A COMPARATIVE ANALYSIS OF NOTICING OF MATHEMATICS TEACHERS WITH VARYING TEACHING EXPERIENCE

EVRİM ERDİK

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Evrim ERDİK

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A Comparative Analysis of Noticing of Mathematics Teachers with Varying Teaching Experience

The thesis of Evrim Erdik
has been approved by:

Assist. Prof. Engin Ader _____
(Thesis Advisor)

Prof. Dr. Emine ERKTİN _____

Assist. Prof. Günizi Kartal _____

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Thesis Abstract

Evrim Erdik, “A Comparative Analysis of Noticing of Mathematics Teachers with Varying Teaching Experience”

Teachers’ noticing refers to attending to classroom events and interpreting why those events are worth noticing. Noticing is regarded as an essential component of teaching expertise. The purpose of present study is to investigate what mathematics teachers with different years of experience notice, and differences and similarities between the teachers in terms of noticing. 15 participant mathematics teachers were purposefully selected and divided into three groups as, inexperienced, less experienced and experienced teachers, according to their teaching experience. Quantitative and qualitative tools were used to analyze the data. Chi square tests were conducted to examine whether noticing of teachers with varying teaching experience significantly differed from each other. A coding schema which assigned actor, topic, stance and specificity to a specific event was used. Results showed that there were statistically significant differences between teacher groups in terms of their noticing about the actor and topic of the noticed incident and the stance they adopted. Statistically significant differences were especially between the experienced teachers and the inexperienced teachers. Moreover, there were qualitative differences and similarities between them on what they noticed and how they analyzed the events that they noticed. Implications of the findings for teachers and teacher educators were apparent.

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Tez Özeti

Evrim Erdik, "Deneyimli ve Deneyimsiz Matematik Öğretmenlerinin Fark Etme Becerilerinin Karşılaştırılması"

Öğretmenin fark etme becerisi, sınıftaki olaylara dikkat etmesini ve bu olayların niçin dikkate değer olduğunu yorumlasını ifade eder. Fark etme becerisi öğretmenlikte uzmanlaşmanın önemli bir bileşeni olarak kabul edilir. Bu çalışmanın amacı, farklı deneyim yıllarına sahip matematik öğretmenlerinin ne farkettiğini ve öğretmenlerin fark etme becerilerindeki benzerlik ve farklılıkları incelemektir. 15 katılımcı öğretmen amaçlı olarak seçilmiş ve kaç yıl öğretmenlik yaptıklarına göre deneyimsiz, az deneyimli ve deneyimli öğretmenler olarak üç gruba ayrılmıştır. Verileri incelemek üzere niceliksel ve niteliksel çözümlemeyi içeren karma bir araştırma yöntemi kullanılmıştır. Farklı deneyim yılına sahip öğretmenlerin fark etme becerileri arasında istatistiksel bir fark olup olmadığını incelemek için ki kare testi kullanılmıştır. Öğretmenin sınıf içinde fark ettiği olgunun öznesini, konusunu, öğretmenin olaya yönelik tutumunu ve olgunun özelliğini belirleyen bir kodlama şeması kullanılmıştır. Deneyimli ve deneyimsiz öğretmenler arasında fark edilen olayın aktörü/öznesi, konusu ve öğretmenin olay hakkındaki tutumu açsından anlamlı farklar bulunmuştur. Ayrıca öğretmenlerin fark ettikleri olaylar ile bu olayları açıklama biçimleri arasında nitel olarak benzerlik ve farklılıklar ortaya çıkmıştır. Bulguların öğretmen ve öğretmen yetiştiren eğitimciler açısından önemli sonuçları olduğu anlaşılmıştır.

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To my family,

for their love, encouragement, and

everything they taught me.

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CHAPTER 1

INTRODUCTION

In every professional area, there are distinct roles assigned to people of a particular group. Teachers take on a variety of roles in the classrooms to enable student learning. Teachers need to attend to a range of elements including students' actions, speech, and thinking processes, how the lesson should proceed, which representations or teaching methods should be implemented. Even though teaching is a very complex activity, teachers cannot respond to all the events that are happening in a particular time. In that sense, teachers should identify some of the classroom events as important for the lesson and such events help teachers to decide how to proceed in an instructional plan (van Es & Sherin, 2002). According to Goodwin (1994), one can build professional vision by "seeing and understanding events that are answerable to the distinctive interests of a particular social group" (p. 606). In this respect, some classroom events occurring during the lesson can be regarded as important for teachers.

There are various teacher roles determined in teaching mathematics to students. One of the roles of mathematics teachers is stated in the Turkish educational system as making evaluation about the tasks done during the lessons and using the results of this evaluation to get information about and develop the teaching and learning processes (TTKB, 2013). In other words, teachers are expected to notice

classroom events and make decisions during the lesson where various classroom events occur simultaneously. Noticing is also considered as an important ability of mathematics and science teachers who are able to make pedagogical decisions in the midst of their instruction in the US (American Association for the Advancement of Science (AAAS), 1993; National Council of Teachers of Mathematics, 2000; Wallach & Even, 2005). In these on the fly moments, teachers are able to diagnose student thinking and unexpected problems, constantly assess students' learning progress throughout the lesson, and take necessary actions for enhancing students' learning. Since in the classroom so many things happen in short periods of time, teachers need to identify issues, notice things, and make several decisions. Therefore, they notice certain things or notice them primarily and ignore others. In that sense, examining what the teacher notices in the classroom is meaningful in understanding the teaching and learning process.

It is inevitable that people gain experience over time after they start out in a new endeavor. As they spend some time and engage in it, they start to make sense of things, which are special to that particular endeavor (Chi, Glaser, & Farr, 1988). Some researchers underlined the importance of teacher expertise in terms of noticing events occurring in the teaching and learning situations (e.g. Sabers, Cushing & Berliner, 1991; Huang & Li, 2012). It can be asserted that teaching expertise in one area has a prominent role in noticing and understanding the things faced with in the area of interest. As a result, it would be worthwhile to investigate teachers' noticing of significant classroom events in terms of years of teaching experience they have. It is also important to analyze the differences and similarities between noticing of teachers having varying years of experiences. If there exists a difference, it can be attributed to the levels of teaching expertise which has implications related to teacher

education. Examining this difference contributes to understanding what levels of teaching expertise the teachers have shape/form their noticing.

The current study is significant in several ways. First of all, as mentioned previously, when teachers are aware of what is going on in the classroom, they can simultaneously make sense of the classroom dynamics. That is, such instantaneous classroom events help teachers to understand what is going on in the classroom and what these occurrences mean in that context. According to Sherin, Jacobs and Philipp (2011), adaptive and responsive teaching helps teachers make decisions based on ongoing events occurring during the lesson. Therefore, examining what teachers notice in the time of incident is important in terms of understanding teachers' attention to classroom dynamics.

Secondly, although plenty of studies have been done on this issue, unfortunately there are only a handful of studies examining teacher noticing of classroom events in Turkey (e.g Işıksal, Koç, & Osmanoğlu, 2012; Osmanoğlu, 2010). Işıksal and her colleagues (2012) examined changes in mathematics teachers' noticing of student roles as they watched and discussed video cases in an online forum. Osmanoğlu (2010) investigated the changes of prospective mathematics teachers' noticing in terms of teachers and student roles based on the reform minded teaching. In both studies, the researchers intended to study prospective mathematics teachers' learning to notice by supporting them with video cases and video discussions. However, there are rarely any studies in Turkey examining a snapshot of what mathematics teachers' current noticing is but only the ones that introduce them learning to notice with video based lessons and discussions. Therefore, the current study addresses teachers' existing notices about the classroom events to enrich the pool of Turkish studies related to teacher noticing in the literature.

Thirdly, in the present study, rather than only examining what teachers notice, understanding noticing abilities of teachers with different years of experience could give an idea about what are noticing differences of teachers with respect to years of experience they have. Therefore, the 'years of experience' variable is expected to bring a new dimension in making sense of teachers' noticing of classroom events. Additionally, there are no Turkish studies focusing on teachers' notice in terms of their years of experience. Thus, it can be meaningful to investigate what kind of classroom events Turkish mathematics teachers with varying experiences notice. In this respect, it is necessary to clarify and understand the meaning of teachers' noticing of classroom events, what teachers notice in the classroom, and teachers' notice in terms of different years of experience, respectively.

CHAPTER 2

LITERATURE REVIEW

Through the literature review, noticing will be examined in a number of ways in the following literature review. First, what noticing means will be discussed. Second, the reason why studying noticing is important in the context of the Turkish educational system will be explained. Then, in light of the previous studies, the development of noticing skills and differences between teachers' noticing in terms of experience will be reviewed.

Noticing

The Meaning and Aspects of Noticing in a Classroom Context

Considering the definition of noticing in general, people notice certain things from a dozen of events in the environment if it is considered as important or striking for their area of interest (Goodwin, 1994). In the educational context, as van Es and Sherin (2008) stated, classrooms are complex environments in which a variety of events can occur simultaneously. In order to best serve the students' needs and

enhance their learning, teachers should attend to and notice certain events within this complexity. With the help of noticing such important moments, for instance, teachers can make future decisions and take necessary precautions.

Noticing classroom events has been largely examined in the literature (e.g. Frederiksen, Sipusic, Sherin, & Wolfe, 1998; Star & Strickland, 2008; van Es & Sherin, 2002). Although teacher noticing has been conceptualized in various ways, Learning to Notice Framework proposed by van Es and Sherin (2002) is a commonly used framework defining the skill of noticing. The skill of noticing includes three main aspects: "(a) identifying what is important in a teaching situation; (b) using what one knows about the context to reason about a situation; and (c) making connections between specific events and broader principles of teaching and learning" (van Es and Sherin, 2002, p.573). According to this framework, teacher noticing involves two main processes: attending to particular events in an instructional setting and making sense of events in an instructional setting. Therefore, aforementioned three characteristics of noticing not only involve identifying what is of importance in the lesson but also interpreting why that event is important and what influence the event has on student learning. That is, not only identification of classroom events but also an interpretive stance for these events is included.

The first aspect of noticing is the identification of classroom events. Classrooms are very complex environments in which various events occur at the same time. Teachers cannot equally attend to all these events. In order to manage classroom complexity, teachers should pay attention to certain classroom events and not to others. Other researchers used different terms in identifying significant events but touched upon similar ideas as van Es and Sherin (2002) pointed out. For instance, Frederiksen and his colleagues (1998) refers to this first aspect as making call outs.

People call out and make notes about the video they watch whenever important events occur. In other words, citing noteworthy episodes in the video recordings of various classroom events corresponds to making a call out. In a different study carried out by Goodwin (1994), one of the practices of professional activity is considered "highlighting" which means making specific events salient. Moreover, Tripp (1993) defined "critical incidents" as interpretation of the significance of the events. That is, incidents that arouse attention in teachers were considered critical.

The second aspect of noticing is using what one knows about the context to reason about a situation. Knowledge of context refers to knowing the grade level of students, the subject matter, the students' understandings about that subject, the social and cultural backgrounds of the students or the culture of classroom environment where they interact with one another (Sherin & van Es, 2005). For instance, a middle school mathematics teacher can make more plausible inferences about the classroom events of a particular middle school classroom than a high school mathematics teacher. In a similar vein, a mathematics teacher is more knowledgeable about the students' understanding about mathematical concepts than a biology teacher. A teacher might also notice and understand more about the classroom interactions of a specific group of students than another group of students. Therefore, knowing the context of a situations and using this knowledge would help teachers to notice particular classroom events.

Thirdly, the skill of noticing necessitates making connections between specific events and broader principles of teaching and learning. It involves making sense of a given situation with general principles of teaching. According to Tripp (1993), there are two stages of critical incidents. The first one is that an event or phenomenon is observed. Then, a description of that event is noted. This stage is

similar to the first aspect of Learning to Notice Framework, namely identifying what is important in a classroom. The second stage involves the reflection of the meaning of that event from educational point of view. In other words, the interpretation of the event is stated and the specific event is discussed from broader principles of teaching and learning. Thus, the second step, reflection of the incident, is closely related to the third aspect of Learning to Notice Framework.

Lampert and Ball (1998) designed a multimedia environment including video based cases of the classroom to improve not only theoretical but also practical knowledge of teaching. It helps beginning teachers to investigate practice with the examination of theory and integrate theory and practice rather than separate the two. Therefore, specific events occurring in practical situations are integrated with broader principles of teaching, namely theory. The relationship between theory and practice emphasized by Lampert and Ball (1998) resembles the third aspect of noticing as stated in the work of van Es and Sherin (2002).

Shulman also emphasized the importance of the relationship between particular situations and general principles of teaching and learning with the question: "What is this a case of?" (as cited in van Es & Sherin, 2008). The answer of this question deals not only with the importance of a specific event but also what it means in terms of theoretical principles of teaching and learning. Therefore, the teachers make some sort of categorization by matching specific events with general educational concepts.

Some researchers define noticing as only attending to particular events whereas others' conceptualization of noticing involves both attending and interpreting these events. For example, Star and Strickland (2008, p.111) examined "what catches teachers' attention and what they missed" when they watched a lesson.

