MATHEMATICS TEACHER IDENTITY DEVELOPMENT OF EARLY CAREER MIDDLE GRADE MATHEMATICS TEACHERS AND THE ROLE OF PARTICIPATED COMMUNITIES

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

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ABSTRACT

MATHEMATICS TEACHER IDENTITY DEVELOPMENT OF EARLY CAREER MIDDLE GRADE MATHEMATICS TEACHERS AND THE ROLE OF PARTICIPATED COMMUNITIES

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This study aimed to explore early career mathematics teachers' mathematics teacher identity development phenomena. Two rounds of interviews were conducted with 11 early career middle school mathematics teachers in order to explore their perceived mathematics teacher identities and the influential factors on the development of their mathematics teacher identities. Furthermore, the coherence between early career middle school mathematics teachers' perceived and actualized mathematics teacher identities, and the effects of working communities in different characteristics on early career mathematics teachers' mathematics teacher identities were investigated. Accordingly, 2 teachers were observed for 10 weeks in their working communities and 3rd round of interview was conducted.

Two types of perceived mathematics teacher identities were explored: Traditional-Practice Mathematics Teacher Identity and Hybrid-Practice Mathematics Teacher Identity. There were 6 influential factors on the development of perceived mathematics

teacher identities: Personal Characteristics, Others' Teacher Identities, Teacher Education Community, Working Community, Discipline, and Educational Policy.

There was a consistency to a considerable extent among the perceived and actualized mathematics teacher identities of two observed teachers. The analysis also revealed the complicated effects of working communities on the observed teachers. The observed teachers were affected negatively from some unsupportive working conditions and positively from some supportive working conditions. Furthermore, one of the teachers resisted to some negative conditions in her working community whereas the other teacher could not benefit from some positive conditions in his working community. It was concluded that the effects of the working communities are mediated through the teachers' existing mathematics teacher identities.

Keywords: Perceived Mathematics Teacher Identity, Actualized Mathematics Teacher Identity, Early Career Teachers, Participated Communities

ÖZ

KARİYERİNİN BAŞLANGICINDAKİ ORTAOKUL MATEMATİK ÖĞRETMENLERİNİN MATEMATİK ÖĞRETMEN KİMLİĞİ GELİŞİMİ VE İÇİNDE BULUNDUKLARI ÇALIŞMA TOPLULUKLARININ ROLÜ

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Bu çalışma, kariyerinin başlangıcındaki matematik öğretmenlerinin matematik öğretmen kimliği gelişimi olgusunu araştırmayı amaçlamaktadır. Algılanan matematik öğretmen kimliği ve bu kimliğin gelişiminde etkili olan faktörleri belirleyebilmek adına kariyerinin başlangıcındaki 11 ortaokul matematik öğretmeni ile 2 görüşme yapılmıştır. Ayrıca algılanan ve uygulanan matematik öğretmen kimlikleri arasındaki tutarlılık/tutarsızlıkları belirleyebilmek ve içerisinde görev yapılan çalışma topluluklarının matematik öğretmen kimliği gelişim sürecindeki etkilerini anlayabilmek adına, 2 matematik öğretmeni çalışma topluluklarında 10 hafta boyunca gözlenmiş ve kendileri ile 3. görüşme gerçekleştirilmiştir.

Çalışmaya katılan öğretmenler için iki algılanan matematik öğretmen kimliği tipi belirlenmiştir: Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği ve Karma Yönteme Sahip Matematik Öğretmen Kimliği. Ayrıca, katılımcı öğretmenlerin algılanan matematik öğretmen kimliklerinin gelişiminde etkili olan 6 faktör belirlenmiştir: Kişisel

özellikler, Başkalarının öğretmenlerin kimlikleri, Öğretmen eğitim topluluğu, Çalışma topluluğu, Branş ve Eğitim Politikaları.

Çalışma topluluklarında gözlemlenen iki matematik öğretmeninin algılanan ve uygulanan matematik öğretmen kimlikleri arasında tutarlılık olduğu sonucuna varılmıştır. Ayrıca, yapılan gözlemler ve görüşmeler neticesinde çalışma topluluklarındaki bazı olumlu şartların katılımcı öğretmenleri olumlu yönde, bazı olumsuz şartların ise katılımcı öğretmenlerin matematik öğretmen kimliği gelişimini olumsuz yönde etkilediği görülmüştür. Öte yandan, gözlenen öğretmenlerden birinin çalışma topluluğundaki bazı olumsuz durumları olumluya çevirmesi ve diğer öğretmenin de çalışma topluluğundaki bazı olumlu durumlardan faydalan(a)madığının görülmesi çalışma topluluklarının etkilerinin, öğretmenlerin var olan öğretmen kimliklerinden etkilendiği gerçeğini de göz önüne sermiştir. Bu nedenle, çalışma toplulukların, öğretmenlerin matematik öğretmen kimliği gelişimi sürecinde karmaşık etkileri olduğu sonucuna varılmıştır.

Anahtar Kelimeler: Algılanan Matematik Öğretmen Kimliği, Uygulanan Matematik Öğretmen Kimliği, Kariyerinin Başlangıcındaki Öğretmenler, Çalışma Toplulukları

To my wife, Münevver Arslan

For her love, patience, and understanding

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CHAPTER 1

INTRODUCTION

Teacher identity emerged as a research topic in the education literature in late 1980s (Beijaard, Meijer, & Verloop, 2004), and there is a growing attention on this topic in the recent years (Darragh, 2016; Merseth, Sommer, & Dickstein, 2008). This interest is led by the assumption that there is a link between one's identity and actions (Wenger, 1998). Therefore, it is generally accepted in the literature that a teacher's actions are mediated through his/her teacher identity (Chong, Low, & Goh, 2011; van Putten, Stols, & Howie, 2014). Teachers who have developed a strong teacher identity have better knowledge of content, pedagogy and professional participation (Van Zoest & Bohl, 2005) and make better educational decisions benefitting from their knowledge (Battey & Franke, 2008). Furthermore, they become more confident in their decisions (Graven, 2004) and they enjoy teaching (Ruohotie-Lyhty, 2013). On the other hand, teachers who could not develop strong teacher identity feel a failure when they are confronted with difficulties in teaching communities (Ruohotie-Lyhty, 2013) and become less confident in their education-related acts and decisions (Graven, 2004). Teachers who have such feelings might even quit the teaching profession (Alsup, 2006; Pillen, Beijaard, & Brok, 2013). In brief, teachers who develop strong teacher identity learn to become effective teachers (Flores & Day, 2006; Friesen & Besley, 2013; Gellert, Espinoza, & Barbe, 2013). Moreover, they become more open to new learnings based on the reciprocal relationship between identity and learning (Graven, 2004; Hodges & Cady, 2012; Wenger, 1998).

The present study explores mathematics teacher identity of early career mathematics teachers. Although there is an agreement on the significance of developed teacher identities for teachers, there is not a consensus on the terminology used in teacher identity-related research. Therefore, the next section is dedicated to explaining the teacher identity-

related constructs—identity, teacher identity, mathematics teacher identity, reform-oriented teacher identity—used in this study to guide the readers to the purpose of the current study more clearly.

1.1. Identity, Teacher Identity, and Mathematics Teacher Identity

In Wenger's (1998) Social Theory of Learning, identity was defined as "*not just an accumulation of skills and information, but a process of becoming—to become a certain person or, conversely, to avoid becoming a certain person*" (p. 215). Wenger (1998) interprets identity, not as a synonym for personality or trait that is brought genetically; rather, he interprets identity as a process of constant becoming in which a person actively engages in practices in the different community of practices. He claims that we get meanings from these participations and engagements, and these meanings help us to shape and transform who we are.

In educational literature, there are different definitions of teacher identity and some studies do not even define what teacher identity is (Beijard, Meijer, & Verloop, 2004). Among them, Chong, Low and Goh (2010) defined teacher identity as "*both a product, a result of influences on the teacher, as well as a process that is not fixed but an ongoing dynamic interaction within teacher development*" (p. 51). Sfard and Prusak (2005) defined teacher identity as "*collections of stories about persons or, more specifically, as those narratives about individuals that are reifying, endorsable, and significant*" (p. 16). Duru (2006) considered teacher identity as how individuals "*make sense of themselves as teachers*" (p. 122). Apart from these definitions, teacher identity was described as responses to the questions of "*Who am I at this moment?*" and "*Who do I want to become?*" (Beijard, Meijer, & Verloop, 2004). Van Zoest and Bohl (2005) described teacher identity as a cache of capacity and understanding that includes knowledge, beliefs, commitments, and intentions a teacher holds and carries from one context to another. As these definitions and descriptions address, teacher identity briefly refers to an ongoing process in teacher development and describing who a teacher is.

Beijaard and his colleagues (2004) investigated the studies related to teacher identity and documented the common features of teacher identity in order to have a better insight into this concept. In their extensive literature review, four common characteristics of teacher identity emerged: (i) being an ongoing process of interpretation and re-interpretation of experiences, (ii) having both personal and contextual components, (iii) consisting of a harmony of several sub-identities, and (iv) being affected by agency and thus requiring being active as a person in the development process. Teacher identity development is an ongoing process which indicates that the formation of teacher identity is not stable (Duru, 2006). It is a lifelong dynamic process and it is affected by multiple experiences (Bjuland, Cestari, & Borgersen, 2012). Another feature of teacher identity is that it is shaped and reshaped by the experiences obtained from interactions with other people in various *contexts* (Chong et al., 2011; Van Zoest & Bohl, 2005). These contexts might be teachers' social contexts, teacher education contexts, and workplace contexts (Duru, 2006; Van Zoest & Bohl, 2005). Being in different contexts enables teachers to construct sub-identities which are linked to each other and sometimes conflict with each other (Kaasila, Hannula, & Laine, 2012). As a last common feature of teacher identity, it is stated that a person must be active in the development of teacher identity. In other words, individuals' acts in social communities affect their teacher identity development (Hodgen & Askew, 2007).

As for mathematics teacher identity, many researchers draw on identity definitions rather than giving a specific definition for mathematics teacher identity (e.g., Hodges & Cady, 2012; Kasten, Austin, & Jackson, 2014; Skog & Andersson, 2015). However, one's discipline is crucial in understanding one's teacher identity (Gresalfi & Cobb, 2011). Therefore, when focusing on mathematics teacher identity one needs to bear in mind that individuals' relationship to mathematics such as beliefs, knowledge, and emotions related to the mathematics discipline is in the center (van Putten, Stols, & Howie, 2014; Van Zoest & Bohl, 2005).

In line with these descriptions, mathematics teacher identity will be used in this study as a term to describe mathematics teachers including their beliefs, commitments, intentions, and knowledge related to the mathematics teaching profession which is constructed both individually and socially. Therefore, the definition of mathematics teacher identity used in this study is not very different from the definitions in the literature; rather it is an inclusive term to understand who a teacher is. Mathematics teacher identity in the current study has two subsets: *Perceived mathematics teacher identity* and *actualized mathematics teacher identity*. Perceived mathematics teacher identity refers to the perceptions of teachers about themselves and actualized mathematics teacher identity refers to the actualization of a teachers' mathematics teacher identity in a classroom setting (van Putten, Stols, & Howie, 2014). These two subsets are not necessarily consistent. For instance, a teacher might interpret him/herself as a reform-oriented mathematics teacher, but his/her classroom practices might show an opposite teacher identity (see van Putten, Stols, & Howie, 2014).

1.2. Reform-Oriented Teacher Identity

Teacher identity development process starts with the years as a student and continues lifelong (Flores & Day, 2006). Teachers have some kind of teacher identity, but developed teacher identity might not necessarily be in line with the purposes of teacher education programs or teacher education policies of the country. Therefore, researchers use different terms when describing the intended type of teacher identity. Researchers have preferred to use reform-oriented teacher identity (Hodges & Cady, 2012; Van Zoest & Bohl, 2005); good, satisfying teacher identity (Alsup, 2006; van Putten, Stols, & Howie, 2014); strong teacher identity (Beltman, Glass, & et. al., 2015; Ruohotie-Lyhty, 2013); and successful teacher identity (Anspal, Eisenschmidt, & Löfström, 2012). Although the terminology differs, the underlying meaning of these terms addresses the identity aimed by the teacher education programs and policy.

In the current study, reform-oriented mathematics teacher identity is used to describe teachers who have competencies and practices consistent with rather constructivist national educational policy. The Turkish national education policy states the importance of students' meaningful learning rather than rote learning in mathematics (MONE, 2013; 2018). In the national context, mathematics teachers are expected to be able to plan, organize and conduct mathematics lessons which enable students to develop problem-solving and reasoning skills for meaningful learning in mathematics lessons; to create positive class environment; to have a good content, pedagogical and pedagogical content knowledge; and to be open to the professional development during their teaching career (MONE, 2013; 2017). Therefore, reform-oriented teacher identity in the current study refers to the identity of teachers who have been improving themselves in line with these competencies.

1.3. Teacher Identity Development Process

In the identity development process, we participate in different communities and gain experiences from these participations (Wenger, 1998). We build meanings from these experiences, and thus we learn and (re)shape our identities (Wenger, 1998). In terms of teacher identity, participation in communities is mainly divided into three time periods in the literature: Studentship period, teacher education period, and in-service period (Beauchamp & Thomas, 2009; Chong et al., 2011; Flores & Day, 2006; Trent, 2011; Yuan & Lee, 2014).

In the studentship period, students begin to observe their teachers and meet with the teaching profession. In this time period, they develop a philosophy on the desired and undesired teacher behaviors and they develop an attitude towards teaching profession (Alsup, 2006; Chong et al., 2010; Flores & Day, 2006). Teachers and teacher candidates commonly refer to their former teachers to explain their own teaching behaviors and philosophy, which is an indication of the effect of studentship experiences on teacher

identity development process (Arslan & Haser, 2016; Beltman et al., 2015; Flores & Day, 2006).

Teacher identity development process continues in teacher education period, rather in a more professional way than the studentship period. In this time period, teacher candidates participate in a different community, the teacher education program, and they gain knowledge and develop beliefs and intentions about different components of teaching and teaching profession (Van Zoest & Bohl, 2005). It is difficult to claim that teacher education communities have similar effects on preservice teachers' teacher identities. Although some preservice teachers graduate from teacher education programs with their existing beliefs about the profession and themselves which were developed before their teacher education training (Flores & Day, 2006), some preservice teachers shape their teacher identities mainly based on the experiences in teacher education programs (Brown & McNamara, 2011). Related studies showed that teaching practice periods have a vital role in preservice teachers' teacher identity shaping process in the teacher education programs (Anspal et al., 2012; Brown & McNamara, 2011; Cooper & He, 2012; Merseth et al., 2008). There are also studies which show the effect of other courses on teacher identity development of preservice teachers. For instance, Kaasila, Hannula, and Laine (2012) demonstrated how a mathematics education course contributed to elementary preservice teachers' teacher identities, and similarly, the study of Trent (2012) exemplified how a research course in teacher education program positively affected preservice teachers' teacher identities.

In line with the findings of these studies, teacher education programs could be interpreted as a community which has the potential to shape preservice teachers' teacher identities. Furthermore, courses in these programs could be interpreted as individual communities and they might also affect preservice teachers' teacher identities. However, when interpreting this potential effect, it is beneficial to bear in mind that the same teacher education program might result in different outcomes in terms of preservice teachers' teacher identities (Antonek, McCormick, & Donato, 1997).

During the in-service period, teachers participate in many communities such as classroom, school, district, and professional development communities (Flores & Day, 2006; Hodges & Cady, 2012; Van Zoest & Bohl, 2005), all of which might be formally or informally structured (Lai, Li, & Gong, 2016). Contextual factors might promote or hinder the teacher identity development process (Beauchamp & Thomas, 2009). Therefore, in some cases, teachers' experiences in such communities support teachers to develop a teacher identity in a more reform-oriented way (Chen & Wang, 2014; Hodges & Cady, 2012) whereas in some cases, these experiences hinder teachers to develop reform-oriented teacher identities and lead them to develop more traditional teacher identities (Flores & Day, 2006).

Researchers put special emphasis on the effect of early years in the teaching identity development process since these years are accepted as the period of transition from student to teacher. It is commonly mentioned in the literature that early career teachers face many challenges (Alsup, 2006; Pillen et al., 2013; Ruohotie-Lyhty, 2013). These teachers have difficulties to decide on how to treat students, how to approach teaching, and how to respond to colleagues' and school administrators' expectations from them (Flores & Day, 2006; Pillen et al., 2013). Developing strategies and solutions to overcome such difficulties support early career teachers' teacher identity development (Akkerman & Meijer, 2011; Alsup, 2006; Pillen et al., 2013). The characteristics of the participated communities are crucial in this process (Hodges & Cady, 2012; Ruohotie-Lyhty, 2013). Supportive working communities help early career teachers in taking up the challenges they faced, whereas unsupportive working communities leave them alone in this process which negatively affects their teacher identity development (Gresalfi & Cobb, 2011; Mansfield, Beltman, & Price, 2014; Ruohotie-Lyhty, 2013). Therefore, early career teachers' teacher identities deserve attention to be investigated in order to support their development of teacher identities (Beauchamp & Thomas, 2009; Flores & Day, 2006).

In summary, teacher identity development could be interpreted as a long process in which many influential factors play a role. Since it is not possible to monitor all the teacher

identity development process, focusing on specific time periods would make more sense in related studies (Van Zoest & Bohl, 2005). There is a lack of sufficient research on the early career teachers' teacher identities and how their identities can be supported in the related literature (Chong et al., 2011). Therefore, I decided to focus on the early years in the profession in the current study.

1.4. Purpose and Research Questions

In the teacher identity development process, early years in the profession are described as the crucial phase. The transition from being a student to being a teacher requires to reshape identity and this process might be highly challenging for many early career teachers (Flores & Day, 2006; Pillen et al., 2013). Therefore, I aim to give voice to early career middle school mathematics teachers in order to explore their mathematics teacher identities. In so doing, I aim to explore the discrepancies and consistencies between the intended profile for mathematics teachers in the national context (see MONE, 2017; 2018) and the perceived mathematics teacher identities early career teachers developed in the profession.

Furthermore, I seek to gain an understanding of how they develop their teacher identities and what the influential factors in this mathematics teacher identity development process are. I believe that exploring influential factors in the mathematics teacher identity development process is necessary to support the early career mathematics teachers in order to develop reform-oriented teacher identities.

In line with these purposes, the following research questions are addressed in this study:

1. What are the perceived mathematics teacher identities of early career middle school mathematics teachers?
2. What are the factors that influence early career middle school mathematics teachers' perceived mathematics teacher identities?

These two questions are addressed through participants' responses to interview questions. Therefore, these questions are related to early career middle school mathematics teachers' perceptions of themselves and researcher's perception of the participants based on what they expressed in the interviews. However, when the focus is on teacher identity, perceptions might not necessarily represent the reality in the class (van Putten, Stols, & Howie, 2014). There might be differences between how teachers see themselves and how they actually are in the classrooms. Hence, in this study, two early career middle school mathematics teachers are also observed in their mathematics classes and working communities in order to have a deeper understanding of their teacher identities. This allowed me to see the consistency between their perceptions and their actions as mathematics teachers which have led to the third research question:

> 3. To what extent is there a consistency between two early career middle school mathematics teachers' perceived and actualized mathematics teacher identities?

In selecting two participants for the observations, their working communities are taken into consideration. Different schools might hold different expectations for their teachers and thus, the characteristics of schools might be highly effective on the teacher identity development process of especially early career teachers (Hodges & Cady, 2012). Supportive working communities might promote the teacher identity development process and unsupportive communities might hinder this process (Beauchamp & Thomas, 2009; Flores & Day, 2006). Therefore, when selecting the two participants to be observed, I selected one participant from a relatively supportive working community whereas the other from a relatively unsupportive working community. By doing so, I aimed to investigate the potential influence of different working communities on early career middle school mathematics teachers' mathematics teacher identity development. The related research question is as follows:

> 4. How do working communities with different characteristics affect early career middle school mathematics teachers' mathematics teacher identity development process?

1.5. Definition of Important Terms

In order to have a better understanding of the research purpose and research questions of the current study, defining important terms would be beneficial. *Identity* is defined as "*the characteristics determining who or what a person or thing is*" (Oxford Dictionaries, 2017). Wenger (1988) described how one builds identity by stating that "*building an identity consists of negotiating the meanings of our experience of membership in social communities*" (p. 145). For the term of *mathematics teacher identity*, I adopted the term explained in Mathematics Teacher Identity Framework by Van Zoest and Bohl (2005) and used it to describe a mathematics teacher including his/her knowledge, beliefs, commitments and intentions regarding mathematics and mathematics teaching. In line with this definition, I used *reform-oriented teacher identity* term to characterize teachers who developed the intended teacher identity profile in the national education policy. These teachers, who developed reform-oriented mathematics teacher identities, have knowledge, beliefs, intentions, and practices which enable students' meaningful learning in mathematics classes via students' active participation in the learning process.

In the current study, two subcategories of mathematics teacher identity are used: *Perceived mathematics teacher identity* and *actualized mathematics teacher identity*. Consistent with the other researchers' approaches (see Beijaard, Meijeer, & Verloop, 2004; van Putten, Stols, & Howie, 2014), both participants' perceptions about themselves and the researchers perceptions about the participants based on what they told in the interviews are used to describe *perceived mathematics teacher identity* in the current study. Therefore, perception is defined as two-layered construct in the current study including both participants' and researcher's perceptions. On the other hand, *actualized mathematics teacher identity* was directly related to the observable classroom events that inform the researcher about the mathematics teacher identity of the participant.

Since identity is developed in participated *communities of practices* (CoPs), defining this term is crucial to understand teacher identity. CoP refers to a group of individuals who

come together in order to pursue a common goal through acting together (Wenger, 1998). Therefore, the school can be considered as a CoP in which all teachers and administrators come and work together in order to maximize their students' learning. Similarly, a classroom or a teacher education program could be considered as a CoP if these groups have a joint enterprise which requires to mutually engage and develop a common repertoire (Wenger, 1998). However, not all the schools or teacher education programs have joint enterprise, mutual engagement, and/or shared repertoire as described above. Therefore, I decided to use the term "*community*" instead of "CoP" to describe schools, teacher education programs, and classrooms in which teachers participate(d).

In the current study, participants were middle school mathematics teachers who were in the first few years in the profession. Different terms are used in the literature in order to describe these teachers such as novice teachers (Hodges & Cady, 2012), beginning teachers (Pillen et al., 2013), and early career teachers (Chong et al., 2011; Mansfield et al., 2014; Trent, 2011). In the current study, the term "*early career teachers*" was used to describe teachers who were in the first three years in the teaching profession, and *middle school mathematics teachers* refer to the ones who graduated from the elementary mathematics education programs in Turkey to be a mathematics teacher who teaches mathematics in 5^{th}, 6^{th}, 7^{th} and 8^{th} grade levels (HEC, 2007).

1.6. The Significance of the Study

Teacher identity is at the core of teachers' actions (Beauchamp & Thomas, 2009) and is accepted as a critical construct to become an effective teacher (Beltman et al., 2015; Flores & Day, 2006). This character of teacher identity makes it essential to explore the developed teacher identities of in-service teachers and also positive and negative factors affecting its development.

In the related literature, it is commonly accepted that teacher identity is highly affected by the communities in which teachers participated. For this effect, especially the early years

in the teaching profession seem crucial (Beltman et al., 2015; Chong et al., 2011). In these years, early career teachers work in communities with different characteristics which offer different resources and experiences to them (Hodges & Cady, 2013; Mansfield et al., 2014). Exploring how different communities affect early career teachers' teacher identities enables us to understand the kind of support early career teachers need in to develop reform-oriented mathematics teacher identities. In the teacher identity development process, early career teachers "*cannot be left alone*" (Pillen et al., 2013, p. 675). They need support and one of the essential ways to give this support seems to be understanding their communities and the effects of these communities on their teacher identities (Alsup, 2006; Hodges & Cady, 2013).

The findings of this study might provide several benefits and opportunities for the Ministry of National Education (MONE) and teacher education programs. MONE might provide opportunities for schools to create effective communities for early career teachers to support their reform-oriented teacher identity development. Teacher education programs might make use of the findings to train teacher candidates by considering potential working communities in which teacher candidates will work in near future. If teacher educators know about the different working communities and the potential effects of these communities on early career teachers, then they are able to develop more effective experiences to train them to develop reform-oriented teacher identities (Beauchamp & Thomas, 2009). When teacher candidates learn about different working communities during their training in the teacher education programs, they are likely to begin to develop strategies for these different communities (Pillen et al., 2013). This situation makes the early years in the profession as a fruitful period rather than a shocking experience (Chong et al., 2011).

Research studies on teacher identities of early career teachers are not only beneficial for the training of pre-service teachers or for the support of in-service teachers, it is also of benefit for the teachers who participated in such studies. Early career teachers usually need to talk about their teaching experiences (Alsup, 2006). This helps them to make a

reflection on their own teacher identities which might positively contributes to their teacher identity development process (Anspal et al., 2012; Beauchamp & Thomas, 2009). In other words, they become aware of what kind of teachers they are and who they want to be by participating in such research studies.

In brief, investigating the teacher identities and identity development of early career middle school mathematics teachers from different communities might be beneficial for early career teachers, teacher educators and possible support systems. Early career teachers can be supported in their teacher identity development through reflections on their teacher identities. Teacher educators can make use of the findings in their efforts to train pre-service teachers in line with the realities of teaching in different working communities. Teacher educators, teacher trainers and administrators at any level of school system can use the findings of the study to support in-service training of other early career teachers in similar working communities.

