
>
> In the group discussions, I benefitted from my colleagues' experiences. By means of these benefits, I learnt how to better organize the lesson and what kind of questions I should ask and solve. These brought me huge benefits in the instructions (post-interview with Leman, for gaining teaching experiences).
>
> The lesson studies helped me to compare two years of teaching, for example. I realized the difference between previous year' and today's sixth grade students' levels of knowledge and learning preferences. I changed the teaching methods and techniques (post-interview with Leman, for opportunity to make comparison with previous years).
>
> I realized how to create interactive teaching and learning environments, and, therefore, developed positive relationship with students (post-interview with Leman, for developing better relationship with students).
>
> Now, I can predict what students could do and state. Since I also know students' readiness levels, I'm making my preparations accordingly (Melih, observations of group discussions, for predicting students' responses).
>
> I think these discussions made me more experienced and equipped teacher. I'm preparing attractive activities. Since students are influenced positively by the activities performed, they are actively participating to the lesson more. So, my instruction become more enjoyable (post-interview with Melih, for experienced/equipped teacher).
>
> By means of lesson studies, I realized that I had to do activities that help students learn easily. Therefore, I started to search new, interesting and beneficial activities. I started to ask other teachers' teaching methods and students' responses to them. These studies made me more researcher and modernist (post-interview with Melih, for researcher teacher identity).

In the second research question, teachers were asked to the factors that they take into consideration when preparing their lesson plans. During the lesson plan processes, each teacher was asked to prepare lesson plans for each lesson. The findings gathered from the interviews and observations of group discussions were summarized as in Table 2.

Table 2. The factors affecting the preparation of the lesson plans.

Categories	**Codes**	**Nalan**	**Leman***	**Melih**
Regarding students	Students' readiness	√	√	√
	Attracting students' attentions		√	
	More understandable activities		√	
	Making students active	√	√	
	Students' achievement levels	√	√	
	Students' individual learning differences	√	√	
	Providing learning with discovery	√	√	
	Providing learning by doing	√		
	Students' previous knowledge	√	√	√
	Not distracting students from the lesson		√	
	Motivating students/using reinforcements	√	√	
	Students' difficulties	√		
Regarding the instructions	Classroom size	√	√	√
	Benefitting from course book/internet/other sources		√	√
	Not breaking the subject pattern		√	
	Appropriateness to focus group discussions	√	√	√
	Method/technique/materal/activity appropriate to the objectives	√	√	
	Using educational technologies	√		√
	Simpler to complex			√
	Appropriate activities for crowded classrooms	√	√	
	Enjoyful mathematics teaching/games	√		
	Using materials		√	√
Time	Time management	√	√	√
Questions	Sample examples/questions appropriate to the objectives	√	√	
	Variaty of questions	√		√

*Teacher names in psydonym

According to the findings of this study, four main categories appeared around how teachers prepare their lesson plans during these lesson study processes; (i) r*egarding students*, (ii) *regarding the instructions*, (iii) *time*, and (iv) *questions*. Considering the findings gathered from the teacher interviews and the focus group discussions, total of 26 codes appeared. After completing the cycles of the lesson studies, all teachers indicated that they improved themselves in positive ways in preparing their lesson plans. They stated that they started to consider more factors when preparing the lesson plans. In the interview, teachers were expected to indicate the factors they take into consideration when preparion their lesson plans. According to their opinions, the following direct quotations regarding the related codes were gathered from the individual interviews and the observations of focus group interviews.

Starting from the category of regarding students, teachers stated as follow.