In other words, they are interested in teachers' initial filtering of classroom events. On the other hand, Sherin and van Es (2009) conceptualized noticing as identification and interpretations of events. For the present study, noticing refers to both paying attention to those events in a classroom and interpreting them by using existing knowledge because only attending to significant events in the instructional environment does not reflect what teachers think about those events and how they explain what they think about. According to van Es and Sherin (2002), how individuals analyze what they notice is as important as what they notice. Because teachers' expectations and knowledge are related to how they perceive classroom event, understanding teachers' noticing also includes understanding the way teachers interpret what they perceive.

Importance of Noticing Classroom Events in terms of New Curriculum in Turkey

In Turkey, elementary (from 1st to 8th grade) and secondary (from 9th to 12th grade) school curriculum was changed in 2006 by Ministry of National Education. In 2013, the recent change took place and elementary school curriculum was divided into two parts as elementary and middle school curriculum. Elementary school starts from 1st grade and finishes at 4th grade, and middle school includes 5th, 6th, 7th and 8th grades.

The current mathematics program emphasizes deep learning, learning as a process, social dimension of learning, the relationship between mathematics subjects and daily life and motivation (TTKB, 2013). According to the new mathematics curriculum, students and teachers have distinct roles in the classroom. While, in the previous curriculum, the teacher was the one who takes initiative for the learning of

students, according to the new curriculum, the teacher has only the guidance role. It intends to raise students who can use mathematics in daily life, solve and discuss daily life problems with other students, do group work, and have positive attitude towards mathematics. At the same time, it pays attention to students' cognitive and thinking skills and building their own knowledge with the help of the teacher's guidance (TTKB, 2006). That is, the focus of the new curriculum which took place in national mathematics curriculum is on the students and for this reason it emphasizes students' actions and thinking during class.

In line with changes in the national curriculum of Turkey, the teachers need to be well prepared to adapt the changes and be responsive to the dynamic processes of learning and teaching. Not only in Turkey but also in USA, noticing was also considered as a crucial ability of mathematics and science teachers who are able to make pedagogical decisions in the midst of their instruction (American Association for the Advancement of Science, 1993; National Council of Teachers of Mathematics, 2000). In other words, to make sound decisions during the lesson, teachers should notice issues such as difficulties that the students face with and questions or comments that they raise about the particular subject. Being aware of such events helps them in using such moments as opportunities for student learning. Schoenfeld (2011) reported that "noticing is a fundamental part of decision making and highly consequential" (p.234). According to the discipline of noticing proposed by Mason (2011), teachers make fresh decisions on the basis of noticed things rather than making habitual reaction. Things that teachers notice or fail to notice shape their future actions. In that sense, noticing can be regarded as a starting point of teachers' pedagogical actions and decisions.

According to the new curriculum in Turkey, teachers are expected to decide the flow of their lesson and assessment techniques according to students' understanding levels and take precautions if needed (TTKB, 2013). In this respect, what the teachers notice in the classroom has an important place.

Teachers' Noticing of Classroom Events

The Use of Video Cases in Noticing Classroom Events

It is accepted that teaching is a learned skill that can be developed with a series of pedagogical trainings. In order to encourage prospective teachers' professional development, Sykes and Bird (1992) proposed a case idea that is employed as a pedagogical approach in teacher training. In this approach, an excerpt of a classroom situation where various cases occur is presented to prospective teachers to watch and discuss these events. Different versions of cases exist such as textbook cases, casebooks, and video tapes. The textbook cases are short narratives given in one part of a chapter, case books solely include cases, and video tapes, on the other hand, are composed of real lesson excerpts including the teacher and the students. According to Sykes and Bird (1992), the case idea refers to "a shift in emphasis from the theories to the practices and a shift in genre from exposition to narrative" (p. 465). In addition, Butler, Lee, and Tippins (2006) stated that case based pedagogy creates an instructional environment where the teachers think reflectively, restructure their thinking and build new perspectives about teaching and learning. Therefore, the usage of cases points out the relationship between the theory and practice of teaching

because the cases given indicate the practical use of teaching and learning theories. By discussing the practice, the teachers relate it to the general pedagogical principles and gain new points of view about teaching and learning.

Besides textbook cases and casebooks, video cases are frequently used in teacher education (Frederiksen et al., 1998; Işıksal et al., 2012; Star & Stickland, 2008; van es & Sherin, 2005, 2008,2009). Wang and Hartley (2003), as cited in Sherin & van Es (2005), stated that video as one component of cases has been used in teacher education in the United States since 1960s after portable video became available. It has soon become a common approach, which enables teachers to reflect on teaching episodes from the video and discuss them with their colleagues. Since that time, there have been a variety of video uses such as microteaching and video based cases (Sherin & Han, 2004).

For microteaching, pre service teachers watch the videotape of their individual lessons and then analyze their practice with a written reflection. On the other hand, in a typical video based setting, one facilitator (researcher or teacher educator) videotapes one of the participant teachers' lessons and then lets all teachers watch some excerpt of that lesson. After viewing it, with the help of the facilitator the teachers share classroom events deserving attention and their perspectives (e.g. Frederiksen, Sipusic, Sherin & Wolfe,1998; Santagata, Zannoni & Stigler,2007; Sherin & Han, 2004; Star & Strickland, 2008). The teachers have an opportunity to watch the same video several times and reflect on it without trying to remember the classroom events from memory. In addition, they have a chance to give and take feedback for the lesson viewed. According to Sherin and Han (2004), video viewing creates an opportunity to reflect on rather than to act against classroom events. Lee (2005) pointed out that reflective activities help teachers both to gain new

perspectives about teaching and learning and to maintain professional growth. Therefore, feedback given or taken from the video has an essential role in developing the teaching profession.

Lampert and Ball (1998) are regarded as the pioneers of using videos in pre service teacher education. They created a multimedia environment in which records of practice helps prospective teachers to develop pedagogical content knowledge in teaching. This hypermedia tool includes teachers' daily plans, videos of lessons, their reflection on lessons and student works. The student teachers try to make sense of teaching and learning as they watch real teaching situations using this tool. A series of studies have used video in guiding teachers' attention to noticing of teaching and learning situations, especially in the work of Sherin (e.g. Sherin & Han, 2004; Sherin & van Es, 2005; van Es & Sherin, 2008). Sherin and her colleagues used mathematics lesson videos to develop participant teachers' noticing skills. To sum up, video case usage plays a key role in developing one's teaching skills and it has been integrated into contexts involving teacher noticing.

Learning to Notice Classroom Events via Video Use

Several researchers have investigated how to improve teachers' ability to notice classroom events (Frederiksen, Sipusic, Sherin, & Wolfe, 1998; Borko, Jacobs, Eiteljorg & Pittman, 2008; Goldsmith & Seago, 2011; Işıksal, Koç & Osmanoğlu, 2012; Santagata, Zannoni & Stigler, 2007; Sherin & van Es, 2005; Sherin & van Es, 2009; Star & Strickland, 2008). A series of studies carried out by Sherin and her colleagues claimed that teaching and learning occurring in the videotaped lessons helped to improve teachers' ability to notice and to reflect on those videos. In

addition, Goodwin (1994) emphasized “professional vision” which is gained through developing the ability to see important events belonged to their area of interest. Just as detectives can notice aspects of a crime by looking at specific and important evidence in the crime scene, the teacher can detect important classroom events and take necessary steps to enhance learning. This awareness highlighted by Goodwin (1994) is a part of the professional vision. The teachers learn to attend to particular events of the classroom via video watching and such learning from the video aid to develop their professional vision (Sherin & Han, 2004; Sherin & van Es, 2009; Tekkumru Kısa, 2013).

In aforementioned studies, viewing and discussing of videotaped lessons by the participant teachers are arranged as an intervention program. By looking at the pre and post comments or reflections of the teachers, the professional development trajectories and shifts in teachers’ perceptions of classroom interactions are stated. After implementing video based lessons with the teachers, researchers investigated the changes took place about the issue of noticing. For example, Frederikson and his colleagues (1998) aimed that teachers who was preparing video portfolios to meet in the video clubs where they watch their own and other teachers’ videos took part in the reflective activity. In this activity, teachers thought about their own teaching practices and tried to develop a common language for viewing and talking about teaching. These activities were intended to develop professional development of teachers. With this aim, they created an assessment framework for noticing and constructed a hierarchical categorization via observation of teachers. They categorized the call outs teachers made into four main categories: pedagogy, climate, mathematical thinking and management. There are 18 sub categories grouped

hierarchically under these four main categories. All these categories were generated from teachers' common call outs after viewing the videotaped lessons.

The first category is made up of pedagogy which means teachers' use of instructional strategies in teaching to foster students' learning by making adaptations to their diverse needs and interests. Pedagogy also involves teachers' use of activities, presentations, materials, explanations and interactions between the teacher and the students during a mathematics lesson. The sub categories of pedagogy are composed of coherent presentation, explanation, interaction and adaptation to students' needs, abilities and interests. The quality of abovementioned components of pedagogy is evaluated by the degree of coherence among classroom activities and how well the teacher explains the subject and adapted such activities or instructional strategies to different academic backgrounds of students, and how the teachers interact with the students. According to Frederiksen et al. (1998), pedagogy is related to Shulman's Pedagogical Content Knowledge (1987) which means that the teacher's knowledge of how a content of the subject can be arranged for better learning and of instructional strategies best suited with the specific subject.

The second component, climate, refers to how learning of the students enabled with the social atmosphere of the classroom where students and the teacher constantly interact with each other. This category covers how students participate and engage in the lesson in multiple settings such as one on one and small group settings, rapport constructed between the students and the teacher, engagement and support by the teacher, mutual respect and sensitivity to students' diversity. This category is similar to Shulman's Knowledge of Learners and Knowing (1987).

The third category, mathematical thinking, constitutes the main goal of the lesson and it is related to students' actions during the lesson to foster mathematics

thinking. Students' explicit thinking about the content, multiple perspectives or ways about the contents or the problem, using mathematical ideas, and the teacher's exploration of their thinking process are the sub categories of mathematical Thinking. It is in line with Shulman's Content Knowledge (1987) in a sense that the use of mathematical knowledge by the students is prominent. However, the focus of third category is not on the teachers' domain knowledge as it is in Shulman's categorization. Rather, the use of mathematical content knowledge by the students in the classroom is emphasized.

The final one is Management which is closely related to dynamics of classroom, and progress of the lesson. Effective use of time, students' understandings and obedience to classroom practices, the relationship between students only and the teacher, monitoring of students by the teacher, and flow of the lesson (i.e. orderly and smooth transition from one activity to another). Management category is similar to Shulman's General Pedagogy concept (1987). As a result, all these categories developed were common descriptions of what teachers notice in the classroom.

As mentioned earlier, the design of aforementioned studies is similar, namely that their aim was to develop participant teachers' noticing skills via videotaped lessons. Although methodological practices are common, variations exist in their conceptualizations of noticing. For instance, some researchers define noticing solely as attending to particular events (M. G. Sherin, Russ, Sherin & Colestock, 2008; Star, Lynch, & Perova, 2011; Star & Strickland, 2008), whereas others conceptualize noticing as both attending to certain events and making sense of those events (Santagata, Zannoni,& Stigler, 2007; Sherin & Han, 2004; Sherin & van Es, 2005, 2008, 2009). Especially in the work of Sherin and her colleagues, they assumed that teacher noticing included both teachers' paying attention to a particular student idea

and teachers' making sense of that idea on the basis of his/her knowledge of that student and mathematics content. In fact, some researchers also differ on their conceptions of making sense of events. Some researchers define making sense as interpreting (Sherin & van Es, 2005; Sherin & Han, 2004; Santagata et. al, 2007), whereas others as both interpreting and deciding how to respond to those events (Jacobs, Lamb, & Philipp, 2010; Jacobs, Lamb, Philipp, & Schappelle, 2011).

Firstly, it is noteworthy to mention how researchers differ in their conceptions of noticing in a more comprehensive way. A framework was proposed by Star and Strickland (2008) who used pre and posttest design to measure pre service teachers' ability to notice the quantity and the type of classroom events via video viewing. In their work, focus was only on what teachers noticed as the first aspect of van Es & Sherin (2002), namely identifying noteworthy events. They used a framework which involves five categories as an observation sheet with multiple choice, true/false and short answer questions in pre and post assessment of noticing ability. In this framework, the following categories were utilized to guide teachers' attention to noticing classroom events: classroom environment, classroom management, tasks, mathematical content, and communication.

Classroom environment is related to physical appearance of the classroom such as grade level, number of students in the class, arrangement of desks, available materials and equipments. Classroom management is similar to the framework proposed by Frederikson and his colleagues (1998) in a sense that it consists of the smoothness of the lesson progress, teacher's physical appearance (tone of voice or patterns of moving around the classroom) and dealing with disruptive behaviors. Tasks refer to activities done by students during the lesson such as worksheets, taking notes and future activities such as homework and actions of the teacher to

reach the lesson objectives such as presentation of the material and assignment of homework. Mathematical content involves examples used and problems solved in lesson and mathematical representations graphs, equations or tables. Finally, communication indicates the relationship among the students themselves, and between the students and the teacher. At the end of the program implemented, they found that prior to video-based lessons, the teachers' foci were classroom management issues and tasks done by the students in reaching the lesson objectives. At the end, the mean frequencies of all components of classroom events were in rise. Except the classroom management aspect, post assessment of noticing of classroom environment, communication, mathematical content, and tasks were significantly higher than the pre assessment of noticing.