CHAPTER 2

REVIEW OF LITERATURE

The current study aims to investigate early career teachers' mathematics teacher identities and their mathematics teacher identity development. Furthermore, the role of working communities on teacher identities and the consistency between participants' perceived and actualized mathematics teacher identities are investigated. In order to ground these aims in the existing literature, I conducted a detailed literature review and this chapter is devoted to explaining this reviewing process and findings. The chapter explains: (1) how the literature review for the current study was conducted; (2) theoretical and conceptual frameworks used to investigate mathematics teacher identity in related studies; (3) findings in the related research studies on teacher identities of mathematics teachers and mathematics teacher identity development process; (4) teacher identity research in the national context; and (5) how the current study might contribute to the earlier findings in mathematics education literature.

2.1. The Procedure for Conducting the Literature Review

In order to review the literature, I benefited from three databases: EBSCOhost, ERIC, and ULAKBIM. In this review, I focused on the research studies published after 2000 since the 2000s are interpreted as the years in which identity work in mathematics education literature emerged and began to increase in the following years (Darragh, 2016). For the review, the keywords of "*identity*", "*teacher*", and "*mathematics*" were checked in titles and abstracts. This search led me to find more than a thousand research studies. However, some of the studies were found in more than one databases and thus, one of the cross-loaded articles were eliminated as the following step in the review. Then, abstracts of the remaining studies were read to decide whether the study contains the following conditions:

(i) The empirical research study investigates the teacher identity or teacher identity development process of mathematics teachers as the main or secondary research purpose; (ii) Participants of the study are in-service and/or pre-service teachers; and (iii) Participants (in-service and/or pre-service teachers) are working or trained to work in K-12 school levels which are pre-school, primary, middle, and high school levels.

Studies that did not include the above-mentioned criteria were eliminated. In other words, studies that include the following conditions were eliminated from the literature review: (i) The empirical research study investigates students' mathematical identities and mathematical identity development processes; (ii) The empirical research study investigates the teacher identities and teacher identity development process of teacher educators, teacher mentors, and teacher coaches; (iii) Mathematics teacher identity-related research study is either theoretical without empirical findings or a literature review.

Based on these inclusion and exclusion criteria, I had 72 studies to be further investigated in this part of the study. These studies were investigated in terms of their research purpose, research questions, theoretical and/or conceptual frameworks, methodologies, and main findings. In the next section, I focus on the theoretical and/or conceptual frameworks used in these studies and give more detailed explanations about the commonly used identity-related frameworks in the mathematics education literature.

2.2. Identity-Related Frameworks Used in the Literature

The concept of identity has been a focus of various disciplines such as psychology, philosophy, and anthropology (Beauchamp & Thomas, 2009). Later on, in the late of 20th century, identity began to take increasing attention in the education literature via the studies on teacher identity (Akkerman & Meijer, 2011). Consistently, research studies on identity began to increase in mathematics education literature in the 21st century (Darragh, 2016) and these studies used various theoretical and conceptual frameworks to interpret teacher identities of mathematics teachers.

In my literature review for the current study, I noticed that many studies, which are 28% of the studies in my literature review, do not explicitly mention their theoretical and/or conceptual frameworks which shape their understanding of teacher identity in their study. Among these studies, some of them conceptualize their understanding of teacher identity by benefitting but not specifically leaning on the frameworks in the literature (e.g., Kaasila, 2007). On the other hand, many other studies that are categorized under this group fail to clearly conceptualize teacher identity.

Apart from the studies that do not have specific theoretical and/or conceptual frameworks, these are the commonly used frameworks in order to investigate teacher identity in my review: Wenger's (1998) *"Social Theory of Learning"* (21%), Holland, Lachicotte, Skinner, and Cain's (1998) *"Figured Worlds"* (10%), Sfard and Prusak's (2005) *"Narrative Theory of Identity"* (8%), and Gee's (2001) *"Four Ways to View Identity"(*2%). Furthermore, 13% of the studies in my review used multiple frameworks by combining at least two frameworks (e.g., Gresalfi & Cobb, 2011), and 19% of the studies used other frameworks rather than the above-mentioned ones (e.g., Walshaw, 2010).

In order to have a better understanding of these frameworks, first, I briefly explain the above-mentioned frameworks. Then, I mention some of the frameworks that specifically aim to conceptualize mathematics teacher identity rather than teacher identity. Finally, I explain my conceptual understanding of "*mathematics teacher identity*" in the current study.

2.2.1. Social Theory of Learning

Wenger (1998) criticizes the view that learning is an individual process. He mentions that learning occurs when individuals participate in activities in the social world. This participation is not mechanically getting something done, rather participation requires

getting something done while also getting meaning from this participation (Wenger, 1998).

Figure 2.1. Components of Social Theory of Learning. Adapted from *Communities of Practice* (p. 5) by E. Wenger, 1998, Cambridge: Cambridge University Press.

The components of this learning theory are highly related to each other. Replacing learning with either of community, practice, meaning, and identity would make no difference (Wenger, 1998). As can be seen in the Figure 2.1., learning occurs in different forms which are briefly explained below.

We learn through doing: As human beings, we always have goals to pursuit ranging from physical to psychological needs (Wenger, 1998). In order to achieve these goals, we engage in the *practice*. With the help of these practices, we continuously learn what to do and how to do in order to achieve our goals.

We learn through our experiences: When engaging in a practice, we do not only do something with our body and brain, we are also in a social interaction process which is called as *negotiation of meaning* (Wenger, 1998). Through actively participating in a community, we construct interactions with the others in the community, and we get *meanings* from these interactions (Wenger, 1998). For instance, a teacher who interacts

with his/her students in the class or with his/her colleagues in teachers' room gets meanings from these interactions as an experience for him/her. This experience might affect his/her lesson plan for the next day which is a product of the gained experience.

We learn through belonging: When engaging in practice in a *community of practice (CoP),* we become a part of that CoP. In other words, we belong to that CoP. Here, there is a need to clarify what a CoP is and how it differs from a group of individuals.

In order to be considered as a CoP, a group of individuals should have *mutual engagement, joint enterprise* and *shared repertoire* (Wenger, 1998). *Mutual engagement* refers to the mutual actions of participants in the community in order to negotiate meanings with each other. Being in the same group does not necessarily require to be in interaction with the others in the group, but mutual engagement requires to be in a collective practice with interaction (Wenger, 1998). *Joint enterprise* refers to the coherence in the pursuits of the community (Wenger, 1998). We share a joint enterprise in the community which mediates our mutual engagement in that community. *Shared repertoire* refers to the resources for mutual engagement in order to keep and develop joint enterprise of the community (Wenger, 1998). In other words, these are the tools which show how to do the practice (Bohl & Van Zoest, 2003). Shared repertoire does not only involve physical tools, it includes "*...routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions or concepts*" (Wenger, 1998, p. 83). For instance, in a school CoP, a teacher who participates in a school meeting is in a *mutual engagement* with negotiating meanings with other teachers and school administrators. This meeting has a reason which is consistent with the *joint enterprise* of that CoP. This reason might be the students' poor performance in a nationwide examination and joint enterprise might be the need for improving this performance in the next examination. In order to achieve this goal, participants in that school CoP might decide to put extra lessons on weekends which is a *shared repertoire* for this CoP. However, not all the schools could be considered as a CoP since some of them do not have and/or apply these three dimensions explained above.

We learn through becoming: Belonging to a CoP and engaging in activities require transforming who we are, in other words, shape our *identity* (Wenger, 1998). Identity is not a product, rather it is a process of becoming, and it is a process of learning (Wenger, 1998). In the learning process, we experience competence in three dimensions which are *mutuality of engagement, accountability to an enterprise* and *negotiability of a repertoire* (Wenger, 1998). Dimensions of competence show similarity with the characteristics of a community which were explained previously. We become a part of the community and become who we are through *mutual engagement* in the community. In this becoming, we are aware of what is expected of us and contribute to this expectation which refers to *accountability to an enterprise.* In the mutual engagement, we recognize the history of the practice of the CoP and benefit from this repertoire in order to experience competence and this process refers to *the negotiability of repertoire* (Wenger, 1998).

In my literature review, I see that researchers benefit from Wenger's (1998) theory by using the relationship between the four components of learning. Therefore, most of the studies benefitted from this theory through investigating how a community of practice affects teachers' and/or teacher candidates' professional learning and teacher identity development. These CoPs might be intentionally designed CoPs (e.g., Cyrino, 2016; Goos & Bennison, 2008; Graven, 2004) or might be the existing CoPs which are not specifically designed for the professional development of teachers and/or teacher candidates (e.g., Brown & Redmond, 2015; Smith, 2006). The common finding among these studies is the potential effect of the participated CoPs on participants' learning and identity development and this supports Wenger's (1998) emphasis on the social-contextual side of identity development.

2.2.2. Figured Worlds

Holland and her colleagues (1998) claim that identity development occurs in figured worlds that a person participates. From their perspective, a figured world is "…*socially and culturally constructed realm of interpretation in which particular characters and*

actors are recognized, significance is assigned to certain acts, and particular outcomes are valued over others" (Holland et al., 1998, p. 52). They specifically refer to the socio-cultural nature of figured worlds and thus, identity. In order to have a better understanding of the socio-cultural aspect of figured worlds, they give an example from the work of Skinner (1990) in which Naudada's (a Hindu Community) women are the focus. In Skinner's (1990) study, it was seen that there are some characteristics attributed to women who live in Naudada: Devoting oneself for their husbands, having sons because of the patrilineal nature of the society, mediating the activities of their daughters in law after their sons' marriage. Holland and her colleagues interpret that community as a figured world that is socially and culturally developed. They indicate that the identities and behaviors of women in Naudada are developed through their participation in this figured world. Similarly, institutional communities might also be considered as figured worlds since certain acts, dressings, and discourses are appreciated over some others.

In figured worlds, power issues and artifacts play a crucial role (Holland et al., 1998). In terms of power and privilege, Holland and her colleagues stress that some sort of hierarchy is developed in figured worlds and thus, respectively different positions of status are gained. Based on this status, one's influence in the figured world might be different than another person in the same figured world. Titles in the academic world or in a company might be a sign of the status in a particular figured world. Furthermore, Holland and her colleagues indicate that actions in the figured world are mediated through the artifacts developed in that figured world and the same artifact might be differently interpreted in different figured worlds. Artifacts could be considered as a tool for the actions in the figured world but should also be considered as a tool for the continuity of the figured world because of the meaning associated with it. However, it is beneficial to bear in mind that reifications are not free from changes, they continually change—are improved—in the figured worlds based on the participants' interactions in the figured worlds (Holland et al., 1998).

Holland and her colleagues consider identity from a socio-cultural perspective as Wenger (1998) and previously, Lave and Wenger (1991) did. This similarity on the perspective for the identity development is already mentioned in their book. By referring to the work of Lave and Wenger (1991), they indicate that: "*Identities become important outcomes of participation in communities of practice in ways analogous to our notion that identities are formed in the process of participating in activities organized by figured worlds*" (Holland et al., 1998, p. 57). Therefore, we can claim that mathematics education researchers who benefit from Holland et al.'s (1998) figured world theory consider teacher identity development as highly influenced by social participation in various figured worlds. The effects of such figured worlds (e.g., professional development programs, internship period in the teacher education program, projects) on mathematics teacher identity are exemplified in several studies (e.g., Graue et al., 2015; Horn, Nolen, Ward, & Campbell, 2008; Wager & Foote, 2013).

2.2.3. Narrative Theory of Identity

"*Identities may be defined as collections of stories about persons or, more specifically, as those narratives about individuals that are reifying, endorsable, and significant*" (Sfard & Prusak, 2005, p. 16). From Sfard and Prusak's perspective, narratives are not reflections of identities, rather these reflections are identities themselves (Darragh, 2016). To decide on what could be interpreted as "*reifying, endorsable and significant*", Sfard and Prusak (2005) indicate that "*verbs such as be, have, or can rather than do, and with the some adverbs always, never, usually, and so forth*" could be interpreted as indication of *reifying* stories; faithful conceding of the storyteller that the story represents herself/himself could be considered as an indication of *endorsable* stories; and if any change in the story would affect the storyteller's identification of herself/himself, it indicates that story is *significant* (p. 16).

Sfard and Prusak (2005) claim that these narratives might tell us about two types of the identity of the storyteller: Actual identity and designated identity. Actual identity

represents the current situation whereas designated identity represents the expected or future situation (Sfard & Prusak, 2005). In other words, actual identity indicates who one is, and designated identity indicates who one wants to be. For example, "I am a good mathematics teacher" might be an example of actual identity whereas "I want to be a good mathematics teacher" might be an example of designated identity. Both actual identity and designated identity have effects on one's actions and the gap between the actual identity and designated identity cause negative emotions for that person (Sfard & Prusak, 2005).

In related studies which use Sfard and Prusak's (2005) Narrative Theory of Identity, researchers focus on the narrative stories of teachers and/or teacher candidates. These stories give insights on the actual and designated identities of the participants (e.g., Andersson, 2010; Bjuland, Cestari, & Borgersen, 2012; McCulloch, Marshall, DeCuir-Gunby, & Caldwell, 2013).

2.2.4. Four Ways to View Identity

Gee (2001) defines identity as being a "*certain kind of person*" (p. 100). To understand and explore one's core identity, he proposes four dimensions to be considered: *nature identity, institution identity, discourse identity,* and *affinity identity*. These dimensions should be considered as interrelated dimensions rather than separate ones (Gee, 2001).

Nature Identity (N-Identities): The source of this dimension of identity is biological reasons on which one has no control and this type of identity is a part of what kind of person one is (Gee, 2001). Being Turkish, being a twin, or having Down's syndrome can be given as examples of nature identity.

Institution Identity (I-Identity): The source of this dimension of identity is derived from being a part of an institution (Gee, 2001). Either being obliged to or volunteer, participation in an institution brings some responsibilities to fulfill and affects identity

(Gee, 2001). Being an instructor at a university or participating in a teacher union could be considered as examples of institution identity.

Discourse Identity (D-Identities): The source of this dimension of identity is "*the discourse or dialogue of other people*" (Gee, 2001, p. 103). Being recognized as a certain kind of person by the others you interact is considered as discourse identity (Gee, 2001). For instance, being interpreted as an authoritarian teacher by the colleagues or being interpreted as a cheerful person by friends could be interpreted as discourse identity. Being an authoritarian teacher or being a cheerful friend is not something gained by birth or participating in an institution, rather it is developed during one's interactions with others.

Affinity Identity (A-Identity): The source of this dimension of identity is affinity groups in which participants engage in practices (Gee, 2001). For instance, a teacher who is interested in using GeoGebra in her/his teaching might join a group of teachers who get together to share their experiences on using this software and develop activities to be used in their classes. Participating in such a group depends on one's interest rather than a requirement. The main requirement in affinity identity is active engagement in practices and these engagements do not necessarily require being in the same place with others in the group (Gee, 2001). For instance, an online GeoGebra teaching group could be considered as an affinity group if they actively share their experiences in that group.

Gee's (2001) characterization of identity was used as the main framework in a limited number of studies (e.g., Kumar & Subramaniam, 2015) but more studies benefited from this framework by combining the framework with some other frameworks (e.g., Gresalfi & Cobb, 2011; Hodges & Cady, 2012). Researchers either benefited from the four ways theorized by Gee (2001) or some subsets of these four ways (e.g., Gresalfi & Cobb, 2011) to conceptualize teacher identity in their studies.

2.2.5. Mathematics Teacher Identity Frameworks

In mathematics education literature, some of the researchers benefit from the preexisting theories and frameworks on identity and/or teacher identity and some of them are explained above, whereas some of them underline the need for the frameworks specific to being a teacher of the mathematics discipline. In this part of the study, frameworks specific to mathematics teacher identity are explained briefly.

2.2.5.1. Professional Mathematics Teacher Identity Framework

Van Putten, Stols, and Howie (2014) proposed a conceptual framework to explore mathematics teacher identity, and they call it *Professional Mathematics Teacher Identity (PMTI)*. They mention the difference between how a mathematics teacher sees herself/himself as a teacher and how s/he actually is as a mathematics teacher in the classroom. Therefore, as seen in Figure 2.2., there are two related parts in their framework to understand PMTI.

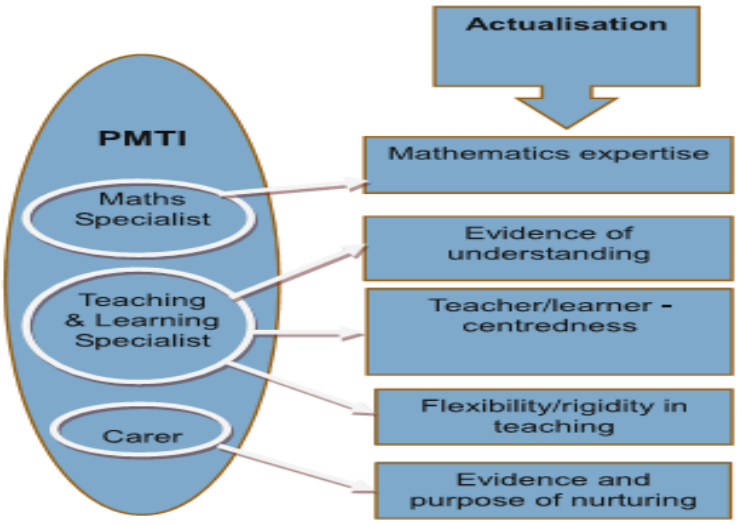

Figure 2.2. Professional Mathematics Teacher Identity Framework. Adapted from "Do prospective mathematics teachers teach who they say they are?" by S. van Putten, G. Stols, and S. Howie, 2014, *Journal of Mathematics Teacher Education, 17*, p. 369-392.

On the left side of the framework, there are three specialization areas for a mathematics teacher: *Math specialist, teaching and learning specialist,* and *carer*. These subcategories were developed based on the study of Beijaard, Verloop, and Vermunt (2000). *Math specialist* subcategory refers to mathematics teachers' perceptions about themselves on their mathematical knowledge and skills; *teaching and learning specialist* refers to mathematics teachers' perceptions about themselves on their didactical and pedagogical knowledge and skills used in mathematics teaching process; and *caring* subcategory refers to mathematics teachers' perceptions about themselves on their knowledge and skills to support social and emotional development of the learners (van Putten, Stols, & Howie, 2014).

On the right side of the PMTI, there are subcategories regarding the actualization of PMTI and these categories were developed based on the models of Ernest (1988) and Thompson (2009). To be considered as a "*good teacher*", there are some requirements to be used in the classroom which were mentioned as *mathematics expertise*, *evidence of understanding, teacher/learner-centeredness, flexibility/rigidity in teaching,* and *evidence and purpose of nurturing*. All these subcategories of actualization of PMTI are related with the subcategories of teachers' perceptions about themselves. For instance, perceptions about the teaching and learning specialist part of the framework are related to certain practices in the classes such as evidence of understanding, the use of teacher or learner-centered approaches, and the use of flexible or rigid approaches in teaching. Therefore, researchers state that the framework consists of connected parts rather than separate and individual parts.

In brief, van Putten, Stols, and Howie (2014) underline the importance of discipline to understand mathematics teacher identity and specifically focus on the dimensions of mathematics teaching. Furthermore, they stress that perceived identities may differ from actualized identities which is the case in their study with pre-service mathematics teachers (see van Putten, Stols, Howie, 2014). The framework of van Putten, Stols, and Howie (2014) conceptualize the components of mathematics teacher identity and the perceived

and actualized mathematics teacher identity. However, there is no specific focus on how the mathematics teacher identity development process takes place and what might be the potential influences on this process are.

2.2.5.2. Mathematics Teacher Identity Framework

Mathematics Teacher Identity Framework of Van Zoest and Bohl (2005) includes both individual cognition and social aspects to understand mathematics teacher identity. These two components are represented on a continuum standing at the different ends but also interrelated with each other (see Figure 2.3).

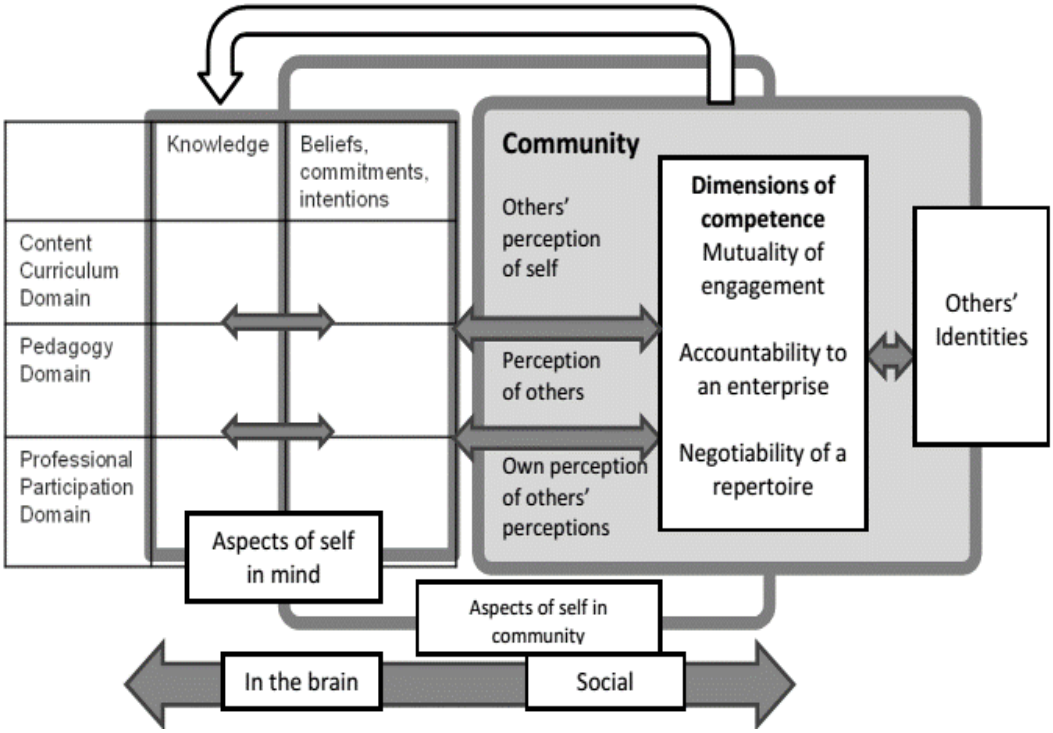

Figure 2.3. Mathematics Teacher Identity Framework. Adapted from "Mathematics teacher identity: A framework for understanding secondary school mathematics teachers' learning through practice," by L. Van Zoest and J. Bohl, 2005, *Teacher Development, 9*(3), p. 333.

Different from Wenger's Social Theory of Learning, Van Zoest and Bohl (2005) indicate that mathematics teacher identity involves not only aspects of self in the community but

also aspects of self in mind. In other words, they claim that teacher identity is not only shaped by the experiences in social communities but also shaped by individual cognition.

In the aspects of self in mind, there are three main domains namely *content curriculum domain, pedagogy domain,* and *professional participation domain*. These domains were developed by benefitting from Shulman's (1987) categorization of teachers' knowledge. Although Shulman (1987) categorized teacher knowledge into seven domains, Van Zoest and Bohl (2005) unified some of the domains and presented in three categories. *Content and curriculum domain* includes content knowledge and curricular knowledge from Shulman (1987) and refers to the essential knowledge about the topics to be taught (Van Zoest & Bohl, 2005). *Pedagogy domain* includes pedagogical knowledge, pedagogical content knowledge and knowledge of learners from Shulman (1987) and refers to the essential knowledge about to whom the topics would be taught and how these topics would be taught (Van Zoest & Bohl, 2005). *Professional participation domain* includes knowledge of educational contexts and knowledge of educational ends from Shulman (1987) and refers to the necessary knowledge about the community in which the teaching would occur (Van Zoest & Bohl, 2005).

For each domain, a teacher has *knowledge, beliefs, commitment, and intentions*. In the framework, knowledge was separated from beliefs, commitments, and intentions since knowledge is not open to personal judgments, unlike belief, commitment and intentions. They refer to conceptions to represent personally held understandings and indicate that *beliefs* include conceptions which "*often provide justifications for acting in particular ways in response to particular types of knowledge in given situations*" (Van Zoest & Bohl, 2005, p. 334). Furthermore, *commitments and intentions* are defined as "*one's desires to either act or not in response to particular situations and the reasons for doing so*" (Van Zoest & Bohl, 2005, p. 334). As can be seen in Figure 2.3., beliefs, commitment and intentions are represented both in aspects of self in mind and aspects of self in the community which indicate that they are developed both individually and socially. On the other hand, knowledge is represented only in aspects of self in mind. However, two-sided

arrows indicate its relationship with aspects of self in community. Therefore, we can say that although knowledge is individually constructed, it still has a social component.

In order to have a better idea on these constructs, giving an example might be beneficial. For the pedagogy domain, knowledge includes being aware of different learning theories whereas beliefs, commitments, and intentions include personal judgments about which theory is most appropriate for a student group and desires on applying this theory in the classroom (Van Zoest & Bohl, 2005).