> First, I prepared questions about whether students know some basic concepts in order to measure their readiness levels in the subject taught (post-interview with Leman, for students' readiness).
>
> I prepared a plan based on my previous plan. I paid attention to prepare plans that students could understand more easily by considering their readiness and individual learning speeds (post-interview with Melih, for students' individual learning differences and students' readiness).
>
> I paid attention to make plans in a way that the students could not be distracted. My first goal was to attract them by motivating them. I tried to make children learn better without getting distracted. I considered students' readiness (post-interview with Melih, for students' readiness, attracting students' attention, and motivation students).
>
> I paid attention to doing activities in a way that students could understand the subject more easily (post-interview with Melih, for more understandable activities).
>
> Then I prepared questions according to the students' levels and added them to the lesson plan. I have very good students; I have low achievement students. My aim was to prepare a lesson plan that would appeal to all of them. I paid attention to the readiness levels of the students. I paid attention to what their level was in terms of basic concepts (post-interview with Leman, for more understandable activities, students' achievement levels, and students' readiness).
>
> While planning the lesson, I also planned to ask the students, at the entrance phase of the lesson, whether they remember the definitions of the line, line segment, ray from last year. In the next stage, I planned to provide the students with a definition of what the angle means by using the method of learning with discovery (Leman, observations of focus group discussions, for learning with discovery and making students active).
>
> While preparing the plan, I wanted to make students actively involve in the process. I wanted to ensure that students acquire some concepts with discovery, not teacher-centered (post-interview with Melih, for learning with discovery and making students active).

Teachers also indicated some factors regarding their instructions. All teachers mentioned different factors to be considered when preparing their lesson plans. Following direct quotations are related to this category.

> I considered students' readiness levels and classroom size (post-interview with Nalan, for classroom size and students' readiness).
>
> I planned to have students do group work. So, I'm planning to make instruction with peer teaching. In addition, I planned to provide learning by doing by making students work with applications for a prolonged time interval. I tried to build knowledge on basic concepts (post-interview with Leman, for method/technique/materal/activity appropriate to the objectives).
>
> I prepared the plan in accordance with the subject suitability and acquisition. Of course, using the necessary methods and techniques was one of the important elements of my plan. First, I paid attention to the class size. Because not every method is used in crowded classrooms. Then, I think

> about doing activities that are suitable for the acquisition of the subject taught. (Post-interview with Melih, for method/technique/materal/activity appropriate to the objectives and classroom size).
>
> I am thinking of preparing a plan that will be based on from simple to complex considering the lowest level of the children, namely, the entry level. (Post-interview with Nalan, for simpler to complex).
>
> I thought of planning how to prepare the lesson better, where to pay more attention or which differences to be included by means of the focus group discussions we had with my colleagues (post-interview with Melih, for appropriateness to the focus group discussions).
>
> I prepared the lesson plans based on the opinions of other teachers (post-interview with Nalan, for appropriateness to the focus group discussions).
>
> I benefited from different textbooks, academic articles and some internet sites related to mathematics education (post-interview with Nalan, for benefitting from course book/internet/other sources).
>
> In these studies, I saw the subject pattern. I understood in which order I would teach the subject. (post-interview with Melih, for benefitting from course book/internet/other sources).
>
> I'm planning to show the fun aspects of the lesson by dividing it into three parts and playing games in the last part. (Leman, observations of focus group discussions, for enjoyful mathematics teaching/games).

All teachers particularly focused on time management in their instructions. Following quotations are related to this category.

> I prepared my plan in a way that the instruction would last in one class-hour size (post-interview with Melih, for time management).
>
> When preparing the lesson plan, I first paid attention to the duration. In one lesson, I made sure to provide sufficient question solutions and allocate enough time for lecturing (post-interview with Leman, for time management).

Last category was about questions. Teachers indicated that they focused on the selection of the questions to be asked in the lesson. They stated that these questions should be appropriate to the objectives of the lessons. In addition, Melih indicated that he should provide different types of questions to students in order to make students fully comprehend the subject. Related to this category Nalan indicated as follows;

> I'm making plans to teach the subject to the children in a more understandable way by showing different types of questions to them. (Leman, observations of focus group discussions, for variety of questions).