As opposed to conception of noticing of Star and Strickland (2008), Santagata, Zannoni, & Stigler (2007) defined noticing as both identification and interpretation of classroom events. Santagata and colleagues aimed to develop pre service teachers' ability to analyze videotaped lessons. In their study, participant teachers watched a video three times and in each time they focused on different aspects of the lesson. The researchers proposed three aspects of the lesson in shaping teachers' lesson analysis: parts of the lesson and learning goals, students' thinking and learning, and alternative teaching strategies. In the first watching, they determined and divided the main parts of the lesson. Then, they stated and reflected on the learning goals of each part by relating it to the whole lesson structure. In the second watch, their focus was on how students thought and learning occurred during lesson. In the last view, participants suggested their own strategies which could be useful in fostering student learning for that specific lesson. Suggesting alternative teaching strategies is similar to the conception of teacher noticing embraced by

Jacobs and colleagues (2010) in their work on professional noticing of children' mathematical thinking. They included in their definition of noticing the decision of how to respond to student learning. In other words, unlike other researchers' definition, these conceptualizations of noticing have a direct link to future action which teachers possibly take (Santagata, 2011).

In the study of Santagata, Zannoni, & Stigler (2007), five dimensions were coded as a result of video based teacher learning project: elaboration, links to evidence, mathematics content, student learning, and critical approach. According to the findings, elaboration of events gradually increased. That is, while teachers only explained what happened in classroom at the early stages, they described events in detail with suggesting alternative actions that could be taken and their possible influences on student learning. Additionally, there were shifts from comments which were general and abstract ideas about what is effective or not in learning to more specific comments that are directly related to classroom events from the video. Another finding was that, over time teachers focused more on student learning of mathematical content in the classroom observed. Furthermore, they gradually used critical approach in their comments which includes reflecting on things observed, possible problems and alternative actions.

Some researchers examined the changes occurring after video based lessons in terms of what in service teachers chose to discuss and the depth of the discussion topics the teachers voiced. That is, they not only focused on identification of noteworthy events but they also investigated how teachers interpret what they noticed. They found that while at first teachers' comments and observations focused on what the teacher in the video did (e.g. pedagogical issues), the primary focus later shifted to what the students did or said (e.g. student conceptions) (Sherin & Han,

2004; Sherin & van Es, 2005). Specifically, at the beginning the teacher stated what a student had said but then some analyses of students thinking such as from trying to understand the meaning of students' comments to generalization and synthesis of their conceptions became visible. In other words, their reports shifted from simple statements to rich analyses of students' actions and mathematical thinking. The focus of student understanding in the work of Sherin and her colleagues is similar to student learning of mathematics content as cited in Santagata et al. (2007). Teachers' ability to understand and analyze students' thinking is given a critical role in successful implementation of teaching and learning (AAAS, 1993; NCTM, 2000; Sherin & Han, 2004). For the study of Sherin & Han (2004), at the beginning the teachers mentioned about the chronological order of the events. That is, they described literally all the events, some of which are not even noteworthy. Over time, they started to attend to specific moments in the lesson by choosing a particular aspect of the lesson such as student mathematical ideas and classroom discourse and questioning.

Another finding in Sherin and van Es (2005, 2009) is a change in how teachers discussed what they noticed in the classroom. They reported that the teachers' discussion shifted from evaluation of teaching and learning to interpretation of them. At the beginning of the video lessons, they criticized the teachers' actions in the video and what could be done differently. They mainly described the weaknesses and strengths of the teaching and learning environment. In course of time, they began to interpret the events that occurred and tried to understand their influence on learning. Sherin (2001) stated that interpretation of the classroom events helps teachers to understand and analyze what happened in the classroom and shed light on the way the teachers should follow.

In a different study, van Es and Sherin (2008) created some categories about what the teachers noticed in the classroom and how they interpreted what they noticed: these categories were actor, topic, stance, and specificity. After attending to video clubs designed to help teachers to notice significant classroom events, some shifts occurred in terms of these dimensions. Firstly, teachers' notices shifted from climate to mathematical thinking when the topic was considered. For instance, their comments were about students being engaged and enjoying a lot before. However, afterwards they commented on what the students thought and understood. Secondly, the percentage of focusing on the student as an actor increased significantly at the end of the study. Thirdly, in terms of stance dimension, interpretation of classroom events took place of description of them over time. Finally, the specificity of the comments made increased significantly at the end of the video clubs meaning that they made more detailed explanations of the events occurred. This finding about specificity is in line with the increase in the elaboration of events examined by Santagata et al. (2007). In a different study, Borko and colleagues (Borko, Jacobs, Eiteljorg & Pittman, 2008) used similar coding strategies with the following categories: when the conversation took place (before, during and after watching video), who participated to conversation (facilitator, videotaped teacher etc.), what type of conversation took place (describing, critiquing the event etc.), and content of the conversation (teacher's thinking, students' thinking, pedagogy, mathematics).

While examining teacher's notice, other researchers focused on a specific dimension based on the coding categories that van Es and Sherin (2008) proposed. For instance, Işıksal, Koç, and Osmanoğlu (2012) investigated what the prospective elementary mathematics teachers noticed in terms of student roles belonging to the category of actor. Participant teachers were able to comment on the student roles

which were divided to three main themes: methodological perspective (e.g. discovering or doing group work), attitudinal perspective (e.g. enjoying mathematics) and classroom culture (e.g. following the rules). Although they all noticed several important issues in the classroom, their noticing skills were not quite developed as in the other studies.

Van Es and Sherin (2008) reported that there were shifts in teachers' stances in their comments about the video, moving from evaluative comments of classroom events to interpretive ones. Instead of looking at shifts occurring in the type of teacher comments, Goldsmith and Seago (2011), on the other hand, focused on analyzing how teachers interpreted classroom artifacts (e.g written student work, and transcripts of students' small group problem solving) and their interpretation shifted. In Artifact Analysis, they found that teachers participating in the artifact-rich professional development experiences, compared to non-participants, were more likely to attend to classroom artifacts which help promote a deep understanding of students' mathematical thinking. With a pre and post measurement, results showed that over time teachers started to discuss by using evidence from classroom artifacts, and deeply focus on mathematical details in students' work.

These studies used video based lessons as a medium to improve teachers' ability to notice important classroom events. Although there are differences in conceptions of noticing between researchers, they all used video based lessons to improve teachers' ability to notice and measured their development in noticing with a pre and post-test design. In other words, such studies somehow intervened with teachers' attention or notices rather than examining teachers' existing perspectives or notices. Before intervention, making sense of and investigating what teachers with different levels of experience currently notice, and identifying the kinds of

differences in their noticing can shed light on what kind of interventions are needed for developing teachers' noticing skills.

Teachers' Current Noticing of Classroom Events

Some researchers examined what teachers' current notices were without using videotaped classroom cases as an intervention method. In a recent study carried out by Luna and Russ (2013), an analytic framework was used. In this study, they focused on local patterns in teacher noticing from which teacher framing (tacit understanding of what is happening) was inferred. The researchers collected data via a small, wearable video camera that teachers can capture moments which are important for their perspective. The camera includes a record button which teachers press when they notice an event. The camera continuously streams the video and as soon as the teachers press, it automatically record previous 30 seconds of the event. This feature helps teachers to record significant events for later reflection. In their study, one participant teacher used this camera to record the events that was noticed and after viewing a 30 second video clip, the teacher described the reason for capturing the moment and what was important about it. With the help of the camera, they were able to investigate teacher framing based on local noticing patterns of teachers. They found that the teacher most often noticed student characteristics and student thinking. But the teacher noticed student engagement and management, and discourse to a lesser extent. In addition, a two-way relationship between teachers' framing and noticing was found suggesting that teachers' notice drives their framing and vice versa.

In a different study, Sherin, Russ, Sherin and Colestock (2008) also used wearable cameras to allow the participant teacher to save the events, which they see as important. They found that classroom activities such as whole class discussion, small group work, student presentations and teacher talk were selected by the teacher as significant. Additionally, after viewing the video excerpts the teacher's reflections of the reasons of selecting specific moments were analyzed. According to results, student thinking, discourse, teacher moves, teacher strategies and student engagement were given as the reasons for capturing these moments. For instance, the teacher said that he captured that moment because there was a respectful discourse between students and it deserved to capture. As another recent study, Huang and Li (2012) investigated what aspects of the classroom that teachers noticed most. They found that developing knowledge coherently, developing mathematical thinking and ability, use of teaching aid tools, and students' self-exploratory learning was among the most noticed events. On the other hand, teachers were less able to notice listening to student and giving their feedback, readiness of student preparation, students' mastering of knowledge and skills, and teachers' enthusiasm and passion.

Aforementioned studies with and without video based intervention measured teachers' ability to notice important classroom events Some suggested that the noticing skills of teachers from many aspects evolved in course of time as they gained several experiences during video watching sessions, whereas others focused on examining teachers' current noticing of classroom events. In this study, instead of intervening, snapshots of what they notice are examined. While taking a snapshot from teachers' noticing, it could be worthy to compare different groups of teachers. In this respect, expertise or experience can be an important dimension. Teachers' years of experience is of importance for the current study because a specific group of

teachers is being studied, and it is necessary to compare these groups based on years of experience, in order to deeply understand the differences in their noticing ability of important classroom events. In other words, the extent to which the years of experience change teachers' noticing skills is studied. Therefore, it is necessary to look at first what kinds of general differences exist between expert and novice teachers in the literature and then specifically review work on the differences between novice and expert teachers' noticing.

Teaching Expertise and Teaching

Identification of Expertise in Teaching

Many researchers studied qualitative and quantitative differences between expert and novice teachers (Borko & Livingston, 1989; Hogan, Rabinowitz, & Craven, 2003; Sabers, Cushing, & Berliner, 1991; Krull, Oras, & Sisask, 2007; Huang & Li, 2012). Although plenty of research has been done so far, an operational definition of expertise in teaching differs from study to study. Schempp, Tan, Manross, and Fincher (1998, p. 11) pointed out: ''there exists no reliable, valid, or empirically acceptable method for identifying a teacher's level of expertise, nor for distinguishing expert teachers from those in the lower stages of expertise development.'' While identification and selection of novice teachers is relatively easy, it is more difficult to do so with expert teachers. Therefore, different approaches were used so far in discriminating teacher by expertise. For example, Jacobs et al (2010) considered expertise in teaching in terms of teachers' professional

development, years of experience in mathematics teaching and engagement in leadership activities. The criteria for selection of expert teachers used by Berliner and colleagues (1991) were the following: 1) teachers who were recommended by superintendents and principals 2) teachers who had high ratings from an observation team and 3) teachers with at least five years of teaching experience.

Sato, Akita and Iwakawa (1993) selected expert teachers based on years of experience and engagement in activities necessitating leadership and voluntary work. Huang and Li (2012) selected expert teachers in terms of the Chinese ranking and promotion system and years of experience in mathematics teaching. Star and Strickland, (2008) identified expert teachers who had a doctoral degree and at least three years of experience in teaching mathematics. Krull, Oras and Sisask (2007) determined three criteria for identifying expert teachers: 1) teachers who had 10 or more years of experience and best ratings in national survey 2) teachers who were certified as senior or teacher methodologists, and 3) teachers with best ratings given by their vice-principals. In these studies, novice teachers were selected based on their years of experience in teaching. For instance, teachers with a few years of experience, ranging from 1 to 3 years, in teaching were considered as novice ones.

Identification and selection of expert teacher is a complicated process, as can be seen. Taking into consideration the fact that no easy and reliable methodology for identifying teacher expertise exists, this study only focused on years of experience in teaching mathematics. The reason for these criteria is to identify the kinds of differences or similarities in teachers' noticing in terms of teaching experience.

Just as there is no single method in identifying expert teachers, determining years of teaching necessary to label a teacher as "experienced" is a complicated issue. In prior conceptualizations, researchers selected experienced teachers with

varying levels of experience such as more than 10 years of experience (Huang & Li, 2012; Krull et al, 2007), more than 3 years of experience (Star and Strickland, 2008), more than 20 years of experience (Sato et al, 1993), and 4 or more years of teaching experience (Jacobs et al., 2010). However, some studies reported that while first three years of teaching is essential for teaching effectiveness, after three years of teaching experience, teachers effectiveness did not change significantly (Rivkin, Hanushek & Kain, 2005; Rockoff, 2004). Therefore, teachers with more than 3 years of teaching in mathematics are regarded as experienced in this study.

Differences between Expert and Novice Teachers in Teaching

Several studies have compared novice and expert teachers in the literature. In the study of Borko and Livingston (1989), they found that novice teachers, when compared to expert teachers, generally indicated characteristics such as more time consuming and less efficient planning, less ability to anticipate students' actions or problems and deviations from the planned lesson while trying to answer to students' questions. They also indicated that expert teachers focused more on student learning and understanding and seldom mentioned classroom management issues. On the other hand, novices concentrated on the assessment of their teaching rather than student behaviors. In a different study, Leinhardt and Smith (1985) demonstrated that expert and novice teachers differed in terms of subject matter knowledge, mainly knowledge of fractions. While novice teachers had more horizontal and separate category systems in solving fraction problems, more experienced ones had more elaborate and deeper categories for problems. Berliner (2001) pointed out the following differences between expert and novice teachers in terms of experts'

approaches: 1) expert teachers excel in their own domain and in particular contexts; 2) experts are more automatic for the repetitive operations to reach their goals; 3) experts are more opportunistic and flexible in teaching than novices.