In the aspects of self in community, social effects on teacher identity development process are represented. In this part, *others' perception of self, perception of others,* and *own perception of others' perception* take place. Here, *others* refer to the persons in CoP with whom mutual engagement takes place and *self* refers to the teacher. When participating in a CoP, others' views on a teacher and also teacher's perceptions on how s/he is interpreted by the others affect his/her participation in that CoP (Van Zoest & Bohl, 2005; Wenger, 1998). For instance, being interpreted as an incompetent person in a CoP (by self or by the others) might lead teacher to participate in activities peripherally which limits his/her learning from that practice.

In the aspects of self in community, *dimensions of competence* which are *mutuality of engagement, accountability to an enterprise* and *negotiability of a repertoire* take a place. These dimensions are retrieved from the study of Wenger (1998) which were briefly explained before. *Mutuality of engagement* refers to engaging in practice with the others in a CoP (Wenger, 1998). A teacher does it in the classroom while engaging in practice with his/her students, or does it in school CoPs while interacting with other teachers and/or administrators (Van Zoest & Bohl, 2005). *Accountability to an enterprise* refers to internalizing joint enterprise of CoP and behaving, taking responsibility to achieve this joint enterprise (Wenger, 1998). There are implicit and explicit expectations for teachers in a CoP, and these expectations establish whether a teacher is doing effective or ineffective work in that CoP (Van Zoest & Bohl, 2005). For instance, in some CoPs,

reform-based teaching activities are appreciated and teachers are expected to behave in this way. On the other hand, some CoPs might appreciate drill-practice where reform-oriented activities might be criticized. *Negotiability of repertoire* refers to using the repertoire developed by a CoP to engage in activities in that CoP (Wenger, 1998). Benefitting from these resources makes a teacher shape his/her identity and consistently his/her teaching (Van Zoest & Bohl, 2005). Moreover, not only individuals benefit from this repertoire, individuals also contribute to this repertoire through their personal history (Van Zoest & Bohl, 2005; Wenger, 1998). Therefore, in the use of this repertoire, there is a reciprocal relationship. For instance, a beginning teacher might benefit from the resources and experiences of other teachers in the school but also might improve the shared resources with contemporary tools/ideas/materials via using his/her experiences in the teacher education program.

At the very end of the social part of the framework, *others' identities* are expressed as a possible influential factor on mathematics teacher identity. As also mentioned in Wenger's (1998) Social Theory of Learning, what shapes our identities is our interactions with others in a CoP (Wenger, 1998), and thus, others' identities might affect a teachers' identity and vice versa (Van Zoest & Bohl, 2005).

When the Mathematics Teacher Identity Framework is interpreted as a whole, it is possible to claim that it benefits from two widely accepted frameworks (Wenger's Social Theory of Learning and Shulman's Teacher Knowledge Framework) and mainly shows that mathematics teacher identity is constructed both individually and socially. Furthermore, it underlines the role of cognitive and affective factors on the different dimensions of mathematics teacher identity.

2.2.5.3. Conceptual Understanding of Mathematics Teacher Identity in the Current Study

In this part of the study some of the commonly used theories and conceptual frameworks on identity and teacher identity (e.g., Gee, 2001; Holland et al., 1998; Sfard & Prusak, 2005; Wenger, 1998), and some of the conceptual frameworks on mathematics teacher identity (e.g., Van Putten, Stols, & Howie, 2014; Van Zoest & Bohl, 2005) are mentioned. When the above-mentioned theories and frameworks are considered, it is possible to claim that there are some common and different interpretations regarding teacher identity. For instance, both Wenger (1998) and Holland et al., (1998) underline the importance of social-contextual experiences on identity development. Their perspective on identity development could be considered as participative interpretation of identity by putting the social participation into the center of identity development (Darragh, 2016). However, Sfard and Prusak's (2005) identity conceptualization is based on narrative perspective and they claim that identity can be explored through self-stories. Although individual cognition is not explicitly mentioned in these theories/frameworks, both Van Zoest and Bohl (2005) and Van Putten, Stols, and Howie (2014) mentioned the discipline-based cognitive knowledge to conceptualize teacher identity. Furthermore, affective dimensions are mentioned in mathematics teacher identity frameworks: Van Zoest and Bohl (2005) mentioned about the role of affective factors, and Van Putten, Stols, and Howie (2014) stressed the emotional part of teacher identity.

To have a better picture of teacher identity, which is described as a complex construct in the literature, researchers need to take benefit from multiple theories rather than drawing on one theory by ignoring the others (Varghese, Morgan, Johnston, & Johnson, 2005). In line with this view, the conceptual understanding of mathematics teacher identity and mathematics teacher identity development in the present study is mainly built on the Wenger's (1998) Social Theory of Learning and Van Zoest and Bohl's (2005) Mathematics Teacher Identity Framework. I consider participated communities (e.g., teacher education community and working communities) as the crucial source for

mathematics teacher identity development. However, I also consider the role of individual cognition for the mathematics teacher identity development process. Furthermore, this conceptual understanding of mathematics teacher identity includes cognitive, affective, and emotional aspects in different dimensions of mathematics teaching (e.g., subject matter, pedagogy, didactics) and all these aspects are interrelated with each other.

2.3. Literature Findings on Mathematics Teacher Identity

In my literature review, mathematics teacher identity has been investigated mainly with qualitative research methods with a small number of participants. The findings of these studies are represented in three categories: (1) Studies that investigate the identity change, (2) studies that investigate the identities and identity development process of mathematics teachers, and (3) studies that investigate early career mathematics teachers' teacher identities and teacher identity development process.

2.3.1. Changing Identities of Mathematics Teachers

In the related literature, many of the studies focus on the identity change which occurred in intentionally developed communities such as professional development programs, communities of practices, and projects. In these studies, identity change is generally used as a tool to understand the effectiveness of the intentionally created communities (e.g., Chronaki & Matos, 2014; Hossain, Mendick, & Adler, 2013).

The intention of such communities differ in nature, and thus, these studies focus on the change in different part(s) of mathematics teacher identities. For instance, some of the studies specifically aim to improve knowledge of teachers in some domains and investigate how this attempt affected mathematics teachers' identities. In one of these studies, Hossain and her colleagues (2013) investigated how a subject matter knowledge improvement program designed for non-mathematics graduates who were trained to teach secondary mathematics affected teacher identities of two participants. They indicated that

one of the teachers' identity change was in line with the program whereas the other's identity was more resistant to aimed change. In another study, Woolhouse and Cochrane (2015) focused on how a subject-specific training changed pre-service science and mathematics teachers' identities. Based on their analysis, researchers interpreted that the program enabled pre-service teachers to improve their subject matter knowledge, pedagogical content knowledge, and knowledge of educational contexts. Therefore, researchers stated that participating in that program helped participants to change their identity from a trainee to a teacher. Knowledge improvement was not only addressed from the discipline perspective. For instance, in the study of de Freitas (2008), it was seen that pre-service mathematics teachers developed a better awareness of the social justice issues throughout the method course, and their teacher identity was changed in order to be able to teach diverse population after their experiences in that course.

On the other hand, some other studies investigated identity change by focusing on teachers' teaching practices, beliefs, perceptions of themselves and the profession perspectives. In one of these studies, Hanley and Darby (2006) investigated how participating in a working group on curriculum change regarding the use of realistic mathematics education affected participant teachers' mathematics teaching preferences. The results indicated that there was a change in participants' teacher identities in line with the curriculum change. Similarly, Graven (2004) investigated teachers' identity change in a curriculum innovation program that lasted for two years. In that study, teacher identity change went hand in hand with teacher learning in the intentionally created community of practice. Teacher learning and teacher identity change relationship was the focus of some other studies. The intention of the communities differed in these studies as improving the teaching of proportional reasoning of mathematics teachers (e.g., Cyrino, 2016); developing culturally responsive pedagogy (e.g., Hunter, 2010); developing equitable mathematics pedagogy (e.g., Wager & Foote, 2013); developing practices for collaborative group work in mathematics classes (e.g., Oslund, 2016); supporting teaching practices that support student exploration in mathematics classes (e.g., Bjuland et al., 2012); developing teaching practices that is supported by critical mathematics education

(e.g., Andersson, 2010); understanding and teaching of algebra (e.g., Battey & Franke, 2008), integers (e.g., Kumar & Subramaniam, 2015) and fractions (e.g., Hanley & Darby, 2006); developing ecocultural pedagogy in mathematics teaching (e.g., Owens, 2014); using literacy in mathematics teaching (e.g., Spitler, 2011). Although the intention of these communities (such as professional development programs, communities of practices, research projects, and collaborations) differed, these communities enabled participants to learn from their participation and supported the shift in their teacher identities in line with the intention of the participated communities.

In brief, it is possible to claim that intentionally created communities help to challenge and change the existing knowledge, beliefs, perceptions, and teaching practices of teachers and/or teacher candidates in many studies and these changes are interpreted as the identity change in related studies. In general, this change is in line with the intention of the community, however, there are also studies in which not all the participants' teacher identity change is in intended way (e.g, Graue et al., 2015; Hodges & Cady, 2013; Hossain et al., 2013). In such cases, researchers underline the potential effect of working context on moderating the effects of intentional programs or communities (e.g., Gresalfi & Cobb, 2011; Hodges & Cady, 2013). However, the effects of working communities on mathematics teachers' teacher identity development process are not specifically addressed in related studies. In other words, although the effects of intentional communities' effects on teacher identities are investigated in various studies, the effects of pre-existing communities such as working communities, are not investigated sufficiently in the related literature.

2.3.2. Exploring Identities and Identity Development Process

In my review of the literature, some of the studies focus on exploring what kind of teacher identities participants developed and/or what the influential factors are in their identity development process. Among these studies, some of them focus on the mathematical identities and mathematical identity development process of teachers or teacher

candidates—mostly in the early levels of education (e.g., pre-school, elementary school). Mathematical identity includes one's knowledge, beliefs, and emotions related to the mathematics discipline (Kaasila, 2007). The findings of these studies indicate that teachers' and/or teacher candidates' mathematical identities are highly affected from what they experienced before entering the teacher education either positively (e.g., Kaasila, 2007) or negatively (e.g., Lutovac & Kaasila, 2011). In terms of the effect of life history on mathematical identities, participants' own teachers are more influential when compared with the positive and negative events they experienced, and their friends and family members (McCulloch et al., 2013). The life history of teachers and teacher candidates should not be interpreted as the only influential factor on their mathematical identity. Because, the impact of mathematical identities seems to be observed in teacher identities of teachers and teacher candidates (cf., Jita & Vandeyar, 2006; Page & Clark, 2010; Pipere & Mičule, 2014). Therefore, life history becomes an important aspect of teachers' and teacher candidates' mathematical identities and mathematics teacher identities. In line with this point, some researchers aimed to change the negative mathematical identities of pre-service teachers before the actual teaching starts. In one of these studies, Lutovac and Kaasila (2011) applied narrative rehabilitation and bibliotherapy to pre-service primary teachers and they found that such an implementation positively contributed to participants' mathematical identities. Similarly, in the study of Saran and Gujarati (2013), method course helped to change pre-service teachers' negative beliefs about their mathematical identities to more positive, and moreover, their teaching practices into the more reform-oriented way. Therefore, even if negative mathematical identities were developed before, these identities are likely to be changed via intentionally developed programs and courses.

Apart from the studies that focus on the mathematical identities of teachers and teacher candidates, many studies specifically focus on exploring the teacher identities of mathematics teachers and teacher candidates. In these studies, there are no common terms to describe explored teacher identity similar to the use of definitions and frameworks used in identity-related mathematics education literature. Some of the studies describe the

teacher identities rather than specifically naming the explored teacher identities. For instance, Lloyd (2006) investigated the teacher identities of pre-service mathematics teachers through analyzing their fictional accounts of mathematics classrooms. The researcher claims that these fictional accounts showed that participants' teacher identities that are in line with using group works, educational technology, and mathematically engaging activities in their future classes. Brown and Redmond (2015) investigated the teacher identities of two teachers who were working in different educational contexts as mainstream and alternative. It was seen that these two teachers had different types of teacher identities as evidenced in different interpretations of content, different teaching and assessment practices. Based on these differences, one of the teachers paid more attention to the educational development of the students whereas the other paid more attention to the development of conceptual understanding through engagement in meaningful tasks. In another study, Mosvold and Bjuland (2016) described different types of teacher identities they explored during the field experiences of two teacher candidates. Using "Positioning Theory", researchers explored that the two teacher candidates differently positioned themselves during the field practice sessions. Based on the analysis of these positioning, it was seen that one of the participants' teacher identity was more confident whereas the other one had more skeptical perceptions about delivering the content, establishing the classroom management and productivity.

Some other studies use specific labels for the teacher identities explored. For instance, in the study of Williams (2011), two mathematics teachers were described as successful teachers by their colleagues. However, the perceived teacher identities of these two teachers were mentioned respectively as *traditional* and *connectionist*. In another study, Friedrichsen and her colleagues (2008) explored teacher identities of graduates who participated in an alternative certification program. There are three observed identity types: *Always a teacher* who had a teacher identity before the certification program; *late decider* who decided to be a teacher late at their undergraduate programs; *career explorer* who neither had a teacher identity nor another professional identity. In one of the studies conducted with pre-service teachers, Lutovac and Kaasila (2014) indicated that there were

two types of identities developed among the participant pre-service teachers: *Decisive identity* which referred to having clear goals, emphasis on the learning and self-development, and *irresolute identity* which referred to having ambiguity and imprecision about the future goals, and lack of self-development.

In the identity-related mathematics education literature, teacher identity development process and influential factors on this process became a focus of various studies. In the studies conducted with pre-service teachers, the effect of field experiences on pre-service teachers' mathematics teacher identity can be seen in several studies (cf., Mosvold & Bjuland, 2016; Neumayer-Depiper, 2013; Ponte & Brunheira, 2001). These studies showed that field experiences helped the pre-service teacher(s) to become more knowledgeable about the contextual, political, social realities of working communities (Neumayer-Depiper, 2013), and their future students (Ponte & Brunheira, 2001), and thus, positively contributed to their teacher identity development process. The effect of field experiences on pre-service teachers' teacher identity was also observed in Smith's (2006) single case study. Smith (2006) investigated teacher identity development from a more holistic perspective rather than specifically focusing on the effects of the specific time period. Analysis revealed that three communities played a crucial role in the teacher identity development: Pre-university schools, teacher education, and field experience communities. In other studies that were conducted with pre-service teachers, Ma and Singer-Gabella (2011) investigated how pre-service teachers made sense of reform pedagogy during a course in the teacher education program. Although reform-related practices and visions were offered in the course, it was seen that not all the pre-service teachers responded the same to these experiences. Some of them adapted these pedagogies more centrally to their teacher identities whereas some of them adapted peripherally. In brief, studies related to pre-service teachers' mathematics teacher identities indicate that the courses and field experiences during the teacher education program have the potential to impact pre-service teachers' mathematics teacher identities.

The studies conducted with in-service teachers' teacher identity development process is smaller in number when compared with pre-service teachers. However, the findings of these studies provide some insights on the mathematics teacher identity development process. Although these studies focus on the effects of specific programs or training, it is seen that the effects of these programs should not be interpreted as independent from the teachers' working communities. Working communities' expectations from a teacher (Gresalfi & Cobb, 2011), the nature and repertoire of the working community (Hodges & Cady, 2013) and interactions with the colleagues in the working community (Lieberman, 2009) moderate the impacts of such programs or intentionally created communities. Although these studies present clues on the potential effects of the working communities on the teacher identity development process, there seems to be a need for studies that focus on the effects of working communities on the teacher identity development process.

Spillane (2000) investigated the teacher identity of a primary teacher in order to explore whether it was reform-oriented or not. In that study, the teacher's teacher identity differed based on the subject she taught. Her teacher identity was more aligned with reform-oriented teacher identity in the literacy course unlike with her teacher identity in the mathematics course. In another study, Sammons and his/her colleagues (2007) investigated the influential factors on teacher identity development. Grounding on their data obtained from 300 teachers, researchers hypothesized that there are three parts of teacher identity: *Professional identity*, *situated or socially located identity*, and *personal identity*. Based on these dimensions, researchers explored four scenarios in the teacher identity development process: *Identity dimension in balance, one dominant identity dimension, two dominant identity dimension,* and *three dominant identity dimension*. In summary, studies related to the in-service teachers' teacher identity shows that there are various potential factors on identity development process such as working communities, participated communities and programs, discipline, and personal and societal factors.

In this part of the study, I share the findings of the studies that investigate the mathematics teacher identities and identity development process of pre-service and in-service teachers.

In defining mathematics teacher identities, it is seen that there is a lack of common terminology in the literature. However, it can be claimed that the intended mathematics teacher identity is in line with engaging students in meaningful tasks and promoting student discussion and exploration during the mathematics classes. In the current study, I defined that kind of teacher identity as reform-oriented teacher identity as explained in the introduction chapter of this study. On the other hand, the findings of the studies that focus on the teacher identity development process provide information about the influential factors on the teacher identity development. However, there still seems to be a need for the studies that enable to connect these factors and provide a better understanding of the mathematics teacher identities and identity development.

2.3.3. Early Career Mathematics Teachers in the Teacher Identity Development Process

Early years in the teaching profession are described as the years in which teachers experience many challenges (Alsup, 2006; Pillen, Beijaard, & Brok, 2013). These years could be interpreted as the crucial period in the development of teacher identities (Beauchamp & Thomas, 2009). However, there are only a few studies in mathematics education literature that focus on early career teachers' mathematics teacher identities.

Among these limited studies, the findings of Haggarty and Postlethwaite (2012) support the above-mentioned claim and show that early career teachers seek help during the induction period. In these years, they mainly focus on classroom management issues and experience negative emotions when their actual teacher identities do not match with their designated teacher identities. On the other hand, there are also teachers who develop reform-oriented teacher identity even if they are in the early years in the profession. For instance, Hodges and Cady (2012) investigated how an early career mathematics teacher is able to develop a reform-oriented teacher identity. The analysis showed that participating in multiple communities such as district, school, classroom and professional development communities that align with the reform-oriented views and practices helped

the teacher to develop such a mathematics teacher identity. Researchers underline that reform-oriented teacher identity cannot be developed quickly, thus there is a need to continuously support early career teachers through enabling participation in such multiple reform-oriented communities. Jong (2016) also focused on the reform-oriented teacher identity development of an early career teacher. It was found that influential education models such as some family members, practicum teacher, method course professor, and her high commitment to learning such as having high expectations from her students and herself as a learner contributed to the development of reform-oriented teacher identity. Furthermore, the researcher explored that her working community had some positive (e.g., using reform-oriented curriculum and enabling support network) and negative (e.g., limited resources for reform-oriented practices and strict curriculum implementation pressure) impact on her mathematics teacher identity development process. There are also some other influential factors on early career mathematics teachers' teacher identities explored in other studies such as the life history (McGlynn-Stewart & Boylan, 2015) and societal and personal images about being teacher (Palmér, 2016).

Among the studies conducted with early career teachers, Goos (2005a; 2005b; 2014) specifically focused on the technology aspect and investigated the teacher identity development of beginning teachers as users of technology. In these studies, Goos explored that both personal such as knowledge and beliefs about the use of technology in mathematics classes, and contextual factors such as teaching environments, play complementary roles on the teacher identities of beginning teachers as users of technology.

When all the findings are taken into consideration, it can be claimed that there is beneficial but limited knowledge of the early career mathematics teachers' teacher identity development process. Although such findings inform about some potential influences on their identity development process, there is a need for the further research studies on the mathematics teacher identities and mathematics teacher identity development of early career mathematics teachers.

2.4. Teacher Identity Studies in the Turkish Context

The teacher identity research literature is very limited in the national context. I could only reach to 7 articles which is related to the current study, and only one of these studies was conducted in the mathematics education field. Although the number of these studies is very limited, most of them were published in recent years which might be an indicator of the increasing attention on this topic.

In the national context, all but one studies investigated the teacher identity using qualitative research methods. The exception is the study of an adaption of a teacher identity exploration scale. In that study, the "Early Teacher Identity Development Measure" which was developed by Friesen and Besley (2013) was adapted into Turkish to investigate pre-service teachers' teacher identities (Arpacı & Bardakçı, 2015). In another study, Duru (2006) made a literature review based on the international research studies to explore the influential factors on teacher identity and concluded that popular culture (e.g., popular movies, books, TV programs), experiences before the teacher education, teacher education programs, and worked schools are effective on teacher identity development. In a similar vein, Taner and Karaman (2013) conducted a qualitative metasynthesis in order to understand the influential factors on teacher identities of foreign language teachers in the national context. In line with this purpose, they focused on 44 studies that investigated teacher identity-related constructs, which are teacher knowledge, teacher beliefs, the effects of teacher education programs, and social context on teachers, to have an understanding of how prospective teachers develop teacher identity. Metasynthesis results indicated that practicum times and reflection during the teacher education program was critical in teacher identity development. Furthermore, it was seen that lack of motivation and knowledge of other cultures negatively affected teacher identity development.

In order to explore teacher identities developed, both Çulha-Özbaş (2012) and Karabay (2016) benefitted from metaphors. In the study of Çulha-Özbaş (2012), 63 in-service

social studies teachers described themselves with metaphors and it was found that most of the metaphors yield traditional teacher identities, where teacher-centered methods are used, rather than reform-oriented teacher identities, where learner-centered methods are used. A similar result was obtained in the study of Karabay (2016) in which 123 prospective teachers from different disciplines in the Faculty of Education described themselves with metaphors. Most of the prospective teachers' metaphors indicated traditional teacher identities who aimed to lecture students to deliver the knowledge. Furthermore, prospective teachers explained the reasons for their choice of metaphors. Based on these explanations researcher concluded that experiences before the teacher education program and experiences during the teacher education program both had effects on participants' teacher identities. In another study conducted with pre-service teachers, Dilci and Gür (2013) investigated influential factors on elementary teacher candidates' teacher identities via discourse analysis of their verbal and written narratives. Findings indicated that participants' experiences, knowledge, expectations, beliefs, and attitudes all played a role in their teacher identity development.

In the only study conducted in mathematics education field, Gülbağcı-Dede and Akkoç (2016) compared the teacher identities of teacher candidates who enrolled in the undergraduate mathematics teacher education program and graduate mathematics teaching certification program. In both groups, it appeared that role models before the programs and their positive experiences with mathematics were influential on their choice of becoming a mathematics teacher and their teacher identities. On the other hand, researchers indicated that the determination levels differed among these two groups of teacher candidates in favor the ones in the undergraduate mathematics teacher education program.

The findings of the studies in the national context show similarities with the findings of the broader international literature and indicate that teacher identity development process is a longitudinal process in which experiences in different communities play a role. However, there is a very limited study in the national context of teacher identity,

specifically on mathematics teacher identity, and there is a need for further studies to have a better understanding of (mathematics) teacher identity development in the national context.

2.5. The Potential of the Current Study in the Related Literature

In this chapter, studies related to the mathematics teacher identity and its development are examined. Based on this review, I can claim that there is an increasing attention in teacher identity topic in mathematics education literature. Although this increasing attention led the field to learn about mathematics teacher identity and its development, there still seems to be a need for the further studies to have a better understanding of this topic.

In order to have a better understanding of mathematics teacher identity and its development, there is a need to clearly conceptualize teacher identity in the research studies. In the existing literature, various theoretical and/or conceptual frameworks were used to investigate teacher identities of mathematics teachers. Furthermore, some studies did not explicitly mention their theoretical and/or conceptual understanding of teacher identity. Critically examining the commonly used frameworks and benefitting from multiple frameworks helped me to clearly conceptualize mathematics teacher identity in the current study. Therefore, the findings of the current study will be based on a clear and explicit conceptual understanding of mathematics teacher identity.

As exemplified in this chapter, many of the studies related to mathematics teacher identity focused on intentional communities and investigated the effects of these communities. Although the role of pre-existing communities such as working communities is mentioned in some studies, no study in the accessible literature specifically focused on the effects of the working communities on mathematics teacher identity development. In the current study, I specifically focus on the role of working communities and investigate how the (relatively) supportive and unsupportive working communities affect mathematics teacher identities of early career mathematics teachers. Therefore, the related findings might take

the existing literature one-step further on understanding the development of mathematics teacher identities.

In mathematics education literature, early career mathematics teachers' teacher identity has been investigated in very few studies. Although the early years in the profession are seen as the crucial transition phase in the teacher identity development process (Beauchamp & Thomas, 2009), there is a limited number of studies focusing on this period. Therefore, I believe that the current study will help to fill the gap in our understanding of early career mathematics teacher identity development.

CHAPTER 3

METHODOLOGY

In this chapter of the study, methodological approach of the study is explained. In order to have a better understanding of the methodological decisions, first research purpose and research questions are reminded. Then, research design, participants, context, data collection, data analysis procedures, and trustworthiness of data and findings are clarified in this part of the study.

3.1. A Reminder of Research Purpose and Research Questions

The current study aims to explore early career mathematics teachers' perceived mathematics teacher identities and the influential factors on these identities. Furthermore, it is aimed to investigate the coherence between two early career middle school mathematics teachers' perceived and actualized mathematics teacher identities via observing their in-class and in-school experiences. As the last purpose, the effects of working communities in different characteristics on early career mathematics teachers' mathematics teacher identities is the focus of this study. In line with these purposes, research questions are specified as follows:

1. What are the perceived mathematics teacher identities of early career middle school mathematics teachers?
2. What are the factors that influence early career middle school mathematics teachers' perceived mathematics teacher identities?
3. To what extent is there a consistency between two early career middle school mathematics teachers' perceived and actualized mathematics teacher identities?