Conclusions, discussions, and suggestions

This study investigated the how the lesson study method contributed to elementary school mathematics teachers' professional developments. In addition, how teachers prepared these lesson plans by using lesson study method was also examined. According to the findings of this study, the following results were observed.

The lesson study method has various contributions to the teachers' professional developments. These contributions, in line with teachers' opinions, were as follow; eliminating *professional deficiencies, professional competence, subject knowledge benefits, not being dependent on other sources, gaining teaching experience, opportunity to make comparison with previous years, developing better relationship with students, predicting students' responses, experienced teacher, equipped teacher, researcher teacher identity, innovative teacher identity.*

Bogner (2008) stated that making revisions in the lesson plans improves teachers' professional developments by means of experiencing lesson studies. Similarly, Melih stated that he began to become more equipped and experienced during experiencing lesson studies in his lessons. Nalan, on the other hand, stated that she gained experience via lesson studies. Considering the other abilities, Sitton (2006) indicated that when teachers apply lesson studies in their curricular activities, teachers gain improvement in their critical thinking abilities. In this study, for example, Leman proposed that she could make comparison between her current situation in teaching and her previous experiences. From this point of view, she could make critical comparison about her mistakes and deficiencies in her instructions. Another important contribution of lesson studies to the teachers is that they can develop more beneficial and useful teaching knowledge (Bogner, 2008). From the findings of this study, this proposion can be verified. This is because teachers indicated that this method increased their content and pedagogical content knowledge, and they were more flexible in using different materials and sources in their lessons. Thus, the teachers started to be more confident and effective in teaching the contents. These situations were supported by Juang, Liu and Chan's study (2008).

In this study, by means of lesson study method, the teachers prepared lesson plans for a geometry subject, which was considered to be hard for students to comprehend. The teachers took varios factors into consideration when preparing these lesson plans. Accordingly, Taylor et al. (2005) stated that carefully prepared lesson plans help teachers to reach the learning objectives effectively and students can comprehend them easily, because different teachers contributed to the preparation of these lesson plans with their experiences, opinions, and instructional knowledge. Findings also support this idea. The teachers have created lesson plans in detail, focusing on how students can learn more effectively and comprehensively. In addition, they paid attention to the factors gathered under four different categories to make instructions more effective. By means of lesson study method, they cooperatively discussed the teaching issues in the preparation of the lesson plans. In this study, by means of cooperative work among teachers, they prepared the lesson plans by taking the following factors into account; *regarding instructions, regarding students, time and considering the questions*. Together with these factors, they prepared effective lesson plans. Accordingly, Lewis (2009) stated that teachers start to realize the levels of students' readiness by means of lesson study activities. In the lesson plans prepared through lesson study activities, for example, the teachers stated that they got to know the students better and considered their readiness and pre-learning levels, and created lesson plans, accordingly. Additionally, Perry and Lewis (2009) indicated that teachers benefit more from the questions in the process of preparing the lesson plans and using them in the instructions. In this study, on the other hand, Leman and Melih proposed that they started to choose more appropriate examples regarding the subject taught, while Nalan indicated that she embedded different question styles into the lesson plans when preparing them. The teachers conducted their instructions without worrying about what to do while teaching the lesson and by using the questions they prepared before.

In the previous studies, it was observed that the lesson study method contributes to the professional development of mathematics teachers. In addition, with the lesson study method, the teachers discussed the lesson plans they prepared in more detail and in cooperation. Considering its potential contributions to teachers, the lesson study method can be given to teachers through in-service trainings. In addition, this method can be embedded in the teacher training curricula as a selective course or a part of the on-going courses. Therefore, pre-service teachers can have opportunity to know the benefits of the lesson study method and give in-sight in using them their future lessons. Moreover, they can apply this method in their future schools and have opportunity to prepare effective lesson plans. Lastly, the development

of teachers was emphasized in the studies regarding lesson study method. It can be tried to determine to what extent the student success has improved by means of using this method.

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