Tsui (2009) proposed two capabilities that expert teachers had: theorizing practical knowledge and practicing theoretical knowledge. Specifically, expert teachers were able to both reflect on their own understanding of classroom experiences and apply formal knowledge of teaching and learning in the classroom context. According to a review of the research done by Hogan, Rabinowitz, and Craven (2003), there were also differences between expert and novice teachers in terms of planning, instruction, perceiving and reflecting on classroom events. Specifically, expert teachers were able to make long term planning and understand the relationship between overall curriculum and daily objectives. On the other hand, it was found that novices were prone to plan in the short run. In addition, experts made more transition among classroom activities with an aim of enabling student understanding and learning than novices did. In perceiving and reflecting on classroom events, experts focused on student understanding and achievement, whereas novices reflected more on their own teaching. To sum up, various differences between expert and novice teachers exist in terms of their focus in teaching, instruction, automaticity in their actions, knowledge of subject matter and perceiving classroom events. For the present study, since identifying classroom events is of importance, a review of studies focusing on noticing differences between novice and experienced teachers is particularly informing.

Comparative Studies in Teachers' Noticing According to Teacher Expertise or Experience

Besides studies describing the general differences between teachers with varying years of experience, there are also studies comparing only expert and novice teachers' noticing of significant classroom events. According to these comparative studies, teachers who watched classroom videos, made assumptions about what they saw, and tried to understand the meaning of the events they observed (Carter, Cushing, Sabers, Stein, & Berliner, 1988) Expert teachers were able to give more detailed descriptions of what they saw in the classrooms, evaluate the classroom events rather than to describe them; they were more attentive to the multidimensionality of the classroom events, and were more attentive to make evaluative judgments and interpretations (Sabers, Cushing and Berliner,1991). They also noticed more classroom events than novices and were more talkative, reflective and interpretive while making a comment, remembered more details related to classroom events observed, cared about some classroom events more, such as teacher guidance to pupils, enhancing retention and transfer of learning, and general teaching strategy as well as classroom atmosphere (Krull, Oras, & Sisask, 2007). In another study carried out by Sato, Akita, and Iwakawa (1993), it was also found that expert teachers excelled in thinking during teaching rather than thinking after teaching and monitored teaching from multiple viewpoints. They deliberately, actively and sensitively involved in a situation, which means that they were able to look at from both the teacher's and the students' perspective, and they monitored teaching as an active and thoughtful practitioner. In addition, expert teachers' thinking was specific

in terms of cognition, content and context. Finally, expert teachers were flexible enough to construct and reconstruct their thoughts as the context changed.

Besides expert teachers, novice teachers' noticing skills were also reported. As opposed to expert teachers, novice teachers made surface descriptions of events focusing on physical classroom environment and neither provided information about the relationships between the events occurring nor made sense of what they saw (Carter, Cushing, Sabers, Stein, & Berliner, 1988). A previous study suggested that the more experience the individuals gained in a particular domain, the more capable they were in giving meaning to situations they faced with in that domain (Chi, Glaser, & Farr, 1988). Therefore, as teachers gain more experience, they start to relate what they see in the classroom to what these events mean from educational context. In addition, findings indicated that novices commented on events in descriptive and less detailed way, noticed primarily the teacher observed and gave less attention to students (Sabers, Cushing and Berliner, 1991). That is, the focus of novice teachers was on the teacher observed. This result supports findings of aforementioned studies (Sherin & Han, 2004; Sherin & van Es, 2005; van Es & Sherin, 2008). Namely, novice teachers can be associated with teachers who weren't given video based lessons as an intervention especially in the studies of van Es and Sherin (2005, 2008). Instead of concentrating on students as actor, each of two groups of teachers emphasized and commented on the teacher on the videos. In another study, it was revealed that teaching experience helps teachers to begin developing expertise in attending to children's strategies and interpreting children's understandings (Jacobs, Lamb & Philipp, 2010). When these findings are considered, teaching experience provides teachers with a consciousness that students are important actors of the lesson.

In the study by Jacobs, Lambs and Philipp (2010), a particular focus for professional noticing of mathematics teachers with varying experience was children's mathematical thinking. In this study, contrary to conceptualizing noticing as attending and interpreting classroom events as in the work of Sherin and her colleagues, Jacobs and his colleagues conceptualized professional noticing of children's mathematical thinking as a set of three interrelated skills: attending to children's strategies, interpreting children's understanding and deciding how to respond on the basis of children's understandings. Results showed that expertise in attending to children's strategies grew with teaching experience and continued to grow with two years of professional experience. In addition, expertise in interpreting children's understandings continued to grow with four or more years of professional development and leadership activities.

As a result of a comprehensive review of research on teaching expertise, Hogan, Rabinowitz, and Craven (2003) argued that expert teachers focused more on mainly student learning and understanding of a concept, and rarely mentioned classroom management issues, when compared to novices. However, novice teachers were more interested in their own effectiveness as a teacher, such as their use of the chalkboard, examples and questions during the lesson.

A recent study done with ten expert and ten novice teachers from China found many quantitative and qualitative differences and similarities between participant teachers' noticing (Huang & Li, 2012). When differences are in question, quantitative findings suggested that expert teachers attended significantly to developing mathematical thinking and ability, and knowledge coherence, and teachers' enthusiasm more than novices did. They paid moderately greater attention to developing higher order thinking and student participation. However, experts gave

significantly less attention to teachers' effective guidance. Qualitative findings also showed that expert and novice teachers' noticing differed in developing knowledge coherently, developing mathematical thinking and ability, use of teaching aid tools, and selecting teaching methods. Specifically, expert teachers noticed more broad and general dimensions of mathematical thinking methods such as movement, transformation, equation method and scientific method. Besides the differences between what teachers attend to, expert and novices shared some similarities such as students' participation; students' self-exploration; classroom atmosphere; teachers' image; instructional language, and board writing; as well as students' motivation and interest. For instance, expert and novices appreciated students' self-explorations in experiments.

In conclusion, there are many qualitative and quantitative differences between expert and novice teachers' noticing skills in the literature. The present study also investigates what kind of similarities and differences expert and novice teachers have in noticing classroom events. This study is based on especially the work of van Es and Sherin (2008). The differences and similarities between participant teachers are analyzed using the actor, topic, stance and specificity categories.

CHAPTER 3

STATEMENT OF THE PROBLEM AND RESEARCH QUESTIONS

The current study was conducted with mainly three motives. First of all, curriculum change in Turkey has brought a new educational approach, which is based on constructivism. According to the constructivist approach, the students build their own knowledge with the help of the teacher. The vision of the new curriculum is to create a dynamic classroom environment where reflective thought and critical thinking of students, solving real life problems, sharing ideas and solutions, working as a group are promoted (TTKB, 2006). In such an interactive and demanding environment, as well as students, teachers have important roles. Teacher's noticing of classroom events and guidance are crucial. Therefore, investigating what is going on from the teacher's perspective in terms of noticing would be meaningful.

Secondly, the research literature suggests that experience in teaching plays a key role in what and how teachers notice classroom events. Studies comparing expert and novice teachers' noticing important classroom events found many differences and some similarities. Although there are many studies examining the expert and novice teachers' noticing classroom events, comparison studies on this issue are scarce in Turkey. Examining what kind of differences or similarities teachers have in terms of noticing could have implications for teacher education and practices as well

as future studies. In light of these foci, this study addresses the following research questions:

1. Is there a significant difference in teachers' noticing of classroom events based on their years of experience?
2. What are noticing similarities and differences among teachers who have different years of experience?
3. When the teachers notice certain aspects of the incidents, how do they explain and interpret what they notice, based on their years of experience?

CHAPTER 4

METHOD

A mixed method design was used in this study, in order to investigate whether there were significant differences between teachers' noticing and the kinds of similarities and differences participant teachers had with varying teaching experience. Mixed method research is a general type of research in which quantitative and qualitative methods are used in a single study. Johnson, Onwuegbuzie, and Turner (2007) defined mixed method research as:

> Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration (p. 123).

In this definition, Johnson and colleagues highlighted the benefits of mixed method designs which combine quantitative and qualitative approaches to get a better understanding of research problems. Some research problems cannot be answered by the quantitative or qualitative research approaches alone. Quantitative research helps researchers make statistical comparison by analyzing numerical data. However, results of quantitative research presents limited data since it provides numerical descriptions rather than detailed narrative and less elaborated human perception. On the other hand, qualitative research gives rich and deep analyses of personal views, feelings, and understandings but it is less easy to generalize the findings of a

qualitative study since fewer people are studied. Mixed methods design takes the advantage of combining both quantitative and qualitative approaches and minimizes the weaknesses of these approaches (Johnson & Onwuegbuzie, 2004). In this study, firstly quantitative analyses were carried out to make statistical comparison of noticing among teacher groups. Then, the data were analyzed qualitatively in detail to investigate how noticing of teacher groups differed in terms of their analyses and which kinds of issues emerged related to the incidents noticed. Therefore, quantitative and qualitative data were used concurrently to provide a better understanding of noticing differences among teachers. Each data set was needed to answer the three different research questions of the study.

For the analysis, the coding framework developed by van Es and Sherin (2008) was used. Within this framework, four main categories emerged as; actor, topic, stance and specificity. Firstly, chi square analyses were implemented to explore whether there were significant differences between the groups of teachers in terms of the actor, topic, stance and specificity of the events they noticed. Secondly, for qualitative analysis constant comparison method was used. New sub-categories that emerged in the collected data were integrated with the four categories mentioned.

Participants

Fifteen teachers of mathematics participated in this study. They were purposefully selected from elementary schools in Istanbul, Turkey. Eleven of them were female teachers and four were male teachers. By virtue of design of this study, participants were divided into three particular groups of teachers in terms of years of experience

they had in teaching mathematics. That is, there were 5 mathematics teachers in each group. The first group consisted of in-service mathematics teachers who had more than 3 years of experience in mathematics teaching. The second group included mathematics teachers with less than 3 years of experience. Therefore, the first group was referred to as experienced teachers, whereas the second group was named as less experienced teachers. The third group involved pre-service teachers without formal experience in mathematics teaching. These pre-service teachers were in the last semester of their undergraduate program in mathematics teaching. All participant teachers graduated or they were about to graduate from a well-known competitive university. This university aims to train creative future teachers who can easily adapt to any kind of change and different points of view. Teacher graduates of this university are prepared for reform-minded classrooms and are expected to be sensitive towards classroom situations. The reason for selecting the participants from the same university is to minimize potential influences from differing types of education they receive and educational vision they are exposed to in their faculties. It was also convenient to select participants from the same university.

The mean year of experience of experienced teachers was 7 years. Less experienced teachers had a mean of 2 years of experience, and pre service teachers had no formal years of experience. Based on the literature, the first three years of teaching is crucial for gaining teaching experience. However, more than 3 years of experience in teaching do not change teachers' effectiveness significantly (Rivkin, Hanushek & Kain, 2005; Rockoff, 2004). Therefore, separating teachers according to certain criteria was important for the current study. Teachers with pseudo names, their experience in teaching and type of school they worked at are given in Table 1.

Table 1. Teachers' Workplace and Experience in Teaching

Pseudo Names	Type of School	Teaching Experience
Ayşe	Private	10
Belma	Private	7
Derya	Private	6
Seda	Private	7
Emine	Public	5
Nermin	Private	2
Salih	Public	3
Şebnem	Private	2
Remzi	Public	1
Elif	Private	2
Enis	-	0
Filiz	-	0
Erdem	-	0
Özlem	-	0
Zuhal	-	0

Purposeful sampling method was used in participant selection. At the beginning of the data collection process, recommendations of faculty were taken into account in selecting prospective teachers and in-service teachers who could be volunteers to participate to this study. Pre-service and in-service teachers were contacted via e-mail, and volunteers were invited to participate in the study.

As well as having different years of experience in teaching, the teachers' workplaces also differed. Both experienced and less experienced teachers have been working at both public and private schools. In addition, the participant teachers also had different academic backgrounds. Some of the in-service teachers continued their academic life in a Master's or PhD programs. All experienced teachers had a Master's degree and one of them was enrolled in a doctoral program. On the other hand, only one of the less experienced teachers was registered in a Master's program. The rest did not pursue a graduate degree.

Data Collection

Videos as auxiliary data collection materials

The researcher used video recordings from real classroom settings. Two mathematics lessons were videotaped by the researcher in two separate mathematics teachers' classrooms at a public school, which was conveniently selected. The first video was from a seventh grade classroom, and the second was recorded in a fifth grade classroom. Seventh grade mathematics teacher had 7 years of experience in teaching whereas fifth grade mathematics teacher had 4 years of teaching experience. The two lessons were part of the regular mathematics curriculum commonly followed by the teachers. Each video was produced from extracts of a 40 minute lesson. The recordings were edited and shortened due to time constraints. The researcher selected and combined clips in order to demonstrate the essential parts of the lesson so that the viewer has a picture of the lesson as a whole. The first video was approximately 13 minutes, and the second was approximately 15 minutes. Detailed information about these videos is given in the next section.