4. How do working communities with different characteristics affect early career middle school mathematics teachers' mathematics teacher identity development process?

3.2. Research Design

Phenomenological research studies seek to have a deep understanding of phenomena through focusing on lived experiences (Creswell, 2007; Moustakas, 1994). In other words, phenomenological studies aim to explore the essence of lived experience (Creswell, 2007). Exploring the commonality on "what" is experienced and "how" is experienced by the participants (Moustakas, 1994) is used to make sense of a common or particular problem and/or topic. Emotional experiences of first-year mathematics teachers, student experiences in an origami-based mathematics lesson, or student experiences while using scientific calculators in a mathematics lesson might be the focus of a phenomenological research study. The main phenomena of the current study are early career middle school mathematics teachers' mathematics teacher identities and their experiences in the mathematics teacher identity development process. Therefore, in order to answer the first two research questions of the current study, I investigated what early career middle school mathematics teachers experience in their mathematics teacher identity development process, and how these experiences shape their mathematics teacher identities.

In order to have a better understanding of the phenomena, it is possible to combine phenomenological studies with case studies (Merriam, 1998) as in this study. Case studies enable researchers to explore or describe an issue through focusing on a case in a bounded system (Creswell, 2007; Merriam, 1998). Here, a bounded system might refer to an individual, several individuals, a program, a community, or a policy (Creswell, 2007; Merriam, 1998). In order to be described as a case study, a phenomenon, a program, or a person should be selected for a particular reason that requires in-depth investigation for better understanding (Merriam, 2009). As in single case studies, multiple case studies also aim to have an in-depth understanding of a particular phenomenon but focusing on more than one case (Creswell, 2007). Working with multiple cases enables to get stronger

results when compared with single case studies (Yin, 2002). It enables to get different perspectives on the issue that is being investigated (Creswell, 2007), and thus enables to have a deeper understanding and exploration of the issue (Miles & Huberman, 1994). Therefore, in order to have a better insight on the third and fourth research questions of the study, I chose two early career mathematics teachers as our cases. These two early career mathematics teachers are selected to be observed to have a better understanding of the mathematics teacher identity development phenomena.

In brief, our research design could be described as phenomenological research study supported by multiple case study. In both phenomenological and multiple case studies, participant selection process is crucial (Creswell, 2007). Details of the participant selection process in the current study are explained in the following section.

3.3. Participants

In phenomenological and multiple case studies, participants are selected purposefully in order to deepen the understanding of the investigated phenomena (Creswell, 2007). In phenomenological studies, participants are purposefully selected based on their lived experiences in common related to the phenomena investigated (Moustakas, 1994). Therefore, for the phenomenological part of the study—to investigate first and second research questions—11 early career middle school mathematics teachers are selected to be interviewed. When selecting these participants, I reached to teachers who graduated from the same teacher education program. Since teacher education programs might be highly effective on teacher identity development process (Anspal, Eisenschmidt, & Löfström, 2012; Brown & McNamara, 2011), I aimed to reach to participants who have similar experiences in the teacher education program. Although I am aware of the fact that similar teacher education program might differently affect teacher identities of preservice teachers (e.g., Antonek, McCormick, & Donato, 1997), I believe that reaching to teachers who graduated from different teacher education programs would limit the commonality in their experiences in the teacher education program. Therefore, I decided to reach to

teachers who graduated from the university in which I was working at the time of the study. This enabled to select participants from the same teacher education community, about which I have knowledge. Apart from the graduated university as a common experience, they all work as middle school mathematics teachers (grades 5th to 8th), and all of them are in the first three years in the profession. However, their working communities and contexts differ. Table 3.1. provides an overview of the participants of the current study.

Table 3.1. *Participants for the First Two Research Questions of the Study*

Case	Gender	Year in the Profession	Area	School	Student Achievement
P1	Female	1st year	Suburban	Very big	Poor
P2	Female	1st year	Rural	Small	Good
P3	Female	3rd year	Urban	Big	Average
P4	Female	3rd year	Suburban	Big	Average
P5	Female	2nd year	Suburban	Small	Poor
P6	Female	3rd year	Urban	Big	Poor
P7	Female	2nd year	Urban	Small	Average
P8	Female	2nd year	Rural	Small	Poor
P9	Female	3rd year	Suburban	Big	Average
P10	Male	3rd year	Suburban	Small	Poor
P11	Male	2nd year	Urban	Small	Average

Note: There is no numerical data for the school size and student achievement sections. These sections were categorized based on how the participant teachers described their schools and general student achievement in their schools. Therefore, these sections were dependent on participants' subjective judgments about their schools and their students.

As can be seen in Table 3.1., two of the participants are in the first year in the profession; four of them in the second year in the profession; and five of them are in the third year in the profession. Among them, two of them work in rural schools (in small towns); four of them work in urban schools (in the central districts of a city), and five of them work in

suburban schools (in the peripheral districts of a city). Two of the participants are male whereas nine of them are female which reflects the women dominancy in the teaching profession in the Turkish context (Oruç, 2013). In brief, although there are some discrepancies in their working communities, all the participants are in the early years of the mathematics teacher identity development process, which is the phenomena investigated in the current study.

Similar to the procedure for selecting participants for the phenomenological part of the study, cases for the multiple case part of the study are selected purposefully. In multiple case studies, selected cases might hold similar characteristics and conditions (Stake, 2006), or might hold different characteristics in order to be compared in line with the purpose of the study (Creswell, 2007). In the current study, I benefitted from both similar and different characteristics to select the cases since it best serves my research purpose(s). For the 3rd and 4th research questions, I selected two cases to be observed. In line with the 4th research question, one of the cases should work in a supportive working community whereas the other should work in an unsupportive working community. In order to decide which working communities are regarded as supportive and which of them are regarded as unsupportive, I made a detailed literature review. Based on this review, characteristics of supportive working communities are listed and some of them are given in Table 3.2.

Table 3.2. *Some Characteristics of Supportive Working Communities*

Benefitted Study	In supportive communities…
Beauchamp & Thomas, 2009; Zembylas, 2010	Positive emotions arouse rather than the negative emotions.
Beauchamp & Thomas, 2009; Chong, Low, & Goh, 2011; Flores & Day, 2006	School administrators, school leaders, and experienced colleagues support and guide early career teachers.
Hodges & Cady, 2012; Van Zoest & Bohl, 2005; Wenger, 1998	There are mutual engagement (collaboration), joint enterprise (common purpose), and shared repertoire (shared tools to achieve the common purpose) in the working community.
Hodges & Cady, 2012	Teachers are encouraged to participate in other communities that have a potential to support teacher's identity development process.

After determining the commonly mentioned characteristics of supportive working communities, 27 interview questions were developed to understand whether a teacher is working in a supportive or unsupportive working community. Some of the interview questions are listed in Table 3.3.

Table 3.3. *Sample Questions from Participant Selection Process*

Number in the Interview Protocol	Interview Question
Q. 5	How do you feel yourself when you are in the teachers' meeting room?
Q. 8	How effective your school administrators are on your in-class decisions?
Q. 10	Is there any collaboration among the mathematics teachers in your school?
Q. 12	Generally in teaching, and specifically in mathematics teaching, how do you solve a problem that you faced? [Is there anyone whom you seek help?]
Q.14	Does your working community support you to participate in educational seminars, courses, and training?

As the next step, interviews with 5 early career middle school mathematics teachers were conducted. Teachers' positive responses to the interview questions were interpreted as indicators of supportive working community whereas negative responses were interpreted as indicators of unsupportive working community. For instance, if a teacher mentions the mutual engagement and collaboration among teachers in his/her working community, it is interpreted as one of the indicators of a supportive working community. On the other hand, if a teacher mentions that s/he tries to solve the problems s/he experienced alone and there is no one in her/his school to help her/him, it is interpreted as one of the indicators of an unsupportive working community. After this process, unfortunately, it was seen that most of the interviewees work in unsupportive working communities. There was only one teacher who was working in a relatively supportive working community in which the indicators of supportive working community are much more than the indicators of unsupportive working community. Therefore, the teacher who is working in a relatively supportive working community was selected as one of the teachers who will be observed. When deciding on the second case to be observed, I aimed to reach to a teacher who has similar experiences with the other teacher to be observed. Some of the characteristics of these two teachers are given in Table 3.4.

Table 3.4. *Some Characteristics of Cases Who Are Observed (P5 and P11)*

	P5	**P11**
Gender	Female	Male
Teacher Education Program	Elementary Mathematics Education Program	Elementary Mathematics Education Program
Teaching Experience in Abroad (Foreign) Schools	One year as a Comenius Assistant in the Czech Republic	One year as a Comenius Assistant in the Czech Republic
Experience in the Profession	2nd year	2nd year
School Size	Small	Small
School Type	Public	Private
School Context	Suburban	Urban
Number of students in classes	Approximately 45	Approximately 20
The physical environment of the school	Poor	Good
The technological environment of the school	Poor	Good
Support from administrators	Poor	Good
Collaboration with other teachers	Poor	Good

As can be seen from the Table 3.4., until starting to the profession, they had similar experiences, but their working communities seemed to differ in nature. This difference led them to be selected as two cases to be observed in the current study.

3.4. Turkish Education Context: Teacher Education Program and Teacher Recruitment Policy

In Turkey, the Students Selection and Placement Center (ÖSYM) administers a central examination to high school graduates and based on the scores obtained from this examination, students are able to choose departments of universities in which they want to have an education. In order to be a middle school mathematics teacher (5^{th}, 6^{th}, 7^{th} and

8th grades), students need to have an education in the Elementary Mathematics Education Program of Education Faculties. In Turkey, there are 78 universities (67 public and 11 private universities) in which there is an Elementary Mathematics Education Program (HEC, 2018). The participants of this study graduated from an English medium public university which is of the top three rank among all the universities who have this department (HEC, 2018).

In the elementary mathematics teacher education program, there are certain obligatory courses that are common to all universities in Turkey, and there are some elective courses that might vary based on the university. In Table 3.5., the obligatory courses are listed based on the semesters of the teacher education program and the European Credit Transfer System (ECTS) at the time of the study.

Table 3.5. *Elementary Mathematics Education Program for the Participant Teachers*

	First Year (ECTS)	Second Year (ECTS)	Third Year (ECTS)	Fourth Year (ECTS)
Fall Semester	Fundamentals of Mathematics (4.5)	Basic Physics I (6.5)	Basic Linear Algebra (5)	Research Methods (8)
	Analytic Geometry (4.5)	Introduction to Differential Equations (7)	Methods of Teaching Mathematics I (11)	School Experience (6)
	Calculus I (7.5)	Introduction to Probability & Statistics (6)	Turkish I (4)	Nature of Mathematics for Teaching (10)
	Introduction to Education (5)	Instructional Principles and Methods (6)	Elective	Elective
	English for Academic Purposes (6)	Educational Psychology (5)	Elective	Elective
		History of Turkish Revolution I (2)		
Spring Semester	Discrete Mathematics (4.5)	Basic Physics II (6.5)	Community Service (4)	Practice Teaching in Elementary Education (12)
	Basic Algebraic Structures (4.5)	Elementary Geometry (8)	Instructional Technology and Material Development (5.5)	Turkish Educational System and School Management (5)
	Calculus II (7.5)	Introduction to Probability and (6)Statistics II	Methods of Teaching Mathematics II (11)	Guidance (5)
	Computer Applications in Education (4)	Measurement and Assessment (5)	Classroom Management (5)	Elective
	English for Academic Purposes II (6)	Academic Oral Presentation Skills (4)	Turkish II (4)	
		History of Turkish Revolution I (2)	Elective	

The courses given in Figure 3.1. are the ones which must be taken in the program. As can be seen in the figure, preservice middle school mathematics teachers' obligatory courses vary on the content. Among them, courses related to the pure mathematics, such as Calculus, Discrete Mathematics, and Linear Algebra, are generally in the first and second years of the program. Those related to the mathematics teaching, such as Methods of Teaching Mathematics, School Experience, and Nature of Mathematical Knowledge for Teaching, are generally in the third and fourth years of the program. Courses in the pedagogy domain, such as Introduction to Education, Measurement and Assessment, and Guidance, vary across the years. However, it is possible to claim that the density of these courses is consistent across the years of the program. There are also some other obligatory courses such as Turkish, English, Physics, History and Computer Applications. Apart from obligatory courses, there are several elective courses for preservice middle school mathematics teachers. The common elective courses selected by pre-service teachers are related to the teaching of mathematics such as Mathematics Teaching with Geogebra, Geometry Applications, Hands-on Mathematics Teaching, and Problem-Solving in Mathematics Education.

When preservice teachers graduated from teacher education program, they take multiple-choice examinations, named Public Person Selection Examination (PPSE), to be recruited in public schools. There are three steps in this examination. In the first step, they take an examination that aims to assess their knowledge in Turkish, Mathematics, History, Geography and Citizenship domains. The examination in the second step aims to assess their knowledge on Pedagogy domain. These first steps are common for all the teacher candidates in different subject areas. However, the last step of PPSE depends on the subject area. In this last step, mathematics teacher candidates' mathematics content knowledge, middle school mathematics curriculum knowledge, and pedagogical content knowledge on middle school mathematics topics are assessed. Based on the scores on these three examinations, teacher candidates make choices for the available public schools. However, it should be beneficial to bear in mind that public school teachers

commonly work in suburban and rural schools rather than the urban schools in their first few years.

3.5. Data Collection Tools and Procedures

In phenomenological studies, in-depth interviews are described as the main data collection tool to help researchers to have a better insight of the lived experience of participants (Merriam, 2009; Moustakas, 1994). Similarly, in multiple case studies, interviews are described as the crucial data collection tool, and using multiple data collection tool helps the researcher to explore the issue in a more detailed way (Creswell, 2007). Therefore, two rounds of semi-structured interviews for the phenomenological part of the study and an additional round of interview supported with observations of cases for the multiple-case study part are the main data collection tools of the current study.

Interview questions were developed in line with the conceptual understanding of mathematics teacher identity in the current study (see the section numbered 2.2.5.3 in the Review of Literature Chapter). In the pilot study, interviews with two teachers were conducted. Since all the interview questions were worked in line with the purpose of the study and only slight changes were made on the interview questions, pilot data were added to the data collected in the main study. Therefore, I conducted two rounds of interviews with 11 early career middle school mathematics teachers to answer the first two research questions of the study. In these interviews, how the teachers perceive themselves as mathematics teachers and how they develop these perceptions are the main focus. In other words, these interviews aim to make sense of participants' perceived mathematics teacher identities and the development process of these identities based on their lived experiences. Interview questions were developed based on our conceptual understanding of teacher identity which was explained in detail in the previous chapter. In the first interview, there are questions about their personal characteristics, family background, experiences as a student before participating in the teacher education program, and experiences as a pre-service mathematics teacher in the teacher education program. To have a better idea of the

content of the first interview, some of the sample interview questions are represented in Table 3.6., and all questions in the first interview are given in Appendix A.

Table 3.6. *Sample Questions from the First Interview*

Sub-domain	Interview Question [Probe(s)]
Personal Characteristics	Could you tell me a little about yourself? [Who is P1, what does P1 like, what does not P1 like?]
Family Background	Could you tell me about your family? [Do you have siblings? How was the environment you grew up?]
Experiences as a Student	What are the positive and negative characteristics of your mathematics teachers that you remember?
Experiences as a Pre-service Teacher	When you graduated from mathematics teacher education program, how well did you know about the content that you are currently teaching? Which courses in the teacher education program contributed you most as a mathematics teacher? [Why?]

Second interviews were conducted one week after the first interview. In the second interview, teachers' experiences as in-service teachers are the foci. Therefore, there are questions about their teaching practices, how they perceive themselves a mathematics teacher, and their working communities. The sample questions for the second interview are given in Table 3.7., and all the questions are given in Appendix B.

Table 3.7. *Sample Questions from the Second Interview*

Sub-domain	Interview Question
Teaching Practices	Do you prepare a plan for your math classes? Which resources do you benefit to plan and organize your mathematics lessons?
Identification as a Teacher	As a mathematics teacher, what are your stronger sides? As a mathematics teacher, what are your weaker sides?
Working Community	What do your school administrators expect from you as a mathematics teacher? Do you meet for department teachers meeting (teachers who teach the same subject area, e.g. mathematics teachers)? [How often? What do you talk about in these meetings?]

Apart from interviews with 11 early career teachers, two of them (P5 and P11) were observed for 10 weeks in their working communities. P11 was observed in the Fall Semester of 2015-2016 academic year whereas P5 was observed in the Spring Semester of 2015-2016 academic year. Cases were observed twice a week lasting between 6-8 hours a day. During the observations, I took observation notes by writing down what I have seen about teaching environment, teaching practices, interactions between observed teacher and other teachers; observed teacher and administrators; and observed teacher and students. In the observation notes, personal interpretations of the observations did not take place. However, an observation report was prepared each week including my interpretations about the observed events. Based on the observation notes and reports, questions for the third interview were developed. In order to have a better idea of the observation and the third interview process, these steps are explained individually for two of the cases.

P11 was observed in the Fall Semester of 2015-2016 academic year for 10 weeks. Each week, his lessons to 5th graders in different classes were observed for 6-8 hours a day. Apart from observing his class, I spent time with him in the teachers' meeting room, teachers' lunchroom, and 5th grade class teachers' weekly meetings [called Coaches' Meeting in the working community of P11]. Observation notes during the class hours were written down simultaneously with his teaching in the class. I was at the back of the class and I had no interaction with the students and/or teacher in class time in order not to distract students' attention. Similarly, observation notes related to the 5th grade class teachers' meeting [Coaches' Meeting] were written down during the meeting. At this meeting, class teachers of 5th graders (a Science teacher, an English teacher, and P11), the counselor teacher for middle grades, and school administrator came together once a week. At this meeting, they met at a round table while I was sitting outside of the table and was taking notes simultaneously. However, during the time I spent in teachers' meeting room and teachers' lunchroom, I did not take notes simultaneously not to make them uncomfortable and distort the natural flow of the interaction among them since these times were less formal in nature. The notes related to these times were written down each day

after the observation ended and I left the observation site. Based on all these observation notes and reports, 29 interview questions were prepared to have a better idea of the observed events and interactions. Some of the questions from the third interview of P11 are given in Table 3.8., and all the interview questions are given in Appendix C. It was conducted at the end of the Fall Semester and lasted about one hour.

Table 3.8. *Sample Questions from the Third Interview of P11*

Question
Q3. When you ask a question in the classroom, many of the students raise their hands to answer your question. Sometimes, you select a student who raises his/her finger and sometimes you select a student who does not raise his/her finger to talk. How do you decide on who will answer the question that you asked?
Q11. As far as I observed, when starting a new topic, you ask some questions to your students and want them to talk about the topic. Then, you summarize what they said and introduce and explain the topic. Afterward, you solve questions related to the topic in the classroom. Finally, you give them some homework. Do you agree with my observations? [If you do not agree, could you explain me the reasons for your disagreement? If you agree, what do you think about how you have developed such a teaching practice?]
Q24. I want to learn about your opinions about Coaches' Meeting that is conducted weekly. What do you think about these meetings? Do you think the discussion in these meetings contribute to you as a teacher? [If yes, how? If no, why?] Do you think that your opinions mentioned in these meetings contribute to the other teachers and to the development of school? [If yes, how? If no, why?]

Similar observation procedure was followed for P5 in the Spring Semester of 2015-2016 academic year. Her lessons for 5th, 6^{th,} and 8th graders were followed for 10 weeks. Each week, two days were spent in her working community lasting between 6 to 8 hours a day. During that time, I observed her class teaching, her interaction with other teachers and administrators in the teachers' meeting room and with students in the class. Similar to the procedure followed for P11, in-class notes were written down simultaneously whereas teachers' meeting room notes were written down after the observation site was left. Apart from these observations, I aimed to observe class teachers' meeting and/or department teachers' meeting in her working community. However, I was not able to do it since no such meeting was conducted during my stay in her working community. Based on these

observations, 32 interview questions were prepared for her. Sample questions from the interview are given in Table 3.9., and all the interview questions are given in Appendix C. The interview with P5 lasted about one hour.

Table 3.9. *Sample Questions from the Third Interview of P5*

Question
Q2. When talking about your students, you use the word "my children". What are the reasons for calling them like this? [Do you think that you behave protective for your students?]
Q8. As far as I observed, there is a sequential process in your classes. First, you start a lesson by asking "What have we done in the last lesson?". After your students talk about it, you summarize what they have said. Then, either you start an activity or introduce a daily life situation and enable your students to discuss it. After this exploration process, you solve questions together in the class. Do you agree with my observations? Can we say that this is the general schema followed by you in your math classes? [If you do not agree, could you explain me the reasons for your disagreement? If you agree, what do you think about how do you develop such a teaching practice?]
Q16. Although I observed that you generally use materials and hands-on activities in your classes, such activities seem to be more common in 5th and 6th grades when compared to 8th grades. Do you agree with my observation? [If yes, what might be the underlying reasons for this difference between grade levels? 8th graders will participate in TEOG, does this situation have an effect on the difference between 8th graders and other grade levels?]

3.6. Data Analysis

Qualitative data analysis basically aims to make sense of the data through reducing data into meaningful parts in order to answer the research questions of the study (Merriam, 2009; Miles & Huberman, 1994). In this process, a researcher first needs to prepare data for the data analysis (Merriam, 2009). For the phenomenological part of the study, all the interview questions were transcribed verbatim and sent back to interviewees to be checked. Then, all these interview transcriptions were imported to Atlas.ti qualitative data analysis software. Before starting the coding process, it is suggested to read all the transcriptions in order to make a general sense of the data (Creswell, 2007; Merriam,

2009). Therefore, I read all the interviews without an analytical perspective. After having a general sense of the data, the coding process started.

In the coding process, researchers seek to develop categories that are chunks for the recurring meaning among data (Merriam, 2009). In other words, researchers seek to develop meaning units representing them in order to answer the research questions (Miles & Huberman, 1994). Two common ways in the coding process are open coding method and using the pre-determined codes (Creswell, 2007; Miles & Huberman, 1994). In open coding, researchers develop codes based on their conceptual understanding of the phenomenon while they are coding the data; whereas in the use of pre-determined codes, researchers use the codes developed before the analysis based on the conceptual understanding of the phenomenon or findings in the literature. In the current study, open coding was used since there is no analytical framework on teacher identity which is in line with our conceptual understanding of mathematics teacher identity. A crucial point of open coding is deciding on the unit of analysis, in other words what is being coded (Merriam, 2009). In the coding process, I used "*meaning*" as the unit of data as to be coded. Therefore, any meaningful chunk of statement (e.g., a sentence, several sentences, and a paragraph) about the phenomenon was coded. Concurrently with the open coding process, a codebook was developed which is described as a crucial step to overcome the meaning shifts of the developed codes (Miles & Huberman, 1994). Each developed code was operationally defined in the codebook, and necessary changes were made as the analysis progressed if needed. After coding the data, it was seen that codes in the codebook were sufficient to code the remaining data: in other words, coding process seemed to be saturated. At that step, I discussed the codes developed with the two experts in the mathematics education field. The codebook and some example codes were the focus of the discussion. Based on this discussion, it was decided that the developed codes were appropriate for the data set and our conceptual understanding of teacher identity. Therefore, I continued to the coding process by benefitting from the codebook developed and a few new codes were added to the codebook based on the coding of the rest of the data. Some examples for the codes are given in Table 3.10.

Table 3.10. *Sample Codes from Data Analysis*

Code	Coded Part
Beliefs about Mathematics Teaching: The Role of Learner-Centered Approaches	Mathematics cannot be taught by asking students to memorize the things. […] it cannot be taught with direct instruction. It should be taught with enriching the instruction with different methods in which students get directly involved […] Therefore, I did not use direct instruction in my classes, rather used different methods (P3)
Experiences in Prior Communities: Choosing the Profession: Having a Role Model Teacher	[…] I still talk with my Physics teacher [from the high school]. He was the reason why I wanted to be a teacher. (P5)
Experiences in Prior Communities: Negative Mathematics Teachers: Behaviors	I did not like one of my high school mathematics teachers. It was not related to how he taught; it was related to how he behaved to us. […] He was always angry with us and all of us were afraid of him. (P2)
Experiences in Teacher Education Community: Content Domain: Sufficient	[When I graduated from the teacher education program] I was quite knowledgeable [on the content]. I had never experienced a problem related to the content. We had been trained very well about it in the methods courses. I had no lack of content knowledge when I graduated. (P6)
Experiences in Teacher Education Community: Professional Participation Domain: Insufficient	[When I graduated from the teacher education program] I did not have knowledge about the professional conditions in the schools. We took practicum course, but we mainly focused on the teaching practices of the practicum teacher. We overlooked the context. I mean, we did not know about the school administrators and their expectations from a teacher since we did not interact with them. (P7)
Experiences in Working Communities: Lack of Mutual Engagement: Among Mathematics Teachers	[…] We only talk about daily life issues like hello, how was your weekend. But, we do not have interaction as teachers of mathematics. We do not have a professional collaboration. (P8)
Identification as a Teacher: Teaching Mathematics: Teacher-Centered Methods	Unfortunately, I use the traditional methods. I teach and then I write questions on the board. First, they work individually and then, one of them come to the board and solve the question. In general, it is like this. (P2)

After my coding process ended, a second coder coded the randomly chosen 2 participants' interviews—4 interviews that are approximately 18 per cent of the all interview data. Before she started the coding process, the developed codebook was introduced to her and a detailed discussion on the use of codes took place. The second coder is a Ph.D. student in the field of mathematics education who works on pre-service teachers' mathematics teacher identity. Therefore, it is possible to claim that she has a sufficient knowledge of the concept of mathematics teacher identity, and mathematics teacher identity development process. In her initial analysis, there was an 88 per cent agreement on the codes. Disagreements on the coding were discussed until the full agreement was reached. Furthermore, the remaining data—interviews of the other 9 participants and observation notes of 2 cases—with my initial codes were given to the second coder. Because of the available time limitations, she did not individually code, but she checked the appropriateness and consistency of my codes for the remaining data. In this process, our disagreements on the remaining coding were discussed and solved.