First video

In the first video, the topic of the lesson was 2-D appearance of the solids formed by unit cubes, according to different viewpoints. In each desk, students had some unit cubes. There were three objectives of the lesson. For each objective the teacher introduced an activity and the students were supposed to carry out each one with

their partners. In the first activity, they were building a shape which was demonstrated by the teacher. They had to draw its appearance from different perspectives. While the teacher was wandering around the classroom and demonstrating the shape, the students were trying to build the same shape with unit cubes. Then, the students were asked to draw its appearance from right, left, back and front. During the activity, the teacher went around and gave feedback to students.

In the second activity, firstly the students were supposed to build their own shapes with unit cubes, and then they drew the shapes from different perspectives. The teacher again wandered around the classroom to check student work and provided feedback. In the last activity, the teacher drew the appearance of a shape from right, left, and front. Then, the students were asked to build the corresponding shape with unit cubes. At the end of the third activity, after each group finished their shapes, the teacher demonstrated that there could be more than one shape with the same appearance from right, left and front.

Second video

The objective of the lesson was doing division. At the beginning, by asking questions to students the teacher reviewed previous subjects such as multiplication, addition and subtraction. Then, she wrote a problem on the board and solved it with students. She gave division terms such as dividend, divisor, quotient and remainder. After that, she projected a different problem onto the board and taught how to solve the problem. She emphasized that the remainder should be smaller than the divisor. She also taught adding a zero in the quotient when the remainder is smaller than the

divider. At the end, she demonstrated two questions using the smart board. The students were asked to solve them first in their seats, and then at the blackboard.

Interviews

The participants were interviewed after they watched the two videos of mathematics lessons. They were asked to note the exact time whenever they noticed something while watching the video excerpts. They were also free to make notes while watching the videos about the events they noticed so that they could remember them. After the video, each moment corresponding to participant notes was again watched and some questions were asked related to that specific event. After going one by one over the incidents an open ended and semi structured interview was implemented, because in case the researcher intervened with the participants' comments during the interview, they would have been restricted, which might have affected the extent of their noticing classroom events. Therefore, the researcher gave teachers freedom to comment on their notices. Although there were some generic questions, other questions were tailored according to the interviewees' notes and comments. The interview can be described as a semi structured one. Two fundamental interview questions were the following:

1. You captured some moments while watching the video. Let's talk about each of them. What do you notice or what stood out for you? (for each instance, the participants were asked this question)
2. Why do you think that it is worth noticing or noting down? What was interesting about it?

Data collection process

After the participants were determined, they signed a consent form. They were informed that they would watch two video excerpts of a real mathematics lessons and they would be interviewed on these videos. For each participant, viewing a video excerpt and participating in a corresponding interview were implemented twice. An interview lasted approximately 15 minutes in average. The participants were asked questions related to the video recordings and their comments during the video were audio recorded. They were informed that all comments they made during the interview would be confidential. Then, interviews with 5 prospective mathematics teachers, 5 teachers with 0-3 years of experience and 5 teachers with more than 3 years of experience were carried out during May and June 2013.

Data Coding

In the current study, mixed method design was used, so data were analyzed both qualitatively and quantitatively. Data collected from interviews were transcribed. The transcriptions were analyzed qualitatively according to the coding categories identified by van Es & Sherin (2008). According to their framework teachers' noticing is examined in 5 main categories: actor, topic, stance, specificity, and video focus. A sample of coded data is given in Table 2.

After transcribing the interviews, the transcription of one interview was divided into segments that focused on a specific event. These meaningful segments were analyzed for 4 dimensions from van Es & Sherin (2008)'s framework: actor,

topic, stance, and specificity. For some events, there were more than one subject and topic voiced by the participants. In addition, some of the comments included evaluation, description and interpretation at the same time. In order to select only one code for each category, the most dominant sub-category throughout the extract was determined and coded according to the framework. Table 2 shows an illustrative extract from the raw data for actor, topic, stance and specificity categories. For quantitative analysis, each subcategory was assigned a numerical value.

Table 2. Data Coding Scheme

Categories	Extracts from the data
Actor	
Student	"The video was interesting for students. It showed how to make division with animations. For the first few minutes, the students were eager to learn. But, then they started to lose their interest since the tone of the speaker was quite monotonous."
Teacher	"The teacher showed each step in the division and solved it as if none of the students knew how to divide. This technique which was used by the teacher was effective."
Other	"Another teacher came to the classroom and gave a book to the mathematics teacher. This did not cause any disturbance for students. "
Topic	
Mathematical Thinking	"The teacher emphasized this difference. While they start addition, subtraction and multiplication operations from the right side of the numbers, in division they start from the left side. This distinction was helpful for students' understanding since they could sometimes start with the left part of the operation while making addition."
Pedagogy	"Before the teacher explained that the remainder should be smaller than the divisor, she asked what the maximum value of the remainder was in that specific example. Rather than giving this rule, she preferred testing students' knowledge about it. This method used by the teacher was good because it arouses both interest and thinking."
Climate	"The video was interesting for students. It showed how to make division with animations. For the first few minutes, the students were eager to learn. But, then they started to lose their interest since the tone of the speaker was quite monotonous."
Classroom Management	"The students did not exhibit off-task behaviors during the lesson."

Other	"The physical appearance of the classroom was effective for teaching and learning when I consider a public school conditions. There was a projector and a computer in the class."
Stance	
Descriptive	"The teacher used technology while teaching division. She showed different division questions to students. For each question, students came to the board and solved them."
Evaluative	"The teacher generally explained the division subject. Rather than using the direct teaching method, she could have had the students do the division to see what kind of mistakes students made".
Interpretive	The teacher wandered around the classroom by demonstrating the solid. However, the appearance of the solid was constantly changing. In addition, the explanation made by the teacher and appearance of the solid were not concurrent. This asynchronization of audial and visual materials might have created confusion or misconception between the students. When visual and audial materials were given students simultaneously, it helps students with different learning styles to understand and remember the subject.
Specificity	
General	"The teacher was trying to teach division concept. The students listened to their teachers and replied her questions. I think she achieved her goal"
Specific	"The teacher said that they could construct different solids with the same shape. But, I think students should arrive at this conclusion themselves with teacher support."

The first category, actor, describes the subjects of the event. Namely, interviewees may talk about the teacher, the students or other people in the video. For instance, as the Table 2 shows, one inexperienced participant said "the teacher showed each step in the division and solved it as if none of the students knew how to divide. This technique which was used by the teacher was effective". This comment was mainly focused on the teacher as actor in the video since the comments of the inexperienced teacher focused on what the teacher in the video did and whether her technique was effective. On the other hand, a less experienced teacher, Şebnem, commented "the video was interesting for students. It showed how to make division with animations. For the first few minutes, the students were eager to learn. But, then they started to lose their interest since the tone of the speaker was quite

monotonous." The student was coded as the main actor in this example because students' attitudes towards learning division and their interest were primarily noticed by the participant teacher. When another teacher or person rather than the classroom teacher were noticed as in the example above in the Table 2, it means that the participant teacher identified "other" as actor.

Second category refers to topic, commented on by the participants. The sub-categories of this dimension are mathematical thinking, pedagogy, climate, management, and other. Mathematical thinking means understanding the thinking of students. The example given above in the Table 2 shows that the experienced participant commented on the students' mathematical thinking related to the concept of division since it includes mathematical relationship between four basic operations and students' understanding about this distinction. The second sub-category, pedagogy, is related to teacher's use of educational strategies and techniques while teaching a subject. The example in Table 2 shows that the participant noticed the technique used by the teacher in the video in teaching how to do division.

The relationship and communication between the students and the teacher refer to the climate of the classroom. Şebnem's example which was stated earlier in the actor category shows the climate in the lesson. Management implies the mechanics and flow of the lesson. This category is closely related to students' behaviors and teacher's reaction to those behaviors during the lesson. Comments such as "the students did not exhibit off-task behaviors during the lesson" belong to management sub-category. If the comments of participants focused on another topic apart from the sub-categories in Table 2, then this event was coded as "other" in the topic category.

The third category, stance, is about how participant teachers analyze the video. They may describe, evaluate or interpret the events. When they describe, they only explain what is going on in the classroom. For instance, as in Table 2, a less experienced teacher commented "the teacher used technology while teaching division. She showed different division questions to students. For each question, students came to the board and solved them". This quotation indicates that the participant teacher described the event she noticed without making any inference or personal comment. For evaluation of the event, teachers may criticize the noticed event by commenting on what was good or bad during the lesson, and suggesting alternatives that the teacher could do differently in the lesson. An experienced teacher said "the teacher generally explained the division subject. Rather than using the direct teaching method, she could have had the students do the division to see what kind of mistakes students made". This example, given in Table 2, includes suggestions made by the participant teacher for the classroom teacher. Interpretation, on the other hand, means making inferences from the noticed events and analyzing the specific event from educational perspectives. The example in Table 2 shows how an experienced teacher interpreted what she noticed in 7^{th} grade classroom since she related the specific event (the explanation made by the teacher and appearance of the solid) to the principles of teaching and learning (the possible effects of asynchronization of the audial and visual materials).

The fourth category focuses on the specificity that the teachers used. While commenting on the events, they can use either specific or general language. Comments such as "The lesson went smoothly" and "The students behaved well" are regarded as general. As a contrast, the following quotation indicates a specific event:

"the teacher said that they could construct different solids with the same shape. But, I think students should arrive at this conclusion themselves with teacher support".

The video focus category in van Es & Sherin (2008)'s framework is about whether teachers' notices are based on the events in the video or those outside the video. In this study, only, Actor, Topic, Stance and Specificity were used for analysis. The video focus category is not relevant for this study, since the focus here is only what the teachers notice and how they explain what they notice. Aforementioned studies in the literature generally aimed to develop noticing of teachers by having them watch video excerpts in training sessions. Therefore, for such studies whether the comments of participant teachers were based on the video or not were crucial. However, since the aim of this study is examining what teachers notice and how they differ in their noticing, rather than improving their noticing, the video focus dimension is eliminated while analyzing the data. While presenting their interview findings, van Es and Sherin (2008) highlighted and analyzed these four dimensions to demonstrate shifts that occurred in teachers' noticing, which shows that dimensions can be analyzed independently from each other.

After deciding on which segments belong to which category, two researchers blindly coded 14% of all the incidents along the four dimensions (50 incidents out of 354 total incidents) and compared their coding scheme to each other. Overall inter-rater reliability was 85 %. By negotiation, both of the researchers arrived at a consensus.

Data Analysis

The data collected from the interviews were analyzed both quantitatively and qualitatively. During the analyses, the sub-categories of students, mathematical thinking, interpretation, and specificity were purposefully chosen for the present study. The reason for selecting these particular sub-categories was their prominence in the new Turkish curriculum. Based on the new mathematics curriculum, students are supposed to take an active role in the lesson, and the teacher is expected to guide them to think and communicate mathematically (TTKB, 2013). In addition, the noticed events by the participant teachers were expected to be specific rather than general, as stated by van Es and Sherin (2008), who also emphasized that interpretation of the ongoing events was as important as the noticed event, rather than describing and evaluating. van Es and Sherin (2002) pointed out that expert teachers connected specific events they noticed to a principle that they knew about teaching and learning, while novice teachers usually give literal descriptions of events. Therefore, this study focused especially on these four distinct sub-categories.

For the quantitative analysis, non-parametric tests were used since the number of participants in this study was relatively small for parametric tests. Chi square test was conducted to determine whether or not there was a significant association between the participants' years of experience and their noticing of classroom events. This test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one of more categories (Yıldırım & Şimşek, 2008). Chi square test was applied because there were categorical variables; years of experience the teachers had (inexperienced, less experienced and experienced) and actor, topic, stance and specificity. In addition, the

expected frequency count was at least 5 in each cell of the contingency table. The *p*-value selected for the level of significance was .05. Additionally, data were analyzed with frequency tables and percentages of teachers' comments for specific codes.

In this study, new related issues emerged based on the main and sub-categories that were developed by van Es & Sherin (2008). New issues and sub-issues related to the sub-categories of student, mathematical thinking, interpretation, and specificity were determined by a detailed examination of the participants' on the events they noticed. Issues about mathematics teaching/learning manifested in teachers' explanations of their notices.

For the trustworthiness issue, each participant was interviewed twice (interviews on 5th grade and 7th grade lessons) in order to ensure credibility. Therefore, each participant provided two layers of data which included richer and a more credible data set. Rich descriptions of the data and how the data were analyzed are presented in the following chapters so that readers have opportunity to make sense of researcher's reasoning (Creswell, 2003).

CHAPTER 5

FINDINGS

The frequency and percentage table given below enables a general overview about the findings. The results of chi square analyses are discussed about whether there was statistically significant difference between the three teacher groups in terms of four categories mentioned above. For the qualitative findings of the study, what participant teachers noticed and how they differed in analyzing the events especially in terms of teaching experience were presented with particular incidents and quotes from the qualitative data.