3.7. Trustworthiness

The quality of a research study is highly dependent on how honestly and accurately data collection and analysis are held, and the findings are presented (Merriam, 1998). These criteria are regarded as "validity and reliability" measures in quantitative research studies (Fraenkel & Wallen, 2006). However, "*validity does not carry the same connotations in qualitative research as it does in quantitative research, nor it is companion of reliability*" (Creswell, 2009, p.172). Therefore, qualitative researchers use a different terminology than the quantitative researchers such as credibility (Eisner, 1991), trustworthiness (Lincoln & Guba 1985; Merriam, 2009), and qualitative validation (Creswell, 2007). In the current study, I used the term "*trustworthiness*" to describe the procedures in order to increase the quality of this work.

Although the used terminology in the literature differs, there are common strategies to improve the trustworthiness of a qualitative research. One of the most common suggested

strategies is giving rich and thick descriptions throughout a qualitative research study (Creswell, 2007; 2009). Merriam (2009) describes giving rich and thick descriptions as a procedure to provide detailed explanations about how the participants are selected, in which context the research study is conducted, how the analysis is performed, and how the findings are revealed. In line with this suggestion, I aimed to give detailed explanations about each procedure followed in the current study, such as presenting the conceptual understanding of mathematics teacher identity in the current study via analyzing commonly used theories and frameworks in the literature, giving detailed explanations of participant selection and data analysis procedures, and supporting the explored findings with detailed quotations.

Another suggested strategy is the use of triangulation. Triangulation might be using multiple data sources, investigators, and data collection methods (Creswell, 2007; Merriam, 2009). In order to answer the 3rd and 4th research questions of this study, both interviews and prolonged observations were conducted, and this could be interpreted as an attempt for the triangulation of data. Furthermore, there was a second coder who coded some of the collected data and checked the accuracy of my coding based on the developed codebook.

In selecting participants of a qualitative research study, using maximum variation which means "*purposefully seeking variation or diversity in sample selection to allow for a greater range of application of the findings by consumers of the research*", is suggested (Merriam, 2009, p. 229). Although a phenomenological study requires some commonalities in experiences of participants (such as being an early career mathematics teacher and graduated from the same teacher education program), there was a variation among participants in the current study in terms of different variables such as the school size, year in the profession, the success of students, gender, and the area of the working community.

In qualitative research studies, having an external auditor who provides objective judgments about the procedures followed throughout research study increase the trustworthiness of the study (Creswell, 2007; Merriam, 2009). Throughout the current study, debriefing sections with Dr. Van Zoest—who developed the Mathematics Teacher Identity Framework with Jeffrey V. Bohl—and with my committee members were held. Therefore, they could be considered as external auditors for the current study.

One of the most important aspects of a qualitative research is clarifying the researcher's role which is also considered as a crucial step in the trustworthiness of the study (Creswell, 2007; Merriam, 2009). As the researcher of the current study, I know each participant in the current study since I worked as a graduate assistant in the teacher education program from which participant teachers graduated. This might cause researcher bias since I have previous knowledge about the participants, and this knowledge might affect how I interpret the obtained data. In order to eliminate this threat, I use numbers (P1_I1) to store the obtained data and conducted the analyses via using these documents. On the other hand, there was a possibility of respondent bias that occurs when participants share the desired responses for the researcher rather than their actual views (Creswell, 2007). The teacher education program from which participant teachers were graduated aims to provide sufficient experiences in helping pre-service mathematics teachers to develop reform-oriented mathematics teacher identities. Since I was a part of that teacher education program, I shared this purpose as well. Therefore, participant teachers might indicate their positive experiences in the teacher education program rather than their negative experiences and they might mention about their reform-oriented practices even if they do not perform such practices in their mathematics teaching practices. However, the findings of the current study indicated that all the participant teachers shared their positive and negative experiences related to the teacher education program in which I worked at the time of the study. Furthermore, they talked about their both reform-oriented and traditional mathematics teaching practices. Therefore, I assumed that respondent bias was not an issue for this study, and the participants shared their honest views with me throughout the data collection process.

CHAPTER 4

FINDINGS

In this chapter, the findings for the following research questions are presented:

1. What are the perceived mathematics teacher identities of early career middle school mathematics teachers?
2. What are the factors that influence early career middle school mathematics teachers' perceived mathematics teacher identities?
3. To what extent is there a consistency between two early career middle school mathematics teachers' perceived and actualized mathematics teacher identities?
4. How do working communities with different characteristics affect early career middle school mathematics teachers' mathematics teacher identity development process?

There are two main sections in this chapter. In the first part, 11 early career mathematics teachers were in the focus in order to answer first two research questions of the study. First, these teachers' experiences contributing to their teacher identity development are explained in detail. These experiences are described in three periods: (1) experiences before the teacher education community, (2) experiences in the teacher education community, and (3) experiences in their working communities. After describing these experiences, their mathematics teacher identities and influential factors on these identities are explored in order to answer the first two research questions. Note that even if identity and teacher identity is related to each other, there was a distinction between these two constructs in explaining the influential factors of mathematics teacher identity: Identity is used when characteristics that are not directly related to the teaching profession, and teacher identity is used to describe teaching-related characteristics.

In the second part of this chapter, the focus is on two early career middle school mathematics teachers, who are P5 and P11, in order to answer the third and fourth research questions of the study. In this part of the chapter, the observations and interviews of two cases are used to illustrate the effects of working communities on the teacher identity development process and, the consistency between the perceived and actualized teacher identities.

4.1. Experiences of Early Career Mathematics Teachers during Their Mathematics Teacher Identity Development

In order to explore the essence of phenomena, it is essential to explain in detail what is experienced in common by the participants (Creswell, 2007; Moustakas, 1994) which are, in this case, the early career middle school mathematics teachers' experiences in their mathematics teacher identity development process. In the current study, these experiences were revealed through two rounds of interviews that were conducted with 11 early career middle school mathematics teachers. Certain similarities have helped me to organize the findings in this part of the study. First, all the participant teachers graduated from the same teacher education program. Therefore, they had the same teacher education program communities. Next, the analysis revealed that participants had several common experiences. These commonalities in experiences are given based on the three time periods: (i) experiences before the teacher education community, (ii) experiences in the teacher community, and (iii) experiences in the working community. Using these three time periods is also in line with the conceptual understanding of teacher identity development in this study. As explained in Chapter 2, teacher identity development starts even before entering the teacher education program and continues lifelong. After exploring their experiences in these time periods, what they developed as their mathematics teacher identities and how they developed them are explored in order to answer the first two research questions of the study.

4.1.1. Experiences before the Teacher Education Community

The experiences in this period covered participants' experiences in communities prior to participating in the teacher education community. These prior communities include their families and their elementary, middle and high school communities including their teachers and classmates. The experiences in these prior communities were explored in order to reveal how they were as students, why they decided to be a middle school mathematics teacher, what they remembered about their own teachers, and how mathematics was taught to them.

All the participants described themselves as successful students in general and in mathematics specifically: *"I was a hardworking student who was always sitting in the front desk in the class"* (P2_I1)[1]. They stated that they developed positive attitudes towards mathematics. Mathematics was either their favorite course or among their favorite courses.

> *While most of the other students were struggling with mathematics, I always loved to work on numbers and deal with mathematics*[2]. (P3_I1)

> *I always loved mathematics. Even, I participated in Math Olympics when I was in the middle school.* (P4_I1)

When referring to their experiences in their mathematics classes in elementary, middle and high school levels, they mentioned being taught mathematics with teacher-centered methods. Their teachers were responsible for explaining the topic and students were responsible to practice on the questions related to the topic.

> *The teacher was explaining the topic and we were taking notes. It was all like this.* (P1_I1)

[1] In this abbreviation, P2 indicates the identity of the interviewee (Participant 2) and I1 indicates where the quote comes from (1st interview).

[2] All the interviews are held in Turkish, thus the quotations are translated into English by the researcher. During the translations, the researcher aimed to translate what the interviewee said without altering the meaning and these translations were checked by the advisor of the researcher.

> *In all levels, the teaching way was traditional. First, the teacher explains the topic and then we solve questions.* (P6_I1)

When they were asked to remember their experiences with their teachers, they generally stated the experiences with their mathematics teachers rather than their teachers from other disciplines. Although they sometimes referred to their teachers in different disciplines, they remembered more about their mathematics teachers. These experiences were sometimes related to their teachers' teaching practices which were interpreted as negative or positive by the participants. For instance, P1 recounted her middle school mathematics teacher positively.

> *He had a good knowledge of mathematics. […] When he enters the classroom, everybody stops talking thanks to respect for him. He was also explaining the topic well.* (P1_I1)

On the other hand, P5 mentioned about one of her high school mathematics teachers' negative teaching practices.

> *He had the knowledge but he was not able to explain it to the students. He was like whispering in the class while trying to explain the topic. Even if we listened to him, nobody could understand. He was not an effective teacher.* (P5_I1)

They referred to their teachers' behaviors towards them more than their teaching practices. Although participants mostly remembered their teachers' positive behaviors, they also mentioned negative behaviors.

> *When we needed them, they were ready to help, they never said "no" to us. […] They saw us as their children and were always kind-hearted to all the students.* (P7_I1)

> *I did not like one of my high school mathematics teachers. It was not related to how he taught; it was related to how he behaved to us. […] He was always angry with us and all of us were afraid of him.* (P2_I1)

When participants were asked about how they decided to be middle school mathematics teachers, it was noticed that there were two types of experiences. The first type of experience was related to the experiences of participants who already aimed to be a

mathematics teacher. For half of the participants, being a mathematics teacher was the primary purpose for them and they were successful at it: "*Starting from the elementary school years, I always liked mathematics and decided to be a mathematics teacher in these years"* (P8_I1).

The second type of experience was related to the ones whose primary aim was not to be a mathematics teacher. Interestingly, all these participants indicated that entering the medicine programs was their primary aim. Although being a doctor was their primary purpose, being a mathematics teacher was mentioned among their alternative purposes. Therefore, even for these participants, mathematics teaching profession cannot be described as a profession that was undesirable for them. When participants were asked about the underlying reasons for their primary purpose as being a doctor, they commonly mentioned the social status of the profession. Medicine is a socially desirable profession in the Turkish context. Since the participants were successful students, they were expected to choose a profession which was highly appreciated in the society. However, students in Turkey who graduated from high schools take the university entrance examination and based on the scores obtained from that examination they choose the university and program in order to pursue their education. Participants who aimed to be a doctor; could not get the necessary score at the university entrance examination, and thus, they chose to be a mathematics teacher as it was their alternative.

> *[Being a mathematics teacher] was my plan b. […] Going to the faculty of medicine was my main purpose. However, my university entrance examination score was not enough for it […] Thus, I chose to be a mathematics teacher.* (P1_I1)

Even if the participants participated in different communities before their participation in the teacher education community, the nature of their communities have similarities which resulted in similar experiences in this period. Participants' positive relationships with mathematics—both in terms of success and attitude—and their teachers' behaviors and teaching practices were the most commonly mentioned experiences for this period.

4.1.2. Experiences in the Teacher Education Community

All the participants had been trained for the mathematics teaching profession in the same teacher education program. This section focuses on their experiences in the teacher education program community. Specifically, their experiences related to the development of beliefs, intentions, and knowledge on content, curriculum, didactics, pedagogy, and professional participation domains were documented.

4.1.2.1. Content Domain

All but one participant described their experiences in the teacher education community as sufficient on the content domain. They felt confident on the content knowledge for the requirements of mathematics teaching profession.

> *After graduation, I felt highly efficacious since I had a very good training during my undergrad years. […] I had a good knowledge of content because we were trained in that way. We talked and discussed every detail. Therefore, I highly believe that I was good in content when I graduated.* (P3_I1)

> *[After the graduation] I had a good content knowledge. Now, I compare myself with other mathematics teachers and think that I am more knowledgeable than them.* (P8_I1)

These teachers also mentioned that the method course(s) in the teacher education program helped them to see the mathematical content of middle grades from a different perspective, which was more conceptual than they learned in the middle grades.

> *[…] In the elementary and middle school years, we only tried to memorize the things, there was no justification for the knowledge. However, in the university, we began to justify what we have learned, where the facts come from. I remember many times in the method class that we were surprised to learn the underlying reasons of the mathematical facts.* (P3_I1)

4.1.2.2. Curriculum Domain

When the focus was on their experiences related to the curriculum domain, most of the participants indicated that they had sufficient knowledge in the teacher education community. They mentioned that they were trained well on the curricular domain and felt efficacious on this domain when they were graduated.

> *[Methods course instructor] insisted that we learn the curriculum well. I did not have trouble [in the profession]. For sure, in-service years helped me to improve [the curricular knowledge], but I did not have anxiety about [the curriculum]. I already knew it.* (P5_I1)

On the other hand, there were a few participants who described their experiences related to the curriculum domain as moderately sufficient. These participants mentioned that they gained curricular knowledge in the teacher education community for the mathematics teaching profession, but they still did not feel highly efficacious on this domain when they graduated.

> *[…] I cannot say that I had a very detailed [curricular] knowledge. We worked on it and learned about which subject is taught in which year. […] I had a general knowledge but not in a detailed way.* (P2_I1)

4.1.2.3. Didactics Domain

Participants' experiences related to the didactics domain showed similarities with their experiences in the content and curriculum domains. All but one participants claimed that their training for the didactics domain was sufficient enough to gain the necessary knowledge for the methods of teaching mathematics required for the mathematics teaching profession.

> *In the university, we learned the methods [to teach the content] in method courses and in some other elective courses. We learned how we can make the abstract content concrete. I am the only one who graduated from [the name of the university] and I compare myself with them. I am definitely better than them [in terms of the didactical knowledge].* (P9_I1)

[…] In the method courses, we did not only focus on what methods can be used to teach but also focused on how the underlying reasons for the knowledge can be given. I mean we learned the method to be used and we learned how not to give the knowledge through memorization. Therefore, these courses were milestones for my teaching career. (P3_I1)

4.1.2.4. Pedagogy Domain

Participants did not interpret their experiences for the pedagogy domain to be as sufficient as their experiences in content, curriculum and didactics domains. Most of them described their experiences in the teacher education community related to the pedagogy domain as moderately sufficient. For instance, P1 mentioned her lack of knowledge of students by stating:

[Referring to her knowledge about middle school students] I had some knowledge based on the practicum experiences. However, in the profession, I realized that I did not know enough and most of my [current] knowledge [of students] comes from the experiences in the profession. (P1_I1)

Similarly, P2 did not feel highly competent on pedagogy domain and gave example about the classroom management.

I had [the theoretical] knowledge since we took many courses such as classroom management. […] I try to apply what we have learned in that course but cannot say that I am successful […]. (P2_I1)

4.1.2.5. Professional Participation Domain

Participants mentioned that the least sufficient experience in the teacher education community was on the professional participation domain. They commonly stressed that they did not have enough knowledge and/or experience about the communities where they will be working after the graduation. Teacher recruiting system for the public schools is based on a general examination (PPSE) and teachers are recruited based the scores in that examination. P2 referred to this examination and indicated that:

I did not know where I was going to be recruited. I had an idea but there is a great variety of the schools in Turkey. Now, I talk to my friends from the teacher education

> *program and realize that we are working in very different schools. Now, I am working in a small town. It would be different if I was working in a big city school or in a rural school. Therefore, I had no idea before.* (P2_I1)

Although being recruited for a private school is different than being recruited for a public school, P11 also mentioned about his lack of knowledge in the professional participation domain.

> *I did not have knowledge on this issue [the professional conditions of the schools]. Because you do not know in which school you are going to work. […] I did not know about the professional environment of the school.* (P11_I1)

Participants also mentioned their lack of practice in the teacher education community in their training for different domains—didactics, pedagogy, and professional participation—of mathematics teaching profession. Even if they described their experiences for these domains with different sufficiency levels, they commonly mentioned that they could not get enough chance to practice what they have learned in the teacher education community. For instance, P7 underlined how beneficial methods courses were for her, but then added: "*[…] I wish we had a chance to practice in real schools, at least once a month. The practice part should not be left to the practicum courses"* (P7_I1).

Similarly, P9 mentioned how sufficient she felt in terms of the knowledge gained in the teacher education program but also stressed her lack of practice.

> *[…] I always felt that I am one step ahead of my colleagues. However, even if I graduated from a successful university, we had a lack of practice. Practicum courses only help you to a degree.* (P9_I1)

P3 also mentioned this lack of practice, specifically focusing on the pedagogy domain.

> *I wish we had a class to practice what we have learned in classroom management course. […] I think it would be more beneficial if there was a chance to practice. […] Similarly, in guidance course we could go to RAM [the center for the rehabilitation activities] and observe the inclusive students. We could get more information about these students by talking to the experts in the RAM […].* (P3_I2)

4.1.2.6. Beliefs and Intentions

Although, so far, participants' experiences were mostly explained based on their knowledge development on the different domains of mathematics teaching profession, their experiences in the teacher education community were not restricted to the knowledge development. They also developed beliefs and intentions related to mathematics teaching based on their experiences in the teacher education community. They commonly mentioned that they experienced mathematics in a learner-centered way in the teacher education community which seemed to influence their beliefs and intentions regarding teaching mathematics. In other words, although their experiences regarding mathematics teaching and learning were more aligned with teacher-centered ways in the prior communities, their participation in the teacher education community provided them with more learner-centered experiences in mathematics teaching and learning. These experiences seemed to cause them to develop reform-oriented beliefs. For instance, P3, who interpreted methods courses as milestones to broaden her perspective for teaching mathematics, shared her beliefs and intentions about mathematics teaching by stating:

> *Mathematics cannot be taught by asking students to memorize the things. […] it cannot be taught with direct instruction. It should be taught with enriching the instruction with different methods in which students get directly involved […] Therefore, I did not use direct instruction in my classes, rather used different methods.* (P3_I1)

Similarly, P5, who indicated that conceptual understanding should be the core of mathematics teaching, mentioned that the courses she took at the university shaped her mathematics teaching vision.

> *The courses I took at the university, specifically methods, material development [instructional technologies and material development], and practicum courses were highly effective on me. They are the main factors for my current mathematics teaching.* (P5_I2)

In brief, participants' experiences in teacher education community indicated that they developed relatively more sufficient knowledge on content, curriculum, and didactics

domain, and relatively less sufficient knowledge on pedagogy and professional participation domains. Regardless of the domains, they did not have enough experiences to put their theoretical knowledge into practice in real school environments. Yet, their experiences in the teacher education program seemed to help them to see the significance of creating learner-centered environments in mathematics teaching, as evidenced in their belief and intention statements related to mathematics teaching and learning.

4.1.3. Experiences in the Working Communities

After graduating from the same teacher education program, participants started to work in different working communities. Participants' description of their working communities differed in terms of the physical conditions and students' achievement level (see Table 3.1. in the Methodology Chapter). Although participants' working communities differed in nature, they had several common experiences in their in-service years. The most commonly mentioned experience was the mismatch between their experiences in the teacher education community and their current working communities. This mismatch occurred in didactics, pedagogy, and professional participation domains. For instance, P10 stressed the difference between the shared repertoire of his teacher education community and his working community, and how this difference affected his mathematics teaching.

> *In the practicum, we developed and implemented the activity by the work of three people [referring to his group mates in the practicum course]. There were 20 students in the class, each class had a smart board and projector. […] Now, I have a class of 40 students and I am alone to do all the things. I do not think that the activities we applied can be applied to classes with 40 students.* (P10_I1)

In a similar vein, P4 mentioned about the lack of support in her working community and how it affected her ability to implement mathematics teaching methods she had planned at the university.

> *When I was at the university, I was planning to benefit from different activities when I start teaching. However, in the profession, I realized that it was not that possible. The expectations of your administrators and parents push you to use more traditional methods.* (P4_I1)

Likewise, P7 stressed that her knowledge of students and educational context did not match with her expectations she developed in the teacher education community.

> *I was expecting more homogeneous classes. It is easier to teach in homogeneous classes. However, in public schools, the classes are very heterogeneous. I mean some of them [the students] are really good, but some of them even do not know reading.* (P7_I1)

Similarly, P8 and P9 stated that their knowledge of students in the teacher education community did not match with their experiences in their working communities. They indicated that practicum courses were not sufficient to gain this knowledge.

> *I did not see students who are highly unmotivated to learn in my practicum. Because we went to the practicum experience in relatively better schools.* (P8_I1)

> *In the practicum, you do not exactly know the student—you do not know what the student can or cannot do. […] But, in the profession you begin to understand [the students] better.* (P9_I1)

Furthermore, participant teachers indicated that the professional environment they have experienced in the teacher education community differed from the professional environment in their current working communities. P10 compared the working habits of teachers.

> *[In the practicum school which was a private school] teachers were working hard and they were conducting meetings regularly. Nevertheless, here [in his working community], teachers are more relaxed.* (P10_I1)

Similarly, P3 mentioned the difference between her practicum school and her working community.

> *[In the practicum school] there was no lack of teaching materials. There were smart boards, all the materials were ready to be used. Teachers were working hard, and parents were interested in their children. But in my school, the conditions are exactly the opposite […].* (P3_I1)

This difference was also mentioned by P8, and she wished she had gone to practicum schools that have a professional environment like her current working community.

> *The reality might be totally different than the ideal conditions. [When you face with the real conditions] you get disappointed. I wish I had gone to a bad school [for my practicum] and see the [professional] conditions, to see how the teachers and students behave.* (P8_I1)

Participant teachers commonly mentioned emotionally negative experiences in their working communities. For instance, P10 stressed the negative impact of her working community's expectation from her.

> *High expectations make me stressed. They think that I am capable of everything. They expect me to do administrative works when the administrators are gone, they expect me to teach English when the teacher is gone. These expectations are negatively affecting me.* (P10_I2)

Having a perceived teacher identity that is different from the other teachers in the working community also led to negative emotions in some participants. For instance, P5 mentioned that she feels alone in her working community.

> *I do not feel valued in my school. However, when I go to [professional development programs], I meet with people who appreciate my work and also, I appreciate their work. I know that teaching is not a profession as it is [perceived] in my school and I need to go those kind of places [professional development programs] to see the ideal teaching.* (P5_I2)

Similarly, after explaining her student-centered teaching methods P7 indicated:

> *My activities are appreciated by students but not by administrators and other teachers. My activities are not fitting into their teaching schemas. Their criticisms are making me feel bad.* (P7_I2)

When these negative emotions arouse continuously, they might even lead to quitting the profession: "*[…] All such things affected me negatively. Even if I like teaching so much, I am getting closer to the end of my teaching career"* (P7_I2).

Based on participant teachers' descriptions of their working communities, it seems that all but one working communities—the exception is the working community of P11 and will be explained in detail in the further parts of the study—did not meet the criteria to be a community of practice (CoP). That is, in these communities, there was a lack of mutual

engagement, joint enterprise and shared repertoire which are the dimensions of a CoP (Wenger, 1998). In the national context, teachers from the same department are required by the Ministry of National Education to meet regularly—department teachers' meeting—in order to improve the mutual engagement among teachers. However, participant teachers indicated that these meetings were not efficient to provide mutual engagement for them.

> *In our school, department teachers' meeting is not held effectively. […] There is no one in the department teachers' committee to ask for suggestions*. (P8_I1)

> *[…] department teachers' meeting began at 1 pm and finished at 1.10 pm. I mean it was that kind of meeting.* (P1_I2)

Similar to the lack of mutual engagement among mathematics teachers, there is lack of mutual engagement between administrators and teachers. For instance, both P1 and P5 mentioned that they asked the school administrators to gather the material to be used in mathematics classes, but could get the support from the administrators.

> *The only thing the administrator needs to do is to write a petition to the Ministry of National Education. I cannot write the petition, the administrators should write it since it is the formal procedure. He did not write it even if I requested for several times.* (P5_I1)

> *I had a problem to get the material for the classes. I communicated with the administrators, but they did not help me.* (P1_I1)

The lack of shared repertoire for learner-centered activities was commonly stated by the other participants as well. The teachers who wanted to use them developed their own ways to overcome this issue.

> *I do not have any material. Sometimes, I buy them on my own and use in my lessons.* (P7_I2)

> *[…] because we do not have 3-D shapes as a material I am developing these shapes by myself.* (P3_I1)

Furthermore, participant teachers' descriptions of others'—administrators' and teachers'—teacher identities in the working community did not seem to support

development of reform-oriented teacher identities. For instance, P7 indicated that the appreciated teachers were the authoritarian teachers in her working community.

> *There are highly experienced teachers in my school and school administrators suggested me to observe their classes. I always try to benefit from the experienced ones. […] However, her methods were so ineffective. Students are counting the minutes to get out of the classroom.* (P7_I1)

Similarly, P1 and P9 indicated that most of their colleagues applied traditional methods in their classes.

> *[…] all the other teachers are just using the traditional ways. They lecture and do exercises. I did not see any different practices yet.* (P1_I2)

> *[…] they are using teacher-centered methods. They want students to take notes and solve as many questions as possible.* (P9_I2)

In brief, the different working communities participants worked did not seem to support their development of reform-oriented teacher identities. The most common experience explored in their working communities was the mismatch between their experiences in the teacher education community and their working communities. Furthermore, negative emotions felt in the working community, and limited mutual engagement and shared repertoire were also commonly mentioned by the participant teachers.

4.1.4. Developed Mathematics Teacher Identities

Participant teachers' perceptions of their experiences in the mathematics teacher identity development process are explained in the previous section and it is seen that they shared several common experiences in this process such as being taught mathematics with teacher-centered methods when they were students, having good relationship with mathematics, intentional choice of mathematics teaching profession, and meeting with learner-centered methods of teaching mathematics in TEC. However, the same experiences might be interpreted in different ways which might lead to developing different teacher identities. I described these experiences in detail because they are the

basis for answering the first two research questions of the study. In this section of the study, the focus is on exploring what kind of teacher identities the participant mathematics teachers developed based on their experiences so far. In other words, I aim to answer the first research question of the study:

1. What are the perceived mathematics teacher identities of early career middle school mathematics teachers?

Teacher identity is considered to be at the core of the teachers' teaching-related actions (Battey & Franke, 2008; Bjuland, Cestari, & Borgersen, 2012; Oslund, 2016; Sfard & Prusak, 2005). Therefore, in order to have some ideas on the participant teachers' mathematics teacher identities, I decided to concentrate on their teaching-related practices. Furthermore, their beliefs and intentions related to mathematics teaching are also the foci for categorizing the developed mathematics teacher identities of participant teachers. Two categories of teacher identities in the participant teachers emerged from the analysis: *Traditional-Practice Mathematics Teacher Identity* and *Hybrid-Practice Mathematics Teacher Identity*.

4.1.4.1. Traditional-Practice Mathematics Teacher Identities

In the current study, Traditional-Practice Mathematics Teacher Identity is used to describe teachers whose professed experiences implied the use teacher-centered mathematics teaching methods. The reasons for such practices might differ for the teachers in this category. Seven out of 11 teachers were categorized as having *Traditional-Practice Mathematics Teacher Identity*: P1, P2, P4, P6, P9, P10, and P11.

Teachers whose identities were described in this category mainly used teacher-centered approaches in their classes which was neither in line with their training in teacher education community nor with the national mathematics education policy. Some of the teachers mentioned that they tried to apply reform-oriented methods in their classes but

failed for some reasons. This failure seemed to lead them to move to teacher-centered approaches in their further practice. The following quotes illustrate this failure:

> *I tried to apply the activities that we developed at the university. I modified these activities and used them in the class. However, the number of the students in my class was between 43 and 45. Thus, I failed even if I tried a few times. Now, I do not use activities.* (P10_I1)

> *I do not prepare and use activities […] In the last years I tried to apply but this year I did not try, I gave up.* (P4_I2)

> *I want to use activities in which students explore things. I tried a few times, but I failed. Because students were not used to doing such activities, and they wanted the teacher to give the information to them. Otherwise, they panicked.* (P2_I2)

On the other hand, some of the teachers did not even mention about their attempt to apply reform-oriented approaches in their classes. They either described themselves as traditional teachers— the teacher is responsible to present the knowledge and students are supposed to practice as much as to learn—or described their teaching practices in the following way:

> *I am using the traditional ways […] In general, I am using the questioning method. I do not use activities. Rather, I try to explain the logic of the things—why it happened, where (the formula) comes from.* (P6_I2)

> *First, I check where we left in the last lesson. Then, I inform students about what I am going to explain that day and share my plan with them. When I share the plan with them they listen to me more carefully*. (P9_I2)

These teachers' beliefs and/or intentions about teaching and learning of mathematics are generally in line with reform-oriented approaches, whereas their teaching practices do not match with these beliefs and intentions. Therefore, the mismatch between beliefs and actions are commonly detected for these teachers. They mentioned that this mismatch was a result of the characteristics of their working communities and/or classroom communities. Mainly, they either described their working communities as unsupportive for reform-oriented practices (e.g., limited shared repertoire for reform-oriented methods) or their students as not being used to reform-oriented activities before. The reasons

provided by these teachers for the mismatch between their beliefs and/or intentions and their teaching practices are illustrated as follows:

> *I would like to use group work and I would like to use materials since most of the topic is abstract for students. Nevertheless, using materials and group work cause to lose the control of the class. I wish students were more used to do group work and use materials. Instead, they use these times to disrupt the lesson.* (P6_I2)

> *I wish to use more student-centered approaches but the intensity of the curriculum and the conditions…I am teaching in classes with 36-38 students […] These conditions affect me a lot.* (P9_I2)

Furthermore, teachers who developed Traditional-Practice Mathematics Teacher Identity commonly stated that students and/or parents have the leading role in students' mathematics learning. Therefore, they indicated that even if they did their best as a teacher, some of their students did not learn mathematics well.

> *Every lesson I teach the topic, but they come to the next class by forgetting everything I taught. Therefore, in the next lesson, we repeat the same things to remember. They are forgetting because they do not work at home on what they learned at school. Parents are also complaining about that. […] I believe that parents do not create the environment to enable students to work at home, and thus, students forget everything they learned.* (P1_I1)

In summary, teachers who developed Traditional-Practice Mathematics Teacher Identity expressed that they applied teacher-centered approaches in their classes because of some reasons. They often mentioned about the conditions in their working communities while explaining the reasons for their mathematics teaching methods. Based on their professed experiences, their working communities cannot be described as supportive communities—with the exception of the working community of P11—to develop reform-oriented teacher identities, and thus, these teachers stated that they gradually oriented towards teacher-centered approaches. However, how they would conduct their teaching practice had they been in supportive communities remains unknown.

4.1.4.2. Hybrid-Practice Mathematics Teacher Identities

The term of "hybrid" is borrowed from NorBa Research Project (see NorBa Project at https://norbal.wordpress.com/?s=resear) which used the teacher identity categorization of Beijaard, Verloop, and Vermunt (2000). Beijaard and his colleagues (2000) categorized teacher identity in three categories: *Teacher as subject matter expert*, *teacher as pedagogical expert*, and *teacher as didactics expert*. However, in NorBa Project, it is seen that a teacher might have expertise in more than one aspect. For instance, a teacher might be both subject matter expert and pedagogical expert at the same time. For such teachers, they proposed the term "*Hybrid*" (e.g., Haser, Arslan, & Çelikdemir, 2015).

Although I borrowed the term from NorBa Research Project, the use of hybrid differs in the current study. I use *Hybrid-Practice Mathematics Teacher Identity* to describe teachers who have teaching practices, beliefs, and intentions both in line with the reform-oriented norms and traditional norms. In other words, these teachers are both resisting to the traditional norms by trying to apply learner-centered approaches in some cases and complying with the traditional norms by using teacher-centered approaches in some other cases. Four out of 11 teachers were categorized as having *Hybrid-Practice Mathematics Teacher Identity*: P3, P5, P7, and P8.

In the current study, the critical issue for the difference between two different teaching approaches seemed to be the grade level. In 5^{th}, 6^{th}, and 7^{th} grades, these teachers tried to apply reform-oriented approaches in their classes. However, in the 8^{th} grade mathematics teaching, they used teacher-centered approaches. Although the practices of these teachers differed based on the grade level, the underlying reason of the difference was the educational policy that regulated the transition from middle school to high school. In the 8^{th} grade level, there is an examination called TEOG (The Examination for the Transition from Elementary Education to Secondary Education). These teachers believed that students needed to get prepared for this examination through developing the practice of solving as many multiple choice questions correctly as possible in a limited time.

Therefore, when they taught in 8th-grade classes, their teaching practices, beliefs and/or intentions were aligned more with teacher-centered ways. In this grade level, working communities' expectations became more prominent for teachers and they chose to comply with these expectations. However, they were able to resist to these expectations in the lower grade levels and continued to apply learner-centered activities. For instance, what P3 said illustrates how two different types of teaching were possible for the same teacher.

> *My teaching in 7th grade and 8th grade differs from each other. In the 7th grades, I am using activities to enable students to explore the concepts via such activities […] I really like to use the activity-based approach in 7th grades. […] In the 8th grade, I do not implement any activities. […] I am trying to help them practice as much as possible before TEOG. Thus, we are solving questions as much as possible. […] I am not happy to implement such a method in 8th grades, what I really wanted to implement is the method I used in 7th grades.* (P3_I2)

In a similar vein, the following two quotes illustrate that teachers tended to apply teacher-centered approaches in 8th grades even if they prefer reform-oriented approaches in the lower grade levels.

> *TEOG affected me a lot in 8th grades. Students wanted to solve questions as much as possible since they wanted to practice [for the exam] and we mainly solved questions in their lessons. In the 6th and 7th grades, I am implementing so many activities but in the 8th grade, I could only apply half of what I did in 6th and 7th grades.* (P7_I2)

> *In the lower grade levels, my teaching is mostly activity-based. But in the 8th grade, it is mostly based on practice. How to approach and solve different types of questions is my focus. Because there is an exam they will* take. (P8_I2)

Although the characteristics of working communities for both teachers who developed Traditional-Practice Mathematics Teacher Identities and Hybrid-Practice Mathematics Teacher Identities seemed to be similar, the developed teacher identities differed. This difference led me to explore what made teachers in this category different than the teachers in the first category. Teachers in this category either developed a good repertoire for reform-oriented methods in the teacher education program and/or they continued to participate in communities in line with the reform-oriented teaching (such as professional development programs and conferences). For instance, P5 mentioned that she felt the lack

of colleagues who had similar teaching-related ideas with her in her working community and she tried to fill this gap through interacting with mathematics teachers out of her working community.

> *I often go to seminars, conferences, and workshops related to education. I ask other teachers about their ways of teaching mathematics and they also ask me about that. In these seminars and conferences, we have very beneficial conversations and interactions. Furthermore, I am also interacting with other mathematics teachers in my master's program.* (P5_I2)

Furthermore, P7 stressed how her experiences in the teacher education program helped her to apply learner-centered activities in her classes.

> *During the teaching practicum, I developed daily plans for every single objective in the curriculum. I mean, now I have 400-500 daily plans as a result of my hard work in the practicum. Now, I revise these plans and thus, I do not have much work to be done for developing plans. I benefit from these plans. […] I highly benefit from the textbook we used in the methods courses. Furthermore, one of the schools in my teaching practicum was using an international mathematics textbook in English. I benefit from these resources while developing my activities.* (P7_I2)

All of the teachers in this category underlined the importance of their experiences in the teacher education program on their current teaching practices. They mostly referred to the experiences in the methods and teaching practice courses.

> *The mathematics education courses in the university were very effective for me. They are the main factors on how I teach right now. Specifically, methods, material development, and teaching practice courses.* (P5_I2)

> *Teaching practice course was so beneficial […] I benefit from the activities of the practicum teacher that worked and I do not use the activities that did not work.* (P7_I1)

> *I used the methods and ways we learned [at the university]. Some of them worked, some of them did not work. Especially, I used most of the things [activities] I learned about fractions. When we were at the university, we gathered all the activities that our friends prepared. Now, I use them […].* (P8_I1)

> *At the university, we learned various ways of teaching a concept. Even if I could not use all of these methods, I use them.* (P3_I1)

Furthermore, teachers in this category seemed to plan their lessons in a detailed way and benefit from resources in addition to the resources offered to them (e.g., curriculum, textbooks, EBA [Educational Informatics Network]) in order to develop learner-centered activities and plans. For instance, P3 and P5 mentioned how they benefitted from online communities and resources.

> *We have a Facebook group consisting of middle school mathematics teachers […] There is a great sharing environment and everybody in the group is so humble. There are so many teachers who have similar views with me and supporting activity-based teaching. We get so many materials from this group.* (P3_I2)

> *In addition to the activities in the textbook, I use the online sources of NCTM. […] I also check for the main educational websites.* (P5_I2)

Teachers in this category referred to the negative emotions they experienced in their working communities similar to the teachers in the first category. They complained about their working communities' expectations that were not in line with the teacher identity they wanted to develop. Even if they could partially resist these expectations, they seemed to be emotionally exhausted. For instance, P7 indicated that the other teachers and administrators did not value her reform-oriented teaching methods since they preferred teacher-centered instruction. This negative emotional experience seemed to affect P7 to a considerable degree.

> *My teaching practices are interpreted as favorable by my students but not by the other teachers and administrators. It makes me unhappy.* (P7_I2)

> *[…] Even if I like teaching so much, I am getting closer to the end of my teaching career.* (P7_I2)

Similarly, P5 stressed that her teaching methods were different than the others in her working community and she sought to work in a community in which teachers share similar enthusiasm and teaching views with her.

> *If I had a chance, I would change lots of things in my school but I do not have such an opportunity […] I try not to compromise my truths. If I work in this school for ten more years, I would be very unhappy since I will eventually have to sacrifice from my truths […] I hope to change my school in the next year.* (P5_I2)

It seems that developing a mathematics teacher identity in line with the reform-oriented practices was possible to a degree. However, such identity might not be permanent if the working community did not support the teacher.

4.1.5. Influential Factors on Mathematics Teacher Identities

Interview data of 11 early career middle school mathematics teachers was analyzed to answer the second research question the study:

> 2. What are the factors that influence early career middle school mathematics teachers' perceived mathematics teacher identities?

Analysis results indicated that various factors have a role in early career mathematics teachers' teacher identity development process. In the current study, the main influential factors were explored as: (1) personal characteristics, (2) others' teacher identities, (3) teacher education community, (4) working community, (5) discipline, and (6) educational policy.

Before focusing on these factors, it is beneficial to bear in mind that not all these factors have equal impact on each participant. For instance, it is possible to observe that one teacher's mathematics teacher identity is mainly affected from her/his experiences in the teacher education community whereas another teacher's mathematics teacher identity is highly affected from the working community and educational policy.

4.1.5.1. Personal Characteristics

Participant teachers' perceptions of themselves as a person have similarities on how they perceive themselves as a teacher. Teachers' personal identity seemed to affect their teacher identity in different ways. Sometimes this effect was seen on how they behave toward their students, sometimes it was seen on their perceptions on themselves as a mathematics teacher, as evidenced in teachers' statements.

> *I am not a teacher who scares the students. Being scary is not part of my personal characteristics. I always smile […]* (P2_I1)

> *[…] I like to be busy all the time. I should always be working on something. This characteristic affected my studentship. Now, it also affects my teaching.* (P3_I1)

> *Having a close relationship with my students is one of my strong sides […] I think that I touch the feelings of my students. Since I am an emotional person, I attach importance to my students' feelings.* (P9_I2)

Teachers' personal characteristics seemed to have effects on their teacher identities in both positive and negative ways. For instance, P1 described herself as an active and hardworking person: "*I am an active person […] I like to work hard, I like to be busy"* (P1_I1). Similarly, when P1 described herself as a teacher and mentioned about her strong sides as a mathematics teacher, she claimed to be a hardworking teacher who always searched for new ways to improve her teaching: "*I like to explore new things and improve myself. So, I like to introduce new things to them [the students]. I cannot stay without doing something"* (P1_I2).

On the other hand, in the first interview, P8 described herself as a person who can get easily stressed in daily life: "*Actually, I can get easily stressed. […] If the things go well, I always try to make it better. But, if they do not, I give up easily"* (P8_I1). Consistently, in the second interview, she talked about how she got stressed because of her administrators' expectations from her. She indicated that this stress caused to weaken her teaching motivation.

> *Yes, it [high expectations of the administrators] makes me stressed and affects my performance. I cannot concentrate. I am already a stressful person […] such things make me more stressed.* (P8_I2)

Although it is difficult to claim that personal characteristics had certain types of effects on early career mathematics teachers' mathematics teacher identities, their mathematics teacher identities did not seem to be independent of their personal characteristics.

4.1.5.2. Others' Teacher Identities

Early career mathematics teachers have interactions with "*others*" in the communities they participated. These interactions might be with family members, teachers in elementary/middle/high school, and colleagues in the working community. Although not all these "*others*" had effects on their teacher identities, some of them became prominent in their mathematics teacher identity development process.

Role model teachers in the prior communities can be considered among the influential "*others*". Many of the participant teachers had a role model teacher in their life who became very effective in their decision to choose to teach as the profession.

> *I decided to be a mathematics teacher by the effect of my 8th-grade mathematics teacher. […] S/he became a role model for me and in that grade, I planned all my future. First, I was going to go to Teacher Training High School and then I was going to choose mathematics teaching profession at the university.* (P3_I1)

> *My elementary mathematics teacher used to ask us interesting mathematics questions and have contests. S/he helped me to love mathematics. In that years, I decided to be a mathematics teacher.* (P8_I1)

Role model teachers were not only effective on the choice of the profession; they were also effective on how the profession was conducted. Role model teachers' behaviors towards their students and their teaching methods seemed to have effects on participant teachers' perceptions of good teaching. Therefore, it appeared that there was a link between participants' teaching practices and their role model teachers' teaching practices. For instance, when P1 was asked to remember her previous teachers, she mostly talked about her high school mathematics teacher: "*The first teacher came to my mind is my high school mathematics teacher. I remember him very well because of his energy in class"* (P1_I1). Based on this statement, I reminded that she also described herself as an active and energetic teacher, and asked whether she saw similarities between her and her high school mathematics teacher.

> *Actually yes, I can say that s/he is the role model for me. Because of my experiences, I know that if you like your job and do your best in the class, it affects the students a lot. Even if I have problems, I am able to postpone to think about them during the class and put all my energy into teaching.* (P1_I1)

In a similar vein, P8 stressed how her middle school mathematics teacher's teaching methods affected her.

> *Our mathematics teacher was teaching differently than the other teachers. She was teaching everything with the underlying reasons. Up to that time, we have not been taught like this. I mean, we were taught that minus times minus equals to plus, that's it. She was also giving the underlying reasons and this made me understand and like mathematics more. She was the reason for why I decided to be a mathematics teacher. I decided to be a teacher like her.* (P3_I1)

Role model teachers were not only participants' teachers from pre-university education. These role model teachers might be from the teacher education community or working community. Therefore, teachers in the teacher education program, teaching practicum teacher, and colleagues in the working community can all be considered as potential role models whose teacher identities might help to shape early career mathematics teachers' teacher identities. For instance, P7 referred to her practicum teacher in the teacher education community and seemed to be highly affected by her teacher identity.

> *[…] She [the practicum teacher] was so innovative. She has very good knowledge of English and always checks for the academic articles. I used to teach with her and she even gave the all control [to me] in one of her classes. I went to the school every day for one semester which is highly over the requirements of the practicum course. Maybe I am under the effect of her teaching methods. Because we learn from everybody we interacted. I am trying to be like Dr. Green [pseudonym for one of the instructors in the teacher education program] because s/he is my idol. I am trying to teach like my practicum teacher because I saw that it worked in the practicum.* (P7_I1)

In brief, the impacts of *others' teacher identities* can be seen on early career mathematics teachers' pedagogical and didactical approaches and/or intentions in the profession. Therefore, it is possible to claim that some of the others' teacher identities helped to shape the mathematics teacher identity of participant teachers.

4.1.5.3. Teacher Education Community

As explained in detail in "4.1.2. Experiences in the Teacher Education Community" section, experiences in the teacher education community seemed to have a prominent role in early career mathematics teachers' mathematics teacher identity development process. For some of the teachers, these experiences became the prominent factor whereas for some of them these experiences had a slight influence on their mathematics teacher identities. However, for all the participants, experiences in the teacher education community seemed to have an effect on their mathematics teacher identity to some degree.

The effects of teacher education community on early career mathematics teachers' teacher identities might differ based on the characteristics and experiences of the teacher education community. In this study, the experiences in the teacher education community mostly seemed to affect content, curriculum and didactics domains in participant teachers' identities whereas it had limited influence on pedagogy and professional participation domains. The following three quotes illustrate how the experiences in the teacher education community positively contributed to participants' reform-oriented mathematics teacher identity development in terms of content, curriculum, and didactics domains.

> *[…] what we saw in the methods course was totally new for us. I mean, we saw that there is an underlying meaning for all concepts we had to memorize during our middle school years. Therefore, in most of the classes, our mouths fell open. These courses broadened my horizon and I re-learned most of the mathematical content at the university.* (P3_I2)

> *I had a good knowledge of content. Because we paid utmost attention at the university. I was better than most of my colleagues [in terms of curricular knowledge]. I did not experience any problem on what to teach and how to teach. In the university, we were prepared very well and thus, I still remember what we did what we talked about for each objective in the curriculum. Sometimes, the objectives in the curriculum are not very well explained and in such times, I do not experience any problem because of our experiences at the university.* (P1_I1)

> *In the methods courses and elective courses [related to the teaching of mathematics], we prepared activities for almost every topic. […] At the university, I developed ideas about how to teach each topic.* (P2_I1)

Similarly, many of the participants indicated how they currently benefited from their experiences—mostly their experiences in the methods course—in the teacher education community in terms of the didactics.

> *In the methods course, I both learned how to teach a lesson with using materials and without using materials. I learned how to benefit from constructivism. Because, in our methods courses, our teachers never used direct instruction. There was always an activity […] Now, I recall these experiences and used them in my own class.* (P7_I1)

> *I try to use all the activities I learned at the university. I remember what we did in the methods course, I even remember what our friends asked while they pretended to be a middle school student during the activity. I experience similarities when I apply these activities in my classroom […] I also want to use the activities we learned in the Geogebra course. Last year we did not have a smart board but this year we have. I plan to use Geogebra this year […]*. (P8_I1)

On the other hand, even if the teachers mentioned that they benefitted from the pedagogical courses in the teacher education community, they generally did not feel themselves as confident as in the pedagogical domain compared to content, curriculum and didactics domains. The following two quotes of P8 might be an example of this issue.

> *I can say that classroom management course is influential on how I teach today. How to arrange the seating plan, how the students see well, how they learn well…? I mean that course helped me to shape all such things in my class.* (P8_I2)

> *I experience difficulty in the classroom management. When the students get distracted I get difficulty to focus them again […] I need to improve my classroom management.* (P8_I2)

Furthermore, some of the participant teachers seemed to be affected by the mismatch between the professional environment they were trained for and the professional environment they faced in their working community. For instance, P6 stressed that what she experienced in the teacher education community was different than what she experienced in her current working community and it seemed to have some effects on her teaching.

> *We have been trained to use materials and hands-on experiments. However, the school in which I am working does not have materials. For instance, I need to copy the activity sheets for students but the copying machine is not working. I did not know that my opportunities would be so limited […]*. (P6_I1)

> *In my practicum school, there was a copying room [to copy the activity sheets needed]. There were lots of materials. There was a room assigned for the mathematics teachers' meeting. In that school teachers were expected to teach with activity-based approaches. If I worked in that school, I would have probably worked more systematic and efficient.* (P6_I2)

Participant teachers spent four years in the teacher education community to be trained in teaching mathematics in middle schools. These years seemed to have an important role in their transition from being a student to being a mathematics teacher. However, the effect of teacher education community on each participant's mathematics teacher identity was not similar in density and furthermore, its effects on different domains such as didactics, content, and beliefs, of mathematics teacher identity were not the same. Despite these differences, this supports the claim that teacher education community was one of the most influential factors for the participants' mathematics teacher identity.

4.1.5.4. Working Community

Participant teachers' experiences in their working communities were given in detail in one of the previous sections (see section 4.1.3. Experiences in the Working Communities). As mentioned in that section, the working communities of the participants did not seem to support developing reform-oriented mathematics teacher identities. However, the experiences in the working community were described as highly influential by the participant teachers even if they developed a different type of teacher identity—traditional-practice mathematics teacher identity or hybrid-practice mathematics teacher identity. Participant teachers indicated that they learned from their experiences in their working communities and re-shaped their practices based on what they learned.

> *Day by day, I learn new things. When I act improperly, I change it for the next time […] For instance, when I teach the topic by using a particular way and it does not work, I change it based on what I hear from the other teachers, and when it works,*

> *I continue to use this new method. I believe that it will get better in the following years.* (P10_I2)

> *[Experiences as an in-service teacher] are among the most influential factors. Because I continuously learn. I learn from students. I learn from my colleagues. […] We learn by doing.* (P2_I2)

> *My experiences in the last two years might be the most influential factor on me […] The last two years affected me negatively. For the classroom management and some other factors, it contributed a lot to me, but I also began to have some doubts when I see the students and other teachers*. (P5_I2)

Although the general effect of the experiences in the working communities was mentioned by the participants, the curriculum and pedagogy domain seemed to be the dimensions in which most of their learning occurred. The revised mathematics curriculum compelled teachers to learn it during their in-service years.

> *I had enough knowledge [of curriculum] but I needed to modify it because the curriculum was changed.* (P7_I1)

> *I learn it again and again. Because it [the curriculum] is changing. For instance, in the 6th grade, we were only teaching positive and negative integers without doing operations. Operations [were] in the 7th grade. But now, operations with negative integers were moved to the 6th grade.* (P9_I1).