Quantitative Analyses of Noticing of Three Teacher Groups

For each classroom event that the teachers noticed, the actor, topic, stance and specificity of the event given as a specific value was coded and entered into SPSS. Eventually, there were 354 noticed events in total. 118 of the noticed events belonged to the inexperienced teacher group, 115 of them were reported by less experienced teachers, and 121 events came from the experienced teachers. It was seen that the number of events noticed were close to one another for the three teacher groups.

Even though the number of noticed events was similar, the analysis of the video interviews indicated that focus of mathematics teachers differed based on their years of experience in teaching. A cross tabulation table was created to analyze noticing differences between the three teacher groups. In Table 3, the frequencies and percentages of the comments for each category are shown. These percentages were then used to investigate how teachers with distinct years of experience differed in their notices of the classroom events.

Table 3. Frequency and percentage of the three groups' notices for each dimension

Categories	Level of Experience		
	Inexperienced	Less Experienced	Experienced
Actor			
Student	(25) 21%	(25) 22%	(53) 44%
Teacher	(83) 70%	(83) 72%	(67) 55%
Other	(10) 9%	(7) 6%	(1) 1%
Topic			
Math Thinking	(21) 18%	(20) 18%	(35) 29%
Pedagogy	(53) 45%	(52) 45%	(66) 55%
Climate	(20) 17%	(17) 15%	(8) 6%
Management	(22) 18%	(21)18%	(10) 8%
Other	(2) 2%	(5) 4%	(2) 2%
Stance			
Describe	(10) 9%	(12) 10%	(13) 11%
Evaluate	(89) 75%	(86) 75%	(47) 39%
Interpret	(19) 16%	(17) 15%	(61) 50%
Specificity			
General	(66) 56%	(63) 55%	(55) 45%
Specific	(52) 44%	(52) 45%	(66) 55%
Total	(118) 100%	(115) 100%	(121) 100%

Note: The numbers in the parenthesis show the frequency of each sub-category.

According to Table 3 the percentages of some sub-categories increased from inexperienced to experienced teachers. These are student in the category of actor, mathematical thinking and pedagogy in the category of topic, interpretation and description in the category of stance and specific in the category of specificity.

The findings showed that inexperienced and less experienced teachers' comments focused on the student with the similar percentage of 21% and 22%. On the other hand, experienced teachers noticed students more when compared to inexperienced and less experienced teachers. From the inexperienced teachers to the experienced ones, the percentage of noticing student as actor shifted from 21% to 44%. As for notices in the actor category, all 3 groups of participants noticed teacher as the main actor most frequently. 70% of comments of inexperienced teachers, 72 % of comments of less experienced teachers and 55% of comments of experienced teachers were about teachers in the videos.

While 18% of incidents that inexperienced and less experienced teachers noticed focused on mathematical thinking, 29% of the comments of experienced participants were on students' mathematical thinking. That is, experienced teachers had a higher percentage of noticing students' mathematical thinking than other teacher groups. In addition, when all teachers with different years of experience are considered, pedagogy was the most frequently used sub-category for all teacher groups. 45% of comments of inexperienced and less experienced teachers, and 55% of comments of experienced teachers focused on pedagogy when all the sub-categories were taken into consideration. Furthermore, 18% of comments of inexperienced and less experienced teachers were on classroom management issues, whereas 8% of comments of experienced teachers focused on classroom management issues.

As for the dimension of stance, 16% of the comments made by the inexperienced teachers were interpretive. Similarly, 15% of less experienced teacher adopted the interpretive stance. However, 50% of the analysis about the events experienced teachers noticed were interpretive. It was also found that inexperienced

and less experienced teachers made more evaluative comments related to an event they noticed compared to experienced teachers. Actually, 75% of both of the teacher groups' comments were evaluative in nature. On the other hand, only 39% of comments that the experienced teachers made were evaluative. In terms of the specificity dimension, 55% of comments made by experienced teachers were specific. However, 44% of the events noticed by the inexperienced teachers were analyzed specifically. Similarly, 45% of the comments made by the less experienced teacher were specific.

After an overview about frequencies and percentages of noticed incidents, chi square analyses were implemented for each dimension in the framework. The chi square test on actor category revealed that there was a statistically significant difference among the three teacher groups in terms of actor in the noticed events, $\chi 2$ (2, N = 354) = 23.96, p = .00. When two specific groups were compared, there was no significant difference between the inexperienced and less experienced teachers in terms of the actor they noticed, $\chi 2$ (1, N = 233) = .49, p = .78. However, the inexperienced and experienced teachers significantly differed in their noticing of actor, $\chi 2$ (1, N = 239) = 19.09, p = .00, There was also a statistically significant difference between the less experienced and experienced teachers in the actor category, $\chi 2$ (1, N = 236) = 16.11, p = .00.

In the second analysis, the results revealed that there was a statistically significant difference between the comments related to topic made by the teachers, $\chi 2$ (2, N = 354) = 19.56, p = .01). The significant difference existed only between the inexperienced and experienced teachers, $\chi 2$ (1, N = 239) = 14.53, p = .01 and between less experienced teachers and experienced ones, $\chi 2$ (1, N = 236) = 16.12, p = .00. However, there was no significant difference between the inexperienced and

less experienced teachers in terms of the topic they commented on, $\chi 2$ (1, N = 233) = 1.55, p = .82.

The analysis on the stance category indicated that there was a statistically significant difference between the teachers with different years of experience in terms of how they explained an event after noticing, $\chi 2$ (2, N = 354) = 52.63, p= .00). Parallel to chi square results carried out for other categories to examine the difference between inexperienced and less experienced teachers, the findings indicated that these two groups did not differ in terms of stance they adopted, $\chi 2$ (1, N = 233) = .31, p = .86. But, less experienced and experienced teachers significantly differed in how they analyzed the incident they noticed, $\chi 2$ (1, N = 236) = 36.17, p = .00. Similarly, there was a significant difference between the stance adopted by inexperienced and experienced teachers, $\chi 2$ (1, N = 239) = 35.38, p = .00.

The last finding was about the specificity of teachers' comments while explaining the event noticed. According to the chi square analysis, there was no significant difference between the groups in terms of how specific their comments were on the events that they noticed, $\chi 2$ (2, N = 354) = 3.16, p= .21).

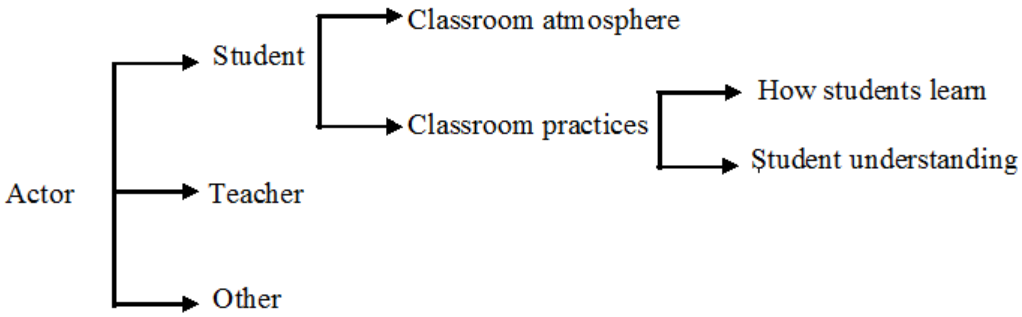
Qualitative Analyses of Noticing of Three Teacher Groups

The data collected from the interviews were analyzed qualitatively. The aim was to identify how teachers analyze the incidents when they notice certain aspects of the incidents. After a detailed examination the participants' comments , new issues and sub-issues emerged based on van Es & Sherin (2008)'s sub-categories for student, mathematical thinking, interpretation, and specificity, all of which are discussed below.

Teachers' Noticing in terms of Students as Actor of the Event

The analysis of the data gathered from the interviews revealed that participants focused on students they noticed on the video from different perspectives. For the actor category, 2 main issues emerged; classroom practices of students and classroom atmosphere (See Figure 1). In accordance with the themes, classroom practices refers to what students do in an instructional environment; classroom atmosphere includes the relationship between individuals in the classroom and students' enthusiasm for and attitudes toward the lesson. The findings indicated that while experienced teachers focused more on classroom practices of students, inexperienced and less experienced teachers generally mentioned classroom atmosphere**.**

Figure 1. Issues and Sub-Issues of Actor Category



The first popular sub-issue that all teacher groups mentioned was students' understanding. However, they approached the same issue from different perspectives. Pre service teachers generally made a relationship between whether or not students understood the subject and the way the teacher taught. The following excerpt showed students' understanding while demonstrating the appearance of unit cubes by the teacher. In the video taken from 7th grade classroom the teacher showed

a shape constructed with unit cubes and asked students to draw its appearance. One pre service teacher reflected on this event as below.

> While the teacher was wandering around the desks with the cubes in her hand, some students needed to stand up and tried to see how it looked like. I do not think all the students had access to see all the stuff and some of them did not understand how to draw. In addition, whereas for students who sat at the right side of the classroom could draw the right side of the shape as front and students who sat in front of the teacher could draw correctly. This situation did not create confusion in that lesson but it might have (Erdem, first interview).

As another example, on the video taken from 5^{th} grade classroom, while explaining division the teacher emphasized the meaning of installment and sharing something. She stated that when such words were used, the problem required division operation. She added that when multiple of a number was given, students were expected to multiply. A less experienced teacher made the following comment on this event.

> It is necessary to give meaning of some verbs or words by the teacher to enable understanding. Explaining the meaning of installment and sharing something was crucial for students. From my experiences with the 5^{th} graders, some students still may not know the meaning of these terminologies and therefore, such kinds of hints help them to understand division operation. Therefore, it is important to emphasize these words especially for younger children (Remzi, second interview).

As it is seen from the two examples, inexperienced and less experienced teachers commented on students' understanding. The first teacher stated that students might not have understood how to draw the appearance of a solid because there was a problem created by the teacher who constantly wandered around the classroom with a solid object. According to this participant, due to the problems in delivering the information, some students did not understand how to draw. The second participant focused on students' understanding of the division topic. However, he added that in order for students to understand division the teacher used some key words. For both of the comments, on the surface it is seen that the students' understanding was the focus of the participants. However, the inexperienced and less experienced teachers

actually focused on the instructional strategy and delivery the information in the video. According to their comments, whether or not the students understood is related to how teachers designed the lesson. That is, relating students' understanding to the way of delivering the lesson indicated that there was a shift in the focus from student understanding to teachers' teaching practices.

As a contrast, an experienced teacher started with a general description of what the teacher did in the 5th grade classroom and finished her comment by emphasizing student understanding. A good example of this issue from an experienced teacher can be seen in the quotation below.

> Making such kind of generalizations, I do not know, does not make sense for me when I think of myself as a student. Stating that when the problem included the word "multiple" in it, the number should be multiplied canbe confusing. To be specific, when the problem asks for five times which number gives 100, this question does not require multiplication. Instead, it asks for dividing 100 by 5. As a result, such kind of generalizations could create confusion instead of understanding. When a student heard what the teacher dictated, it is normal that the student multiplies 5 by 100 (Ayşe, second interview).

In this example, the experienced teacher discussed the classroom teacher's use of the word "installment" in division operation and predicted what kind of a mistake that the students would make when such keywords were given to students. At first, it can be asserted that this participant teacher focused on the way the teacher in the video taught her students the concept of division. However, the main issue the participant teacher pointed out was the way of students' thinking and understanding. In fact, the teacher discussed what kind of problems students could face with in that instructional context.

Some sub-issues were voiced similarly by all teacher groups such as how students learn. For instance, they verbalized taking students' own initiative which refers to providing sufficient freedom for students so that they can construct their

knowledge. Generally teachers commented about the 7th grade classroom that the teacher should not say there would be different solids with the same appearance. Instead, students should have worked independently to reach the conclusion after discussing the alternatives. Briefly, all teachers with varying experience in teaching adopted learning practices which included taking an active role and building one's own knowledge. They expected students to share and discuss their solutions with the class members so that each learner in the lesson could see there would be alternatives. It can be asserted that all participants agreed that the mathematics classroom should be an active community where ideas and comments were continuously shared by students to learn.

Besides, experienced teachers emphasized misconceptions and their necessity for learning. For example, a teacher said that students could learn from their mistakes, referring to an incident in the 7th grade classroom.

> The student drew 3 unit cubes and he did it correctly. Since the unit cubes were not equal in size, there seemed to be four unit cubes. This was a mistake and could create a misconception for the students. By asking questions about the number of cubes drawn and their size could be helpful for students to eliminate this mistake and learn from it. However, the teacher came and drew the cubes on her own (Ayşe, first interview).

In this excerpt, experienced teacher proposed a strategy to eliminate misconception, and emphasized that the students could learn from their mistakes. In addition, the teacher considered such a mistake as an opportunity to learn. In other words, experienced teachers explained how students learn with not only giving students enough freedom to take responsibility of their learning but also learning from their mistakes.

The second issue is classroom atmosphere which includes students' attention, enthusiasm, and interest. All the teachers mentioned students' interest in the lesson. But, experienced teachers noticed classroom atmosphere less than other teacher

groups. There was one striking difference between experienced, and pre service and less experienced teachers about what they based their comments on. Pre service and less experienced teachers stated especially for the 7th graders that students were interested in the lesson since there were manipulatives and these manipulatives helped both to arouse curiosity and to teach abstract concepts. They used their instant observations while commenting on what they noticed. On the other hand, experienced teachers reflected on the same lesson that it was not interesting for students to draw what they saw. The reason for this was that students should have already learned to draw the appearance of a solid at 6th grade. At 7th grade, the teacher should have challenged them to think abstractly. Specifically, one experienced teacher suggested an alternative as in the extract below.

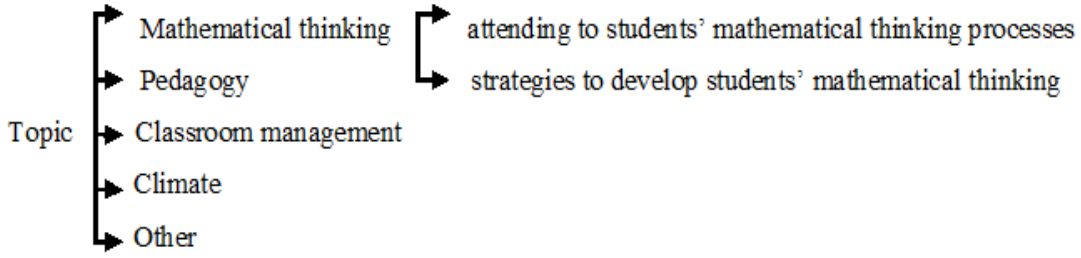
> The teacher could have said that there were 4 unit cubes on the right, and 6 unit cubes on the left, and 3 cubes in the front. And then she might have asked students to draw this solid, and students groups could have shared their answers. Thus, enthusiasm for this lesson would be aroused more compared to the present lesson. I think, students would already knowhow to draw. If the students experience a challenge appropriate to their level of understanding, their enthusiasm increases (Belma, first interview).

Another experienced teacher reported that it was redundant to ask them to stand up and draw what they see from different sides. She also added that according to her observations of students in her class and their grade level they could perceive appearances of different sides without looking at them. In short, comments of experienced teachers were based on their own experiences and knowledge of the spiral structure of the middle school mathematics curriculum. As can be seen, the reflections of the experienced teachers were based not only on their observation of the video excerpt but also on the knowledge of the student characteristics as well as the objectives of the curriculum.

Teachers' Noticing in terms of Students' Mathematical Thinking

According to chi square analyses of topic, mathematical thinking of students was worth investigating in a detailed way. Although all teacher groups noticed students' mathematical thinking to a degree, there were qualitative differences between these groups in terms of level of engagement with children's mathematical thinking. A deep analysis of how teachers differ on students' mathematical thinking yielded two sub-issues; attending to students' mathematical thinking processes, and strategies to develop students' mathematical thinking (See Figure 2).

Figure 2. Issues of Topic Category



On the basis of two sub-issues mentioned, a sharp difference in attending to students' mathematical thinking processes existed. Inexperienced teachers generally did not attend to children's own thinking processes. They did not mention students' individual strategies throughout the lesson. On the other hand, experienced teachers pay attention to how students thought about and responded to the subject learned in the classroom. For instance, in the 5th grade classroom while division was being taught, experienced teachers frequently reflected on what students did or did not do, which strategies they used during solving a problem, and what kind of questions they asked to the teacher. The excerpt below shows an experienced teacher's comments on students' thinking processes.

> While doing a division problem, the teacher added a zero, since the remainder was smaller than the divisor. At that point, the student asked why she added the zero, and the teacher replied that if she did not put zero, the answer would not be correct. She only gave this answer and did not even need to explain the reason behind this operation. I was very surprised watching it, because I do not think the student got the idea. When he faced with such a problem, he may make a mistake or automatically put zero without knowing the reason (Emine, second interview).

Another experienced teacher commented on the 7th grade lesson. As mentioned before, one student did not draw unit cubes in equal size. After the teacher noticed this situation, she intervened and drew the correct shape. The teacher voiced this issue by focusing on students' thinking.

> The student drew different sized unit squares and therefore, he could not continue to draw the rest of the solid, since size of the base was incorrect. Making such a mistake was quite possible for students if you, as a teacher, do not use checked paper. More interestingly, the teacher went to the board and corrected student's mistake without explaining why he should draw equal sized squares. I think the student did not understand what was happening (Derya, first interview).

As it can be seen from these examples, experienced teachers attended to students' questions and mistakes. They also discussed how to respond in such kind of situations as a teacher to develop students' mathematical thinking and understanding. In the comments below made by another experienced teacher a detailed explanation is given to show how to foster student understanding by explaining why we add zero in to the division.

> Students did not have any idea about why they should have put zero to the division since this issue were not discussed throughout the lesson. The students will reflexively divide numbers and add zero if necessary. They will do crosscheck and understand if the answer is correct or not. However, they will not understand the idea of adding the zero. Why do we need to put zero in to division? The reason could be explained as the following. If we do not have enough number in the remainder to be divided by the divisor, this nonexistence refers to zero in mathematics. If the teacher explained like this, I think the students would understand why they need to put zero (Belma, second interview).

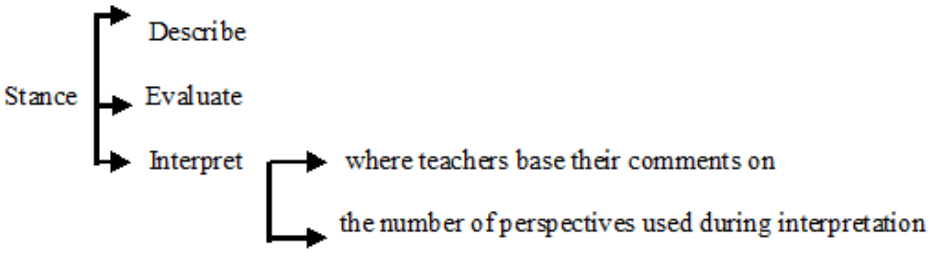
This extract indicated that the teacher discussed how to foster understanding and to relate known concepts (nonexistence in daily life) to a mathematical subject (the meaning of zero). Therefore, she tried to give suggestions to develop students' mathematical thinking and understanding.

In contrast to experienced teachers, inexperienced and less experienced teachers commented on general strategies that the teachers used in the lessons in order to develop students' mathematical thinking. For example, one inexperienced teacher stated that instead of giving the definition, starting division topic by writing a classical division problem on the board helps students to think mathematically. Another less experienced teacher pointed out that explaining the meaning of keywords such as paying one installment of payment, or sharing something with friends were helpful for students to relate words with mathematical operations. The same participant added that when the teacher gave students some mathematical rules like keywords, the students could place these rules in to their own mathematical schemes and use them if needed.

Another inexperienced teacher emphasized that the teacher in the 5^{th} grade classroom provided different division examples from simple to difficult and this tiered teaching was good for students to add a new dimension to their understanding. As it is seen from the examples and excerpts given, inexperienced and less experienced teachers noticed more general and superficial strategies in developing students' mathematical thinking. Experienced participants attended to how to foster understanding and thinking about division, by referring to students' current mathematical thinking on the video, and mentioned in a more detailed way the intricate links between teacher's teaching practice and students' thinking.

The investigation of how the participants analyzed the events they noticed pointed out clear-cut differences between the teachers with varying teaching experience. In line with quantitative results, the experienced teachers differed from the inexperienced and less experienced teachers in their interpretive comments (See Figure 3).

Figure 3. Issues of Stance Category



While interpreting an event, the experienced teachers used both their own experiences and previous observations, such as predicting students' characteristics in a specific context, constructing relationships among students' understanding of a specific subject and objectives of the curriculum and the current event. They related their experiences and the existing event to the theoretical knowledge. On the other hand, the pre service teachers based their interpretive analyses on theoretical knowledge they had and the events they noticed. Very rarely, pre service teachers' interpretations were nourished from their internship experiences. Below, two different cases are presented to highlight this difference.

> The teacher asked the students to stand up and look at the solid. Then, they drew what they saw for each appearance of the shape. For each appearance, students drew it on the board; therefore, all students could see the correct appearance and continued to draw from other's perspectives. Even the students who did not draw the shape could check their answers from the board. I noticed this event because I had a similar experience in my internship school. I planned to implement an activity which had various steps in order. I

> wanted students to complete one step and start the other. At the end, I was planning to arrive a point that student would get the idea. However, we did not discuss our results after each step. After a while, the students started to ask what the result of first step was. This issue was very important for me then. This situation caused students confusion since they have already forgot what they did so far. Making sense of the idea we wanted to give as a teacher for each step may prevent such confusions (Erdem, first interview).

This quote belonged to a pre service teacher who interpreted the event by using his internship experience. Since he experienced a similar event, he noticed this event and made an interpretation about it. However, the data collected from the inexperienced teachers rarely included cases like the one mentioned above. Instead, they explained the noticed event by using theoretical knowledge that they learned from their college courses. Generally, they thought of an ideal learning and teaching environment, which was constructed based on their college education. On the other hand, the example below shows how an experienced teacher interpreted an event she noticed.

> While the teacher was explaining division, she suddenly started to talk about multiplication. She explained where to use division and multiplication by giving keywords such as installment and multiple of something. However, in this scenario the students might not understand why their teacher explained multiplication instead of only division. As teachers, we want to deliver mathematical relationships we have in our minds to students. As far as I observed, the students generally fail to construct this relationship unless we explain division and multiplication individually, and help them to construct the relationship between the two (Ayşe, second interview).

While interpreting, she used observations of her own students and made comments about their understanding in such a situation. Similar to this case, experienced participants analyzed the events by predicting students' level of understanding of a specific subject, making relationship between students' understanding and objectives of the curriculum. The excerpt below, taken from an experienced teacher's interview, highlights this relationship.

> The students were not really interested in the lesson since they already knew how to draw the appearance of a solid from different perspectives. At 7^{th} grade they should draw appearances of 3 dimensional shapes by using isometric paper since they should have learned to use isometric paper in 5^{th}

> grade. However, the objective of this lesson belonged to 6th grade objectives because they should have learned to drawn appearance of a shape from different perspectives using their notebook (Seda, first interview).

The teacher commented on the objectives of 5th, 6th and 7th grade geometry topics. She also emphasized the spiral structure of the curriculum by commenting on what students are supposed to learn about appearances of solids in each grade. The teacher interpreted the event from the video excerpts by considering to what degree the current lesson was in accordance with national mathematics curriculum. Her interpretation was based on the knowledge about middle school mathematics curriculum and the specific event in the video.

The other difference between participant teacher groups was interpreting the event noticed from multiple viewpoints. Namely, experienced teachers analyzed the event from multiple perspectives and gave their possible consequences. However, inexperienced teachers mainly used a single perspective while commenting on such events. Less experienced teachers could be considered in between the two groups. They sometimes adopted more than one viewpoint according to the event they noticed. In the comment below an experienced teacher analyzed the event she noticed from the 7th grade classroom where appearances of unit cubes were drawn from multiple perspectives.

> The teacher did not check students' previous knowledge but students have learned this subject last year. They did not discuss what students knew and remembered from 6th grade, and what they will learn in that lesson. At first, I did not understand whether that lesson was an entry to the topic or not. In the curriculum, this topic is in 6th grade. But, how much students remembered the topic is vague. Also we do not know whether the same teacher was these students' mathematics teacher last year, and how she taught this subject last year. In that context, revising the topic from the previous year, and explaining which new concepts students will learn would be useful for both the teacher and the students. (Derya, first interview).

In the above excerpt, the experienced teacher interpreted the event by using multiple viewpoints such as the mathematics curriculum, students' current and previous

knowledge, and the teacher factor. In addition, she related all these dimensions to the importance of reviewing students' previous knowledge at the beginning of the lesson. Shortly, she analyzed the event by giving rich explanations. However, a pre service teacher declared the event that occurred in 7th grade classroom only by focusing on students' learning styles.

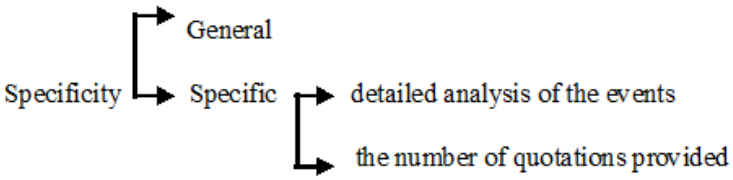
> The teacher showed what students would do by modelling the unit cubes. She did not only draw the solid on the board or say the appearance verbally. Instead, she used models to show them concretely, and verbalized what she did. In a classroom, not every student could understand what teachers said or showed. When necessary, using both words and visual materials helps students with distinct styles of learning (Enis, first interview).

This quotation indicates that the inexperienced teacher focused on one dimension of the event which was types of learners. Moreover, the teacher did not provide a detailed analysis of the event. Instead, he gave a general description, and related this specific event to learning and teaching disciplines.

Teachers' Noticing in terms of Specificity

Quantitative results on specific comments of participant teachers showed that all teachers' comments were both general and specific, and they did not significantly differ from each other. However, when specific comments were investigated further, differences were identified between teachers with varying years of experience in terms of how detailed and fluent their analysis of an event was (See Figure 4).