Teachers had more chance during the time in the working community to interact with students, which helped them to improve their knowledge of students when compared with their experiences in the teacher education community.

> *We were not able to see different student profiles at the university. Here, I can see very different student profiles, different kind of problems. […] In the practicum, I learned some, but now I realize that I did not know much. Most of my knowledge comes from my working experience.* (P1_I1)

Furthermore, most of the participant teachers mentioned that they continuously revised their pedagogical decisions based on whether it was working in their classes.

> *I was using minus and plus lists as a rewarding system but I realized that plus is working whereas minus is not. When there is a reward, students get more motivated and my classroom management is getting better. However, when you use minus as*

> *a punishment, it does not work. After getting two minuses, students began not to be affected by them. I learned it by trying.* (P2_I1)
>
> *I compare myself in the last two years. I realize that my behaviors towards students are changing this year. Last year, classroom management was more difficult for me. This year, it is better and next year, it will probably be even better. Year by year, I learn how to interact with each student and how to behave them.* (P5_I2)
>
> *At first, I get tough with the class to improve the classroom management. But now, I am behaving more close to the students. Because, when they like the teacher it is becoming easier to teach them mathematics. [When I asked for what led to this change] I thought [about] myself. When I was tough, students began not to like mathematics. When I get tough, the students had success. There was no problem about the success, but they did not like the subject. Thus, I realized that it will be a problem in the longer term.* (P10_I2)

It was commonly seen that there was a mismatch between these teachers' beliefs and/or intentions and teaching practice—specifically for the ones that developed traditional-practice mathematics teacher identities. They were aware of this mismatch and provided several reasons for this mismatch. The following instances illustrate this issue:

> *In my master's thesis, I used activity-based approach. In each lesson, there was an activity sheet, there were steps to discover, and there were open-ended questions… It was more enjoyable. But, it was only for 8-9 students. In my classroom, it is difficult to apply such a method because of the number of students. Thus, I do not prefer*. (P4_I2)
>
> *I would like to be more student-centered, I will consider each student as different individuals. But, the intensity of the curriculum and the number of students all affect me. There are 36-38 students in my classes and it affects me a lot*. (P9_I2)
>
> *If we specifically get interested in each student, I believe that every student can learn mathematics. But in the real classroom, I do not think that it is possible. Because there are 20 students in each class and it is difficult to reach to all students. […] Maybe I am using this issue as an excuse but in each class, there are at least 2-3 students who have serious problems to understand the content. I am not able to pay individual attention to these students. I tried, but the time is not enough to do that, and you need to pay too much attention to them.* (P2_I1).

To sum up, it can be claimed that initial in-service years were highly influential on participants' mathematics teacher identities. Wenger (1998) claimed that one learns

through his/her participation in a new community and experiences in that community. In line with this claim, participant teachers in the current study seemed to learn from their in-service experiences within a certain community and continuously re-shape their mathematics teacher identities based on these experiences.

4.1.5.5. Discipline

The findings of the current study highlighted that teacher identity was not independent of the discipline that is being taught. It was seen that participants of the current study commonly stressed how being a mathematics teacher affected their views, beliefs about teaching, and their identification as a teacher.

Participant teachers commonly indicated that teaching mathematics is different than teaching any other subject areas. They believed that teaching mathematics is more difficult than other subject areas. Students' negative attitudes and views about mathematics seemed to be the main reason for this difficulty.

> *Probably teaching is different in all the disciplines but teaching mathematics is harder than others.* (P4_I1)

> *Most of the students do not like mathematics […] Furthermore, it is difficult for them. When they experience difficulty, they dislike mathematics more […] Since they do not like mathematics, teaching it becomes harder […].* (P2_I1)

> *[…] Students have strong negative prejudgments about mathematics. This makes teaching mathematics more difficult. They believe that they are not able to learn mathematics and it makes teaching mathematics harder. In Social Sciences, in Turkish, they are more confident and relaxed.* (P1_I1)

> *Prejudgments make it difficult. At first, students come to class by stating "I hate mathematics". In my classes, there are only a few students who say "I like mathematics a lot". Most of the students are afraid of mathematics. They think that they can be successful in Turkish by reading the content, similarly in other social sciences. They think that Science course is a kind of play because of the different [scientific] experiments in the course. But, if the student is not active in mathematics, teaching mathematics becomes more difficult.* (P9_I1)

In addition to the difficulty issue, P3 also mentioned that teaching mathematics was more enjoyable than teaching other disciplines.

> *[Teaching mathematics] is harder. […] However, when I compared teaching mathematics with other disciplines such as Social Science or Turkish, I think that it is richer. In mathematics, there is more to be explored by the students. I remember many times how surprised my students were when they explored a new thing. I like that feeling in teaching mathematics. I do not think that it is that possible in other disciplines.* (P3_I1)

Furthermore, some of the participants indicated that learning mathematics requires more effort and/or different kind of intelligence than the other subjects.

> *Learning mathematics requires higher order thinking, it is more dependent on the student. For sure, intelligence is a factor. For instance, when we check the students' success in TEOG, they are most successful in Turkish and Education of Religion and Ethics, whereas they are the least successful in Mathematics. They are the same students. It might be because of their lack of mathematical intelligence.* (P4_I1)

> *[…] when you teach the subject, they learn it. They are able to do the related exercises. But, there might be very different questions for the same content. What you teach them is never enough, they have to do more by themselves. When they face a different kind of question, they are not able to do it. Because they do not want to think in detail, they think that what we offer to them in the course is enough for them.* (P2_I1)

The discipline also seemed to affect how the participants perceived themselves as a teacher. Teaching mathematics and being a mathematics teacher were interpreted as something valuable by the participant teachers. This effect can be seen in P4's choice of profession. She indicated that she has never thought about being a teacher in another discipline because of two reasons. Her first reason was enjoying mathematics, and her second reason was how she interprets being a mathematics teacher.

> *[…] Among all the disciplines, mathematics teaching is the most prestigious one. Thus, I preferred to be a mathematics teacher and never thought about being a teacher in the others [disciplines]*. (P4_I1)

The following two quotes also illustrate how the subject being taught affected some of the participants' perceptions about themselves as a teacher.

> *I do not mean to boast, but there is a big difference between being a teacher of mathematics and being teacher of another subject. […] We think the details more, we have a quick mind, and we put more effort in teaching the subject […]*. (P3_I2)

> *Being a mathematics teacher is better. […] I think that it is different than being a teacher. It is superior, more prestigious.* (P11_I2)

On the other hand, P9 shared her experiences in her working community and indicated that there is a difference between being a mathematics teacher and being a teacher in another discipline.

> *There is more expectation [from mathematics teachers]. For instance, when there is a meeting with parents, they are not interested in some other disciplines. However, even a small problem in mathematics lessons can be a serious problem for them. Because they think that mathematics is a very important lesson. I mean, they attach more importance to mathematics teachers […]*. (P9_I2)

In a similar vein, P7 mentioned this difference and the potential reasons for this difference.

> *Based on my previous experiences, I can say that mathematics teachers are respected more. I mean it is a kind of win-win situation. Because mathematics is more important in TEOG and mathematics teachers are respected more. Unless there is an examination like TEOG, [people] might not behave the same.* (P7_I2)

In short, the responses of participant teachers indicated that how the teacher perceives himself/herself as a teacher, and how s/he interprets the teaching profession seem to be related to the subject area s/he has been teaching. It seems that some of the participants believe that being a teacher of mathematics led them to have a different type of perceived teacher identity. The participant teachers might perceive themselves different if they were teaching another subject area.

4.1.5.6. Educational Policy

Teachers' working conditions and/or working communities are not independent of the educational policy of the country. In the study context, the impacts of the educational policy were mostly seen on the transition from middle school to high school. As mentioned previously, middle school students' transition to high schools were held via

centralized examination called TEOG at the time of the study. In each semester, 8th-grade students took this examination and the scores obtained from this examination became the most influential factor in students' high school education. In TEOG, students responded to multiple choice questions in 6 subject areas: Mathematics, Turkish, Science Education, Education of Religion and Ethics, History and English. Among these 6 subject areas, Mathematics, Turkish and Science Education had the biggest impact factors on the total score. TEOG seemed to have some effects in the working communities of participant teachers and P7 mentioned how the success in TEOG was the leading factor in her working community:

> *Nobody cares about what the students know about mathematics. They care about TEOG score. They do not care about whether the students like mathematics. They are not interested whether the attitudes of the students are changed. They are interested in whether the students will be eligible to attend a good high school.* (P7_I1)

P9 and P10 also mentioned about the pressure that TEOG caused.

> *[…] In the 7th and 8th grades, all the teachers' main focus is TEOG. Which subject will be asked on the exam, how we will finish the topic before the exam, what do I say to administrators if I could not finish the topics before the exam… There is always a fear […]*. (P9_I1)

> *TEOG causes both students and teachers to get stressed […]*. (P10_I1)

Teachers' didactical approaches were also affected by the educational policy. Although P3's didactical approach was aligned with learner-centered methods in the 5th, 6th, and 7th grades, her didactical approach was more teacher-centered in 8th grades. When I asked about the reason for this difference she stressed that:

> *It is because of TEOG. In order to solve more questions, I aimed to complete the course objectives as soon as possible. For instance, I directly explain the content to students in the class. I also explain where the things come from, what are the underlying reasons of them. I mean, for example, I say the volume of the square pyramid is one-third of the square prism. Because, when you fill the square pyramid with water for 3 times it will fill up the square prism. But, I told them, they did not discover by themselves. I told them the things that need to be discovered by*

themselves […] The course is mostly based on solving questions. Solving questions as quick as possible. Does that make me happy? Not at all. (P3_I2)

A similar issue was also mentioned by P8:

In the lower grade levels, my teaching is mostly activity-based. However, in the 8th grade, it is based on training them for TEOG. Solving different kinds of questions, explaining how to think for different types of questions… There is an exam that they are required to take. Thus, my teaching is mainly to train them for it. (P8_I2)

All the participants seemed to be affected by the consequences of the national education policy. This effect was mostly emotional and/or didactical based on the working community of the teachers.

4.2. Two Cases to Explore Actualized Mathematics Teacher Identities and Possible Influences of Working Communities

In the previous sections, I focused on the phenomena of early career mathematics teacher identity and its development via exploring the professed experiences of 11 early career mathematics teachers. In this section of the study, I will zero in on two early career teachers, P5 and P11, and their experiences in their working communities. In so doing, I aim to explore the actualized teacher identities of these two teachers, the consistency between their perceived mathematics teacher identities and actualized mathematics teacher identities, and the influences of their working communities on their mathematics teacher identities. In other words, 3rd and 4th research questions of the study are explored in this part of the study:

3. To what extent is there a consistency between two early career middle school mathematics teachers' perceived teacher identities and their actualized mathematics teacher identities?
4. How do working communities in different characteristics affect early career middle school mathematics teachers' mathematics teacher identity development process?

In parallel with these research questions, I observed each of these two teachers for 10 weeks and made an additional interview in order to discuss my observations with the observed teachers. In order to have a comprehensive idea of the cases, the results for the 3rd and 4th questions are given together for each case. The story of P5 is given first in the next section, followed by the story of P11.

4.2.1. The Case of P5

In this part, first, the interviews conducted with P5 are the focus in order to have an idea of the perceived mathematics teacher identity of P5 based on her professed experiences. Second, the actualized teacher identity of P5 is explored through focusing on the observations and additional interview conducted with P5. Third, the consistency between the perceived and actualized mathematics teacher identity of P5 is discussed. As the final part, how the mathematics teacher identity of P5 is influenced by her experiences in her working community is given.

4.2.1.1. Perceived Mathematics Teacher Identity of P5

P5 described herself as a successful student in general and in mathematics specifically.

> *I was a hardworking student. I graduated as an honor student [referring to her high school]*. (P5_I1)

> *When I was a senior student at the high school, I came first at a math contest of the province I lived. Then, I was able to participate in a nationwide math contest. I mean, I had a good relationship with mathematics. I was successful at it.* (P5_I1)

Although she liked to conceptualize the mathematical knowledge first and then practice, she described how the mathematics was taught her in traditional ways.

> *I used to understand [the content] at the lesson. […] After conceptualizing the knowledge, I used to practice via solving multiple-choice questions.* (P5_I1)

> *It [mathematics teaching] was based on memorizing. We did not use any material or we did not make any activities. I did not even know what the activity means until*

> *coming to the teacher education program. Our [teachers'] teaching method was direct-teaching.* (P5_I1)

P5 always wanted to be a teacher and she mentioned that she had role model teachers affecting her choice of career.

> *[During the elementary school] My role model was my cousin who is an English teacher. She became a role model for me by giving advice for my life.* (P5_I1)

> *What you want to be depends on whom you like most. I really liked my physics teacher at the high school. However, being recruited as a teacher of physics is difficult. For this reason and for loving mathematics, I decided to be a mathematics teacher. I am so happy with this decision.* (P5_I1)

P5 had memories of good and bad teacher behaviors during her studentship period.

> *One of my mathematics teachers had a very good content knowledge but s/he was not able to transfer what s/he knows to the students. Her tone of voice was so low and she was speaking very fast. Even if s/he had a good content knowledge, s/he was not an effective teacher. I used to understand the content because I had a good background knowledge. However, I know that most of my classmates did not understand.* (P5_I1)

> *[Referring to the physics teacher at the high school] He was polite and he was teaching very well. He was doing his job very well. I still talk to him and he was one of the reasons of why I chose this profession. He was not teaching with the activity-based approach because he had not been trained in that way. However, his teaching was very effective. He took great care of what he does. For instance, he said that he spent 3-4 hours for only designing the exam sheet. I have a huge respect for him.* (P5_I1)

P5 described her experiences in the TEC for content, curriculum and didactics domains sufficient—mostly thanks to the method course(s).

> *[In terms of the content knowledge] Our method courses were highly effective. Although I did not realize how important the method courses were when I was at the university, I highly benefitted from these experiences in the profession. For sure, my experiences at the profession helped me to improve myself as a teacher, but I did not have big problems when I started to teach. Furthermore, we learned the curriculum very well in the method courses. I did not experience a problem when I started to teach. I mean, I did not have a fear of "How am I going to do this?" since I already had the related knowledge.* (P5_I1)

> *[In a response to a query about how efficient she felt on mathematics teaching methods when she graduated] I believe that I was good in terms of methodological knowledge. My colleagues at the university and I were all good. We were investigating the literature and collaborating with each other. I still investigate the literature since things are changing rapidly […].* (P5_I1)

However, P5 did not think that the experiences for pedagogy and professional participation domains at the university were as sufficient as the above-mentioned experiences. She indicated that the experiences in the profession helped her to develop this knowledge.

> *I learned how to treat students by time and by the effect of experiences in the profession. […] For sure, the related courses at the university helped me, but the main development was at the profession. […] I learned by trial and error method.* (P5_I1)

> *[When she graduated] I did not have enough knowledge about how the educational environment will likely to be. […] I had more or less guesses about that because I worked as a voluntary teacher in a similar school when I was at the university. However, being a [integral] part of that context is very different.* (P5_I1)

P5 mentioned that she believes every student can learn mathematics, and teachers have the main responsibility to do so.

> *I believe that every student can learn mathematics […] I think there is no student who cannot learn, there are teachers who cannot teach.* (P5_I1)

> *[…] You need to be good at your job in order to teach well. You need to keep students busy in order to avoid losing their interest in the topic. In order to do so, you need to get prepared well for the lesson. When you do this, students realize that and respect you. I mean students understand that you are doing your job well which enable to respect you, love you.* (P5_I1)

The following quote illustrates how she believes about teaching mathematics.

> *I believe that there are some important points in teaching mathematics. Literature also supports my belief. Let me give an example from fractions since we are working on fractions at the 5^{th} grade right now. The concept of "unit fraction" cannot be*

> *covered only at one lesson. Because when the student does not conceptualize the unit fraction, s/he cannot understand equivalent fractions, or cannot transform compound fraction to exact fraction. Furthermore, s/he cannot model the fractions and cannot make operations with fractions. Therefore, I paid extra attention the concept of "unit fraction" when teaching it. I spend time on such important concepts. When the students conceptualize such important concepts, the rest of the topic becomes easier. Now, my students have no problem with the equivalent fractions. I also think that I will have fewer problems with the operations because the students conceptualized expanding fractions. Therefore, as a teacher, we need to spend time on such important concepts by making these important concepts concrete, by using materials.* (P5_I1)

P5 often mentioned that her experiences at the teacher education program helped her to develop her beliefs and vision of teaching mathematics.

> *The most influential factor for developing my vision of teaching mathematics was the mathematics education courses I took at the university.* (P5_I1)

> *What I thought about teaching mathematics was mainly built at the method courses at the university. The efforts of our method course instructor were very beneficial to develop these thoughts […].* (P5_I2)

After graduating from the university, P5 started to work in a middle school located in a peripheral low-to-middle socioeconomic status districts of Ankara. She was in the second year in the profession and she was teaching the 5^{th}, 6^{th}, and 8^{th} graders at the time of this study. She described her working community as:

> *[…] We have ten classrooms in total. Class size is between 40 and 50, generally 45. Physical conditions of the school can be described as poor. […] Most of the students are coming from lower middle-class families. Most of the parents do not pay attention to the education of their children. I mean only 10 out of 50 parents want their child to have a further education. The rest of them do not care whether their child is having a good education or not.* (P5_I2)

When she was asked about the success of the students in her working community, she stated: "*Not very good. For example, the success at the last TEOG was very low […] In terms of mathematical success and academic achievement, it is not good"* (P5_I2). Furthermore, what she stated about the professional environment of her working community did not seem to hold the essential dimensions of a CoP. For instance, there

seemed to be no mutual engagement among teachers, and between teachers and administrators.

> *Among mathematics teachers, we do not have a professional collaboration. We only talk about daily life and procedural work related to the working community. I guess I am the only one who talks about education in the teachers' meeting room. However, they [the other teachers] do not want to talk about such topics, the conversation does not last long. Thus, we start to chitchat after a short while. Let me give an example, last week I participated in an educational conference. One of the speakers was an economist and said that: "The problem in the education can only start with training effective teachers at the universities". Actually, I really enjoyed his speech, and agree with most of what he said. However, I also got upset since he was an economist, not an educator. I mentioned about this issue in the teachers' meeting room. Most of the teachers in the school were in the room at that time but nobody got interested in this issue. I mean, it is just a basic example.* (P5_I2)

> *I do not remember a time when I and the other mathematics teachers discussed a topic related to mathematics. I mean, it never happens.* (P5_I2)

> *The administrators at the school expect only to make the students quiet in the classroom. They do not pay attention to how well I develop myself as a teacher or how well I teach the subject.* (P5_I2)

The other teachers' identities in the working community did not seem to be in line with the reform-oriented teacher identity.

> *The other teachers at the school use the traditional methods. They do not apply student-centered activities.* (P5_I2)

> *Once we were talking about 5th graders, I said that we are learning fractions in the 5th graders. They criticized me for falling behind schedule. Actually, it was my own decision since I prefer to apply activities to help students conceptualize the topic. However, they [the other mathematics teachers] believe that the best teacher is the one who finishes the curriculum first.* (P5_I1)

Furthermore, the school administrators did not seem to support reform-oriented practices.

> *When we were doing an activity, the school principal came to the classroom for a reason. He thought that we were playing instead of teaching. Because he does not have any knowledge of student-centered teaching.* (P5_I2)

P5 commonly expressed negative emotions she experienced in her working community.

In the school, the teachers always complain about students. They always use a negative language; we never speak of positive sides. They never talk about something that makes them happy in the class. This situation makes me angry. (P5_I1)

[…] I was really surprised when I graduated from the university and started to work in this school. Because I saw that I have colleagues that stopped making efforts to learn. They did not want to learn anything new, but they try to teach to the students. This made me feel disappointed. (P5_I1)

[…] I do not feel myself as a part of this school. (P5_I2)

Although her working community did not support her, P5 often participated in other communities in order to improve herself and her teaching.

[…] The school principal does not support me to participate in educational conferences or workshops. If he could, he would not let me go to such conferences. However, he has to give permission because of the legal obligation. (P5_I2)

[…] when participated in the workshops, I met with very good teachers. I learn from them and they learn from me. Even the very experienced ones were eager to collaborate and learn. Nevertheless, my colleagues at the school are not like that. (P5_I1)

I do not feel valued in my school. However, when I go to conferences and workshops, I meet with other teachers who are doing a good job. They also understand and appreciate what I do. I know that teaching is not a profession that is done in my school. However, I need to see good examples to improve myself; these groups [conferences & workshops] are the only chances for me to see such examples. By participating in such groups, I see good examples and improve myself as a teacher. (P5_I2)

Apart from her experiences in her working community in general, P5 also mentioned about her experiences in the classroom community. In line with her beliefs, which were mentioned above, she stated her use of learner-centered approaches in her classes. She benefitted from multiple sources to plan and apply learner-centered activities.

Our 5th-grade textbook is already very good. I apply all the activities in that book. In addition, I often check the website of NCTM. I also benefit from the book we used in the methods courses. Furthermore, we developed a portfolio [in which there are

> *various activities developed by the students who took that course] in the methods course and I use it.* (P5_I2)

> *[…] In my Master's courses, I continuously learn new websites, online sources, and programs. I often search them. Furthermore, in the workshops I participated, I collaborate with other teachers. I share the things that worked in my classes and they share with me what worked in their classes. I mean I always keep searching for better ways to teach.* (P5_I1)

However, 8th-grade seemed to be an exception for P5's mathematics teaching.

> *My teaching methods differ based on grade level. […] In the 8th grade, I sometimes use learner-centered ways but I mostly use teacher-centered methods. I tried to apply learner-centered methods, but I failed. However, in the 5th and 6th grade, I conduct learner-centered activities in which students are active and able to explore.* (P5_I2)

> *[…] I also want to use learner-centered methods for the 8th graders, but I am not able to do it. Students do not listen to me. Thus, I gave up. However, in the 5th and 6th grades I apply learner-centered methods. In the 8th grade, even if I believe that it is not correct, I mostly lecture.* (P5_I1)

When she was asked about the reasons for such a difference, P5 mentioned mainly two issues.

> *8th graders believe that they need to solve as many questions as possible to be trained for TEOG. Using materials or applying learner-centered activities are interpreted as a game by them. Their parents also think so, which might be the reason. I am not able to motivate them to such an instruction.* (P5_I1)

> *My 5th and 6th-grade students, especially the 5th grade, got used to having such an instruction [activity-based]. However, the 8th graders did not get used to it. It seems late for them since they are more resistant to this change.* (P5_I2)

Apart from her teaching methods, P5 also mentioned about her relationship with the students in the class.

> *[…] I believe that I have a good relationship with my students. I mean, I think that I can understand them. They do not hesitate to ask me questions or share their problems. This might be a good side of me as a teacher.* (P5_I2)

In brief, the professed experiences of P5 indicated that her working community was not in line with the reform-oriented practices. Therefore, in terms of the current study, it could be described as an unsupportive working community for P5. However, based on the experiences in TEC and in other communities she participated, P5 developed beliefs and intentions supporting reform-oriented mathematics teaching. Furthermore, she was able to apply these methods in the 5th and 6th grades successfully. On the other hand, her teaching practices in the 8th grade were in line with the traditional practices in which teacher-centered practices were used. When all these professed experiences of P5 are taken into consideration, her perceived mathematics teacher identity was described as "Hybrid-Practiced Mathematics Teacher Identity" in the current study.

4.2.1.2. Actualized Mathematics Teacher Identity of P5

P5 was observed for 10 weeks (twice a week, 6-8 hours a day) during the Spring Semester of 2015-2016 Academic Year. In that semester, P5 was teaching the 5th, 6th, and 8th graders and I observed her classes in each of these grade levels regularly. During the observations, I took observation notes and based on the notes, I prepared observation report each week, which was explained in detail in the Methods chapter under the Data Collection Tools and Procedures section. At the end of the observations, I conducted a final interview with P5 to discuss the observed events. In this section, I will zero in on these observations and interview in order to explore the actualized mathematics teacher identity of P5.

4.2.1.2.1. Physical Conditions

The working community of P5 was in the peripheral low-to-middle socioeconomic status districts of Ankara. The school consisted of two main buildings. One of them was a Sports Hall that was devoted to the Physical Education Lesson. The other building consisted of four flats, and all the classes located on these flats. There were 10 classes in total for the all middle school level—the 5th, 6th, 7th, and 8th grades. The number of students in each class changed in between 40 and 50. In the classes, there was a whiteboard and a

smartboard that are distributed by the Ministry of National Education to the public schools. Apart from the boards, there was another metal board on one of the walls to show the student work, posters or that kind of additional work.

I also spent time in the teachers' meeting room. Teachers spent time in this room in their free lessons and/or between the class hours. In this room, there were two tables—one is oval and one is rectangular. There were chairs around the tables but the number of the chairs is less than the number of teachers. In addition to the tables and chairs, there was one desktop computer and one big teapot for the teachers. The size of this room seemed to be small for a teachers meeting room. When there were more than 5-6 teachers, it was difficult to move in that room. There was no other room for teachers to meet and work with their colleagues or students. In brief, the physical conditions of the school cannot be described as satisfactory.

Physical conditions of the working community of P5 are given to have a better understanding of the context for P5's teaching practices. Thus, the next section continues with explaining the teaching practices of P5 in detail.