Figure 4. Issues of Specificity Category



An inexperienced teacher mentioned how the teacher in the 5th grade classroom taught division to students as:

> The teacher wrote a division example on the board. She asked why questions to the students. For example, she asked how many 8 there were in 472 and why they thought so. That is, she was always asking inquiry questions and guiding students to think about the question (Özlem, second interview).

In this excerpt, the pre service teacher noticed a specific sentence while commenting on the event. She emphasized the importance of asking why questions which required reasoning. But, she did not provide any other specific explanation. Compared to inexperienced teachers, less experienced teachers reflected on the event they noticed in a more detailed and specific way. A less experienced teacher focused on the same event and provided more quotations in the below excerpt.

> The teacher usually used why questions. For example, she wanted students to think of the reason of division when how many 8 there were in 472 was asked. In addition, while showing how to divide 472 by 8 she explained the division by making comparison to addition, subtraction and multiplication operations. She said that they start from units in making addition, subtraction and multiplication operations. However, in division they should start from the left side of the divisor given. This comparison was good for me because I did not use this while teaching (Nermin, second interview).

In this case, this teacher used more than one sentence to describe the event. The why questions were once again stated by this teacher. But she also described the event specifically by giving extra quotations. She added that comparing division to other operations was striking for her since she did not use this technique in her own lessons. While giving detailed and rich explanations in her comments, she not only stated more specific comments but also made a reflection about herself. Both pre

service and less experienced teachers used specific explanations of what teacher did or say in their comments. They focused on teachers' pedagogical methods and whether or not they were useful for teaching. Unlike inexperienced and less experienced teachers, experienced teachers' comments included the details of what students did or said and those details were used to inform their analyses. The quotation from an experienced teacher (Emine, second interview, p. 61) indicated how this experienced teacher grounded her comments in the specifics of the event. Her comment indicated that she focused on an event which took a short time. This event included one question and its answer. She provided two quotations one of which was a student's question, and she examined the student's understanding in detail. She added that the reason for asking the teacher why she put zero pointed out that he did not understand what adding a zero meant. She also predicted what that student would do in the future when he encountered a similar question. In short, the experienced teacher here used details she noticed to inform her analyses.

In conclusion, experienced teachers differed from inexperienced and less experienced teachers in the extent of their comments. Experienced teachers focused more on students and their mathematical thinking processes, and suggested strategies to develop students' mathematical thinking. While analyzing the incidents they noticed, they also used their experiences in teaching and their knowledge of middle school mathematics curriculum. They used their experience to inform their analyses and interpreted the event with its specifics from multiple perspectives. On the other hand, inexperienced and less experienced teachers were generally similar in what they noticed and how they analyzed it. They focused on students and teachers at the same time, and suggested general strategies to develop students' mathematical thinking. Due to lack of enough experience in teaching, they, especially pre service

teachers, used their existing knowledge on teaching and had limited viewpoints while analyzing the event.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

The results presented in the findings section suggest that teachers with varying years of experience differed in terms of noticing classroom incidents. Evidence of differences in noticing strengthens the argument that teachers with different years of teaching experience attend to different features of classroom videos. Moreover, teachers showed quantitative and qualitative differences in how they analyzed events that stood out for them. Throughout this section discussion is held around four main findings according to Learning to Notice Framework. In addition, limitations of study and recommendations for further research are discussed

The present study differs from previous studies that implemented learning to notice training which aimed to develop teachers' noticing skills. There were two main goals in this study. The first goal was to examine whether mathematics teachers with varying years of teaching experience differed in their noticing. The second one was to analyze the similarities and differences between these teachers from both quantitative and qualitative aspects. The findings of this study were generally in parallel to the previous studies mentioned. Experienced teachers in the present study differed from inexperienced and less experienced teachers in terms of noticing events. There were similar findings for experienced teachers in this study and teachers who received training in previous studies. One explanation of this finding

could be that four of the experienced participant teachers had Master's degree and one of them had PhD degree in teaching. They had taken various types of advanced teaching courses in related graduate programs. Therefore, their way of noticing and reflection skills on an event may be somewhat similar to teachers who took a training on noticing.

Firstly, one of the differences observed was the main actor of the identified event. When years of experience in mathematics teaching increased, the teacher's focus tended to be more on the students in the video rather than the teacher. This difference in focus may indicate a successful implementation of the new mathematics curriculum by the experienced teacher, which places students in the center of an instructional environment (NCTM, 2000; TTKB, 2006; TTKB, 2013). This finding is also parallel to the findings from the literature (Sabers, Cushing & Berliner, 1991; Sherin & Han, 2004; Sherin & van Es, 2005; van Es and Sherin, 2008). According to related literature, expert teachers primarily noticed issues about the students, and gave more attention to students rather than focusing on teachers.

In this study participant teachers commented on two key points related to the actor category: classroom practices of students and classroom atmosphere. Qualitative findings indicated that whereas experienced teachers focused more on classroom practices of students, inexperienced and less experienced ones generally mentioned classroom atmosphere. Data analysis on students as the main actor of the event indicated that inexperienced and less experienced teachers focused on the instructional strategy, and delivery of information by the teachers in the video. Relating students' understanding to the way of delivering the lesson indicated that there was a shift in the focus from student understanding to teaching practices. On the other hand, experienced teachers in the study emphasized students' thinking and

understanding. Relevant literature points out that expert teachers focused mainly on student learning and understanding of a concept, and they rarely mentioned classroom management issues compared to novices. However, novice teachers were more interested in their own effectiveness as a teacher such as the use of chalkboard, examples and questions (Hogan, Rabinowitz & Craven, 2003). Previous studies also pointed out that while participant teachers focused on climate of the classroom before learning to notice training, they started to notice mathematical thinking of students (van Es & Sherin, 2008; Sherin & van Es, 2009).

Findings about the classroom practices revealed that all teacher groups similarly commented on how students learn. They discussed that students were active learners who took initiative for their own learning and could construct their own knowledge with sufficient teacher guidance. This point of view about teaching and learning adopted by all teachers may arise from graduating from the same department at the same university. Although they had not taken exactly the same courses offered by the same faculty, the vision of the undergraduate program in teaching mathematics is to educate prospective teachers who are able to adapt to new approaches in mathematics curriculum. Therefore, the reason may be that regardless of teaching experience, the participant teachers embraced changes in the roles of teacher and students.

Another finding on the actor category indicated that teachers in the video were the most frequently noticed actor by all teacher groups. Even though experienced teachers noticed teachers less than pre-service and less experienced teachers, all teacher groups predominantly identified teachers as the main actor, and the pedagogy that the videotaped teachers used within all incidents they noticed. The findings of relevant research confirmed this finding since teachers in this study did

not participate in any training program to develop their noticing skills, their focus was still on the teachers (Jacobs, Lamp, & Philipp, 2010; van Es & Sherin, 2008; Sherin & van Es, 2009). Related literature asserted that attending to students' thinking and making sense of their thinking, rather than focusing on teachers and their instructional strategies, is a key component of teaching expertise. However, years of experience teachers had alone are not enough to acquire this expertise (Sherin, Jacobs, & Philipp, 2011). Therefore, it can be concluded that participant teachers still need professional development to develop their ability to notice students and what they think.

Secondly, the data analysis of the topics the participants attended to revealed that the experienced teachers were more inclined to attend to mathematical thinking of students compared to the inexperienced and the less experienced teachers. On the other hand, the pre-service and the less experienced teachers focused more on classroom management issues. Previous studies support these findings, since beginning teachers devote more overt time to issues of classroom management and as teachers develop, they become more proficient at implementing mathematical activities, and attending to students' mathematical thinking (Hogan, Rabinowitz & Craven 2003; Schoenfeld, 2011; van Es & Sherin, 2008; Jacobs, Lamb & Philipp, 2010). It was suggested that successful teaching referred to perceiving student behavior and the meaning of that behavior in terms of student understanding and thinking (Miller, 2011). As evident in the literature, attending to and making sense of what students think help teachers to create an effective instructional environment.

Findings of the study indicated that the experienced teachers emphasized mathematically important details of children's strategies such as how children make division and mathematical questions they asked in the lesson. Moreover, the

participant teachers based their decision on what they have learned about the children's understandings and suggested what might be done for the students so that they could conceptualize the subject. On the contrary, the inexperienced teachers generally proposed superficial alternatives for improving students' thinking. These findings are parallel to previous studies such as the work of Jacobs, Lamb and Philipp (2010). Jacobs and his colleagues found that teaching experience and professional development supported attending to and interpreting students' mathematical thinking, and deciding how to respond in an instructional environment.

Another finding revealed that there was a striking difference between the experienced teachers, and the inexperienced and the less experienced teachers in terms of how they analyzed an incident. While the comments of the experienced teachers were more interpretive, the comments of the less experienced and pre-service teachers were based on evaluation of the observed teachers and the lesson. Previous studies confirmed this finding that pre-service teachers were not keen observers of the lesson and made fewer interpretive comments (Erickson, 2011; Star, Lynch & Perova, 2011). In addition, findings also indicated that pre-service teachers benefited from theoretical perspectives they acquired in their college teacher education program and their internship experiences while making interpretations. On the other hand, interpretations of experienced teachers were based on their own experiences, an elaborated observation of the instructional setting, and the specific objectives of mathematics curriculum. In addition to how they grounded their noticing, the experienced teachers analyzed the incidents from multiple perspectives and presented a rich explanation of the events they noticed. Experienced teachers used their knowledge of classrooms and made multiple hypotheses and interpretations of what they saw (Santagata, 2011). On the contrary, pre-service and

less experienced teachers provided interpretations which included a small number of educational perspectives. According to the literature, expert teachers understand, monitor and interpret multiple events in more detail and with more insight than novice teachers (Sabers, Cushing & Berliner, 1991). When all the findings related to how the teachers analyzed incidents are taken into account, it can be asserted that the reason why experienced teachers made more and richer interpretations of what they saw in the video may stem from years of teaching experience as well as the graduate program they attend at the university. The experienced teachers were more academically oriented and provided multiple perspectives while analyzing an issue. Since interpretation includes making sense of incidents from educational perspective, graduate education and years of experience might contribute to the experienced teachers' interpretations.

There was no significant difference between the teacher groups in terms of how specific they were throughout their comments. This finding is not in line with the literature which asserts that comments of the expert teachers about the noticed incidents were more specific than comments of the novice teachers (Sabers, Cushing & Berliner, 1991). The reason of this contradictory finding may arise from the education all the participants received in college. The prospective teachers at the university are expected to write learning logs which includes detailed analyses of specific classroom events at their internship schools. Moreover, they are supposed to prepare reports and assignments which require specific and reasonable justifications. Therefore, it may be reasonable that teachers groups did not differ in how specific they were through their comments. Even though there was not a statistical difference between the teachers with varying experience in terms of how specific they were, they differed on the extent of specificity. While analyzing an event, the

inexperienced teachers referred to scant quotations that the students or the teacher used. However, the experienced teachers analyzed incidents providing much more detail and longer quotations. It can be concluded that the experienced teachers are better observers of the classroom and portrayed the context of the lesson in more detail. This conclusion is parallel to the findings of Star, Lynch & Perova (2011) which stated that the pre-service teachers were not astute observers of mathematics lessons and less capable of distinguishing important events from negligible ones.

Limitations and Suggestions for Further Research

The present study has three main limitations. The first limitation is about generalizability which includes the extent to which findings can be generalized to other settings. There were 5 participant teachers in each experience group and data collected from participants were composed of 30 interviews. If there were more participants, findings could have been substantiated in more varied data. However, in qualitative studies, the issue of generalizability is not of major importance (Creswell, 2003). Qualitative studies aim at providing rich descriptions of the context and making sense of what is happening in a particular context. Therefore, in this study methodology and findings sections provided detailed and rich descriptions of the setting. Further studies would be needed in order to make claims about generalizability of findings of this study.

The second limitation is about selection of the experienced participants. The participants were purposefully selected from graduates of the same university. In order to examine noticing differences among them, the participants were selected according to their level of teaching experience. However, besides years of

experience, all of the experienced teachers had completed graduate programs, whereas only one of the less experienced teachers was attending a graduate program. Therefore, not only the teachers' years of experience but also their education at graduate programs could cause a difference regarding what teachers noticed and how they analyzed what they noticed. For further studies, potential links between teachers' academic backgrounds and their noticing could provide a fruitful line of inquiry in order to make better sense of teacher noticing.

Thirdly, the present study included teachers who volunteered to participate, which can be an indication of being academically oriented. Since the participant teachers selected themselves into the research sample, self-selection bias might arise.

In sum, the findings of this study indicate that there are differences between teachers with varying years of teaching experience in terms of what they notice and how they analyze noticed incidents. In order to reduce the gap between noticing of teachers with varying experience levels, teacher educators might give opportunities to prospective teachers to make more observations and interpretation about the events they noticed in their internship classrooms. As Sherin and van Es (2005) have indicated, improving the ability to notice should be an explicit focus of initial teacher preparation courses where environment that help teachers develop their ability to notice can be created. Further studies might develop and use new issues emerged in this study under the main categories of learning to notice framework proposed by van Es and Sherin (2008), and provide insights to teacher educators to develop prospective teachers' noticing skills.

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