4.2.1.2.2. Teaching Practices of P5

The teaching practices of P5 differed based on grade level. Therefore, these practices are given in separate sub-headings. First, the practices in the 5th and 6th classes and then, the practices in the 8th grade are explained in detail.

4.2.1.2.2.1. Teaching Practices in the 5th and 6th Grades

In the 5th and 6th grade levels, P5 always started the lesson by asking students to recount what they did in the previous lesson (e.g., P5_O1; P5_O2; P5_O3)[3]. After the students shared what they did in the previous lesson, P5 summarized and started to the new lesson.

[3] In this abbreviation, P5 indicates the ID of the interviewee (Participant 5) and O3 indicates where the quote comes from (3rd week observation note).

P5 used different strategies in her classes such as discussing a daily life example related to the objective of the lesson, doing an activity, or using concrete materials. For instance, in the 6th grade, she asked the students who have been in a taxi before (P5_O6). Some of the students shared their experiences with the taxi. After that, they began to discuss how the fee is calculated in taxis. First, the distance was mentioned by the students. Furthermore, some of the students mentioned about the starting fee of the taximeter that shows that they realized that the total fee is not only dependent on the distance. Then, P5 asked the students to calculate the total fee when one went 3 kilometers with the taxi (the starting fee is 5tl and the fee for each kilometer is 2tl). After students calculated, this example continued for 5 kilometers, and then 10 kilometers. Then, they discussed how the total fee is changing based on the total distance and this discussion led to realize the constant term and variable. Thus, they met with the algebraic expressions and wrote the algebraic expression to calculate the total fee for the taxi.

In another lesson of 6th graders, each student brought pillbox from their homes. P5 created groups consisting of 2-3 students and each group started to explore how many sugar cube would fill the pillboxes (P5_O10). While filling the boxes, they also filled a table in the activity sheet prepared by P5. In the activity sheet, there were cells to write how many sugar cubes are on the dimensions of the pillbox. After the experiment, groups shared what they found and they collectively arrived at the formula of a rectangular prism.

In one of the lessons of 5th graders, students brought beans from home and took 12 of them as their whole (P5_O5). Then, students worked on to find 2/3 of the whole. They continued to work on with different wholes and different fractions. At the end of the lesson, they were able to calculate the desired fraction without using beans. In other words, first P5 enabled students to work with concrete materials and then students explored the procedural way.

As some of the lessons are exemplified above, it can be claimed that the general practice of P5 in the 5th and 6th grades was using materials and hands-on activities in order to enable

student exploration. Table 4.1. that is given below summarizes these practices and might be beneficial to have a general overview of the classes of P5.

Table 4.1. ***Hands-on Mathematics Teaching Practices of P5***

Week	Grade Level	The Related Objective	Teaching Practice
1	6th	Data Analysis-Calculating the Arithmetic Average	All the students had Hundreds Chart in their portfolio, they used that chart to choose two integers. First, they estimated the arithmetic average for the integers they chose. Then, they calculated the arithmetic average by using calculators. They checked the accuracy of their estimates and actual arithmetic average and some of the students shared (e.g., choosing a number that has a similar distance to the chosen numbers) their strategies by mentioning whether it worked or not. The similar procedure was followed for 3 numbers. Finally, they tried to find different sets consisting of 3 integers that has an arithmetic average of 24.
2	6th	Operations with negative integers	Students drew an apartment (5 floors above the entry level and 4 floors below the entry level) on their notebooks and each floor was devoted for one family or apartment facility (e.g., Family A, Basement). Students were required to calculate the distance between the floors stated on the activity sheet. Since some of the floors were below the zero level, they needed to do operation both using negative and positive integers.
2	5th	Comparing fractions	Students folded paper to make the fractions of $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$. Then, they stacked these fractions one under the other to see which one is bigger. They did the similar practice with other fractions and at the end and they concluded that fraction becomes smaller when the denominator increases.
3 & 4	6th	Operations with negative integers	Students worked on the operations given with the activity sheet. In order to do operations, they used counters, which were developed by themselves before.
4	6th	Exploring patterns and pattern rule	Students used tooth sticks to create the shape given on the activity sheet. The shape consisted of triangles and in each step, the number of triangles got one more. They made the shapes by also filling the table (such as, the number of the step, the number of used tooth sticks and the number of triangles) on the activity sheet. At the end, they explored the formula the given pattern and calculated the further steps (e.g., 50, 76) for the pattern.
5	5th	Calculating the fractional part of a given whole	Students used beans to establish their whole (e.g., 12 beans were accepted as the whole for the first question), and then tried to find the fractional parts given on the activity sheet. They first found the unit fraction and decided how many unit fractions they needed to find the desired fractional part. First, they worked beans to calculate, but after the class discussion, they explored that dividing the whole into the denominator and then multiplying with the numerator enabled them to find the desired fractional part.
8	5th	Decimal Fractions	Students were provided the frequencies for multiple radio channels (e.g., 93.2, 101.8). They were asked to show all these radio channels on the number line. After working individually, they discussed the correctness of their solutions—some of the students came to board, shared their solutions, and discussed with their classmates until the agreement was reached.
10	6th	Exploring the volume formula of rectangular prisms	Students brought small boxes (e.g., pillbox, chocolate box) from their homes and tried to calculate how many sugar cubes would fit inside that boxes to arrive at a general formula to calculate the volume of boxes in a rectangular prism shape.

P5 indicated that such student-centered activities were her intentional choice for teaching mathematics.

> *I try to do apply activities as much as possible. Because, in activities, students are able to visualize the abstract concepts. Math is not something abstract. First, we need to show the concrete examples of mathematics, we need to show that math is a part of the real life. […] When students have a chance to talk about mathematics, they provide very interesting discussions about the mathematical concepts. Thus, we need to give them chance to talk about and deal with mathematics. This also increases the success. […] For instance, you can say that unit fraction is the fraction that has a numerator of one. It does not mean anything to the student. Students need to see it.* (P5_I3)

P5 also mentioned she aimed to enable the active participation of students in the mathematics lessons.

> *[…] I want students to be active in math classes. I want them to think about the mathematical concepts and discuss them. I aim to create an active classroom environment.* (P5_I3)

Observations showed that P5 was successful on this aim. Most of the students actively participated in the discussions, solving questions, and activities during the observed classes (e.g., P5_O2; P5_O3; P5_O5; P5_O10).

P5 enabled students' "talk" in the class. In other words, she gave them chance to discuss the mathematical concepts rather than only lecture them the correct explanations. For instance, at the beginning of the lesson about the percentage, students learned that a fraction can be shown as a percentage when it has a denominator of 100 (P5_O9). At this point, one of the students asked what they could do if the denominator is 1000. Instead of directly answering this question, P5 directed this question to the class to explain their ideas. After a short class discussion, they concluded to simplify the fraction. Then, they explored that they can also use the percentage through expanding the denominator when it is lower than 100 and divider of 100. After that, one of the students shared his interesting view about the symbol of percentage.

I wonder how the symbol for the percentage [%] was discovered. Is it possible that the slash on the middle represents the number 1 or division line, and the small holes represent zero? So, when we say 5%, it means 5/100. (P5_O9)

During the lessons, P5 was careful not to lead students to have mathematical misconceptions. Some of her such attempts are given in Table 4.2., and these examples could give some insight of her didactical knowledge.

Table 4.2. *Examples of Teaching Practices of P5 Avoiding to Cause Misconceptions*

Week	Grade Level	Student Statement & Behavior	Teacher Statement & Behavior
2	6th	In the integers activity (see Figure 4.1., line 2), some of the students drew an apartment having different size of floors.	P5 reminded that all the floors should have the equal dimensions.
2	6th	One of the students came to the board and drew a number line. However, the distance between the numbers was not equal.	P5 asked the class: "*What were we paying attention when we draw a number line?*". Students replied with a chorus answer: "*Having equal distances between each number*".
2	5th	In order to solve a question, students needed to draw a whole and then divide it into 6 parts. However, some of the students' parts were not equal to each other.	After walking in the class and saw that some of the students draw a fraction that has not equal parts, she asked the class: "*If I divide a whole into 6 parts but not equal parts, can I show it with a fraction?*" After many students say "*No*", she continued "*Then, you need to be careful to divide your whole into equal pieces for this question. You can use your ruler to do it.*".
3	5th	While working to transform compound fraction (in this case 13/4) into a mixed fraction, some of the students only divided 13 into 4 and left it.	P5 reminded that in order to show the equivalence, they cannot do the division and finish it. She mentioned that they needed to show the equivalence by using the equivalent symbol. Thus, on the board, she wrote the proper solution. Students who did not perform in that way corrected their solutions on their notebooks
5	5th	Students were working on a task that required to find the 5/6 of 48. One of the students came to the board and began to share his solution: "$48 \div 6 = 8 \times 5 = 40$"	P5 asked the student "*Can we write the equation as you did? Is 48 ÷ 6 equal to 8 x 5?*" After the student realized his error, he wrote the equation by using the proper notation.
8	6th	P5 asked: "What we need to find the area of this parallelogram?"; multiple students responded: "Base and height".	P5 wanted students to use proper language and asked: "*But, we have more than one base and height". Then, students corrected their statement: "Base and the height for that base*".

Not only the didactical approaches but also behavioral approaches of P5 were observed. It was observed that P5 showed evidence of caring and nurturing characteristics in her lessons. When she talked to me about her students, she called them "*my children*" (P5_FN1) [4]. She explained the reasons for this in the interview.

> *Yes, I generally use that word when talking about my students. I love teaching and maybe because of my personal characteristics, I feel like that […].* (P5_I3)

> *[…] I really care about them [the students]. I care about their thoughts and feelings […].* (P5_I3)

In some of the lessons—when it was the last course of the day and students were exhausted—she read passages from Little Prince by Antoine de Saint-Exupery to the 5th grade students for 5-10 minutes. She told me that she aimed students to gain reading habit and have a little rest after a long day. In those moments, students were eager to listen to her and seemed to enjoy (P5_O1). In a similar way, when the students had various problems/issues she personally talked to those students to show them that they are important for her; talking with two students who had a fight at the break (P5_O5); informing the class about Diabetes when the student who suffers from Diabetes was not at the class and requesting students to help their classmate (P5_O3); warning a student who has to wear glasses but did not (P5_O2); asking silently whether there was a problem when the students were looking thoughtfully (P5_O3; P5_O4); and inquiring after a student's health since he was sick at the last class (P5_O6).

In almost every lesson of P5, it was noted in the observation notes that there was a positive classroom environment (e.g., P5_O1; P5_O2; P5_O7; P5_O8) where students were eager to discuss and collaborate with their classmates in a friendly environment; either the students or the teacher made jokes; and none of the students hesitated to indicate their thoughts. P5 also always motivated students to share their views and/or solutions, and appreciated the students when they did so (e.g., P5_O2; P5_O3; P5_O7; P5_O10). In the

[4] In this abbreviation, P5 indicates the ID of the interviewee (Participant 5) and FN1 indicates where the quote comes from (1st week Field Note).

interview, P5 indicated that she was behaving on purpose for enabling such a positive class environment.

> *I have never been an authoritarian teacher; I did not like that kind of teachers when I was a student. It does not mean that there should not be an authority in the class. I want that students to know that I am the authority in the class, but also they should know that I am in that class for them. In order to create such a friendly authoritative class environment, there is a need for jokes; there is a need to smile […] I want them to feel themselves in a friendly environment and behave in accordance with it. I believe that it is important.* (P5_I3)

In the observed classes, it was seen that P5 was always active and continuously walked on the aisles during the instruction. This enabled P5 to monitor the work of students. P5 made in the moment assessment of students' work and guided students when they were stuck (e.g., P5_O1; P5_O2; P5_O5; P5_O7; P5_O10). P5 explained in the interview what she took into consideration when she was walking on the aisles.

> *I am using those times to check the students' work, as a way of assessment. Therefore, I see what the students know, what kinds of problems they have. I help the ones who had difficulty, or I enable to collaborate with their friends. I ask them about their work. I mean, I become a mentor in this process.* (P5_I3)

Furthermore, P5 was successful to find immediate solutions to the problems that arose in the class. For instance, in one of the 6th grade activities, students were required to work with counters, but some of the students did not bring their counters with them. Thus, P5 immediately changed the activity into a group work—that required modifying the activity sheet—to enable the active participation of all students (P5_O3). Similar situations took place in the other grade levels and P5 behaved in a similar way (P5_O5; P5_O6). This showed that P5 had some pedagogical backup plans for her lessons and was successful to apply them in the moment of the instruction.

In brief, it was observed that P5 showed many characteristics of a reform-oriented mathematics teacher in her lessons for the 5th and 6th grades. Based on the interview, it can be claimed that such a teaching method was her intentional choice and this aligned with her beliefs and intentions about mathematics teaching.

4.2.1.2.2.2. Teaching Practices in the 8th Grade

In the 8th grade lessons, P5 started to the lessons by asking students to recount what they did in the last lesson, as she did in the 5th and 6th grade lessons (e.g., P5_O3; P5_O5; P5_O9). After remembering what they did in the last lesson, they either started to the new topic or practice. In the instruction of new topic, P5 rarely used student-centered activities as she did in the lower grade levels. The only time she used a hands-on activity was when introducing the pyramids (P5_O8). In that lesson, P5 brought spaghettis and play dough to the class and students tried to construct different types of pyramids (e.g., rectangular, triangular). Then, they tried to establish the number of edges, sides, faces of the pyramids by filling the chart on the activity sheet and then discussing with their classmates. In the other lessons, P5 mostly preferred teacher-centered practices. For instance, on the topic of the volume of pyramids, she stated without much questioning or discussing: *"We calculate the volume of pyramids via this formula: V= (Base Area x Height) / 3."* Then, she wrote the volume formulas for different types of pyramids via asking questions to the class (P5_O10). Similarly, in the topic of prisms, she stated without letting the students to elaborate: "*Prisms are named based on their base*." Then, P5 showed different types of prisms to the students, they tried to name these prisms via chorus answers (P5_O7).

Similar to the lessons in the 5th and 6th grade levels, practicing was a part of P5's classes. However, there were differences between the practices made in the 8th grade and in the lower grades. First, the time devoted to practicing is evidently more in the 8th grade classes. Second, the nature of practicing in the 8th grade classes differed when compared with the other grade levels. Unlike her practices in the 5th and 6th grades, in the 8th grade level, she gave less chance to students to explore in the practicing periods. P5 gave students some questions to work on, and then she solved the question on the board through asking chorus answered questions to the class (e.g., P5_O1; P5_O3; P5_O4; P5_O5). For instance, when the students made mistakes in chorus answer questions, she corrected them rather than enabling student exploration of own mistakes (e.g., P5_O1). Therefore, these practices were generally interpreted as teacher-centered practices in the 8th grade classes.

However, the didactical practices of P5 in the 8th grade were not completely different than the lower grade levels. As she did in the 5th and 6th grades, she paid utmost attention to not lead students to have misconceptions. Table 4.3. are some of the examples of such practices of P5 in the 8th grade classes.

Table 4.3. *Examples of Teaching Practices of P5 Avoiding to Cause Misconceptions*

Week	Grade Level	Student Statement & Behavior	Teacher Statement & Behavior
3	8th	Students were required to solve a question related to the trigonometry topic. P5 wanted students to understand the question first and then try to solve: "*What is asked in the question?*". Multiple students answered "*Sinus and cosinus*".	P5 asked students "*Can we only say Sinus and Cosinus?*". Since the students did not reply, P5 reminded that one needs to also state the angle like sinus alpha or cosinus 90. She stated, "O*therwise, we talk about sinus or cosinus functions not about the measures*".
3	8th	Students were practicing on a question in which there was a triangle. In the question, the ratio of the length of two sides of the triangle was given as 12/5. One of the students came to the board, started to solve the question by writing the length of these sides on a triangle. Even if the unit was not given in the question, she wrote centimeters as the unit—12 cm and 5 cm for the related sides of the triangle.	After she completed her solution, which was correct, P5 asked the class "*How do we know that the sides are given in centimeters?*" As a chorus, they indicated that they did not know the unit. Then, the student on the board replaced centimeters with the unit.
8	8th	The students were working to construct pyramids by using spaghetti and play dough.	P5 reminded all class that, in order to be considered as a pyramid all the faces should be covered. She indicated that because of the lack of material, they would not be able to cover the faces but wanted them not to overlook this point.
9	8th	When students were working on a problem related to the surface area, some of the students did not use units and indicated the result only with a number (in this case 64).	While walking on the aisles and checking the students' work, P5 asked these students individually: "*What is 64? Can we show the surface area only with a number?*".

Similar to the didactical practices of P5, there were some differences and similarities on the pedagogical approaches of P5 in the 8th grade and in the 5th and 6th grades. Similar to the lower grade levels, P5 walked on the aisles to monitor the students' work and used these times both as a way of assessment and classroom management (e.g., P5_O2; P5_O3;

P5_O9; P5_O10). However, in the 8th grade lessons, classroom management issues were observed several times. Most of the time, the issue was the misbehavior of the particular students (e.g., P5_O1; P5_O2; P5_O4; P5_O5; P5_O8). Some of these students were inclusive student whereas some of them were not. During the first weeks of the observation, P5 tried to find solutions to these problems such as individually talking with these students to explore and solve their problems (P5_O4), warning these students in front of the class (P5_O4; P5_O5), and changing the seating plan of the classroom (P5_O3; P5_O5). However, she was not successful at these attempts, and such issues continued to occur in some of the lessons. Towards the end of the observations, it was noted that P5 began to overlook these students even if they were misbehaving (P5_O8; P5_O9; P5_O10). In the interview, she agreed with this observation and explained this issue.

> *I tried to overcome these issues, but I could not. Thus, I stopped doing that. I mean, when the treatment is not working, you stop applying that treatment. There was no improvement at all.* (P5_I3)

She was also asked about the possible reasons for this problem. One of the reasons was not being trained enough in TEC for such issues, specifically for inclusive students.

> *There was no instruction about the inclusive students at the university. What to do when these students misbehave, how to behave to these students, how to overcome disadvantages of such students… I was not prepared for them when I graduated; I had to experience it when I started the profession.* (P5_I3)

Furthermore, she mentioned that she could not get help from her working community to overcome such problems.

> *At first, I asked them [colleagues and administrators] to help, but they offered nothing. Thus, I started to try overcoming by myself.* (P5_I3)

> *They [colleagues and administrators] already gave up hope of these students. They believe that these students cannot be successful at all.* (P5_I3)

In the 8th grade classes, P5 tried to motivate the students to participate in the lesson as she did in the 5th and 6th grade lessons. However, this time the main motivating factor was

TEOG. She wanted students to give their attention to the question or the concept since it will be probably asked in TEOG (P5_O5; P5_O7; P5_O8; P5_O9). When asked about this choice, P5 mentioned about the role of TEOG for her 8th grade students.

> *TEOG is the main motivation for them. Even if I do not believe that it is correct, I use TEOG to motivate them. They pay attention more and listen to me more carefully when it is something related to TEOG […].* (P5_I3)

In brief, teaching practices of P5 were interpreted as aligned more with teacher-centered methods in 8th grade lessons. I mentioned my observations during the interview that she did not benefit much from the learner-centered activities as she did in the 5th and 6th grades. She agreed with this observation and tried to explain the reasons for this difference from her perspective.

> *You are right; I do not use learner-centered activities much in the classes of the 8th grades. TEOG is a reason for it, but not the only reason. Because of TEOG, we practice more in the 8th grades. If there were no examination like TEOG, I would use activities more in order to help them conceptualize the topic. The other reason is my students in the 8th grade. In these classes, many students have misbehaving problems. At first, I tried to apply such methods [learner-centered] but failed. Then, I gave up.* (P5_I3)

She was also asked about the difference between the students in the 5th and 6th grade and the 8th grades in order to understand why she only failed at the 8th grades.

> *It might be too late to change the students in the 8th grade. When they came to the 8th grade, it is more difficult to break down the prejudices; it is more difficult to change the mathematics-learning environment they got used to. I mean, as the twig is bent, so is the tree inclined. In the lower grades, I was successful to do that but in the 8th grade, I was not able to do that […]. (P5_I3).*

Therefore, it is possible to claim that various factors (such as TEOG, the nature of classes and the working community) played a role on the difference between the practices of P5 in the 8th grade lessons and in the 5th and 6th grade lessons.

4.2.1.2.3. Actualized Mathematics Teacher Identity of P5: A Summary

The data obtained through the observations and interview enabled to explore the actualized mathematics teacher identity of P5. The data showed that teaching practices of P5 differed based on the grade level. In the 5th and 6th grade mathematics lessons, P5's didactical approaches were in line with the reform-oriented mathematics teaching, which showed consistency between her professed beliefs and intentions regarding the teaching of mathematics. In these grade levels, P5 used hands-on activities, benefitted from daily life situations, and enabled class discussion and exploration of mathematical concepts. In designing such classes, it was noted that she benefitted from various resources such as the experiences in TEC, resources offered by MONE, experiences in other communities (e.g., in-service training), and online resources. On the other hand, in the 8th grade lessons, lecturing and teacher-centered practicing were preferred more. In these classes, she seldom enabled students to explore the mathematical concepts by themselves. Although her didactical approaches differed, she was careful not to lead students to have mathematical misconceptions in the classes at all grade levels. Furthermore, her pedagogical choices, such as aiming to create a positive class environment, and showing caring and nurturing characteristics, showed more or less consistency across different grade levels. However, it should be kept in mind that she experienced some classroom management problems in the 8th grade, and could not overcome such problems until the end of the semester.

In brief, actualized teacher identity of P5 could be described as "Hybrid-Practice Mathematics Teacher Identity". The breaking point for her difference on the teaching practices seemed to be the grade level.

4.2.1.3. Perceived vs Actualized Mathematics Teacher Identity of P5: How consistent?

In the previous sections, professed and observed experiences of P5 were explained in order to explore her mathematics teacher identity. Professed experiences informed us that being a mathematics teacher was an intentional choice of P5. Since she always wanted to be a teacher and had a good relationship with mathematics, it can be claimed that P5 had internal motivating factors to be a mathematics teacher. P5 believed that she developed herself well in terms of content, curriculum, and didactical domains during the time she spent in the teacher education community. Furthermore, she mentioned that her beliefs about teaching mathematics, which were in line with reform-oriented practices, were mainly developed in TEC. However, she indicated that her knowledge of pedagogy and professional participation was limited when she graduated. She indicated that the main development on such domains had been occurring after starting to the profession with the help of her in-service experiences. P5 also talked about her teaching practices. These practices yielded that P5's mathematics teaching differed based on grade level. In the 5^{th} and 6^{th} grades, she preferred reform-oriented teaching methods, but in the 8^{th} grade, her teaching methods were aligned more with traditional methods. She mentioned that although the used method in the 5^{th} and 6^{th} grades was her desired approach, she was not successful to use that method in the 8^{th} grade for various reasons. P5 professed that she had a positive relationship with students in her classes where she cared about her students and her students did not hesitate to share their views and/or work in the class. Based on these experiences, it was decided that P5 showed the general characteristics of a "Hybrid-Practice Mathematics Teacher Identity" in the current study.

The experiences of P5 in her mathematics classes and working community were observed for a semester in order to explore the actualized mathematics teacher identity of P5. It was seen that P5 showed different teaching practices at different grade levels. In the 5^{th} and 6^{th} grades, she used hands-on activities, materials, daily life examples to teach mathematics. On the other hand, these kind of practices was significantly less in the 8^{th} grade classes.

In the 8th grade lessons, she mostly used teacher-centered methods to teach mathematics. Rather than enabling student exploration—as she did in the 5th and 6th grade classes—she mostly explained the concepts to the students and spent more time on practicing. Regardless of the grade level, she was careful not to lead students to have mathematical misconceptions, which could be interpreted as a result of her content and didactical knowledge. Although there are some classroom management issues in the 8th grade lessons, the positive relationship with the students was observed in her classes. It was observed that she cared about the students, and she gave chances to students to talk and collaborate. Although her working community did not hold the necessary dimensions of a CoP, she participated in in-service programs to improve her teaching. In brief, the observed weeks informed that P5 performed practices in line with the reform-oriented practices in the 5th and 6th grades, but such practices were far less in the 8th grade lessons. Therefore, her actualized mathematics teacher identity could be described as "Hybrid-Practice Mathematics Teacher Identity" in the current study.

As explained above, there was a substantial consistency between the mathematics teacher identity of P5, which was inferred based on her professed experiences; and her actualized mathematics teacher identity, which was inferred based on the observations in her working community. First, it shows that P5 made essential and comprehensive reflections on her teaching practices. Being able to make self-reflection is considered as an important characteristic of a teacher to have better self-understanding of her/his own teaching (Alsup, 2005). Second, it might show that doing multiple and detailed interviews, which asks various questions to uncover all experiences in the journey of becoming a teacher, helped to have a robust understanding on the mathematics teacher identities of participant teachers. P5 also mentioned the role of interviews in helping her to make a self-reflection.

> *[…] Answering all these questions was a good experience for me. Thus, I am happy to participate in this study. I made a self-reflection on my teaching practices and myself as a teacher.* (P5_I3)

The analysis of data collected through multiple methods to explore P5's mathematics teacher identity and the effect of these methods on P5's self-reflection enabled me to drive

conclusions about her mathematics teacher identity as "*Hybrid Practice Mathematics Teacher Identity*". The effects of the working community are explored next.

4.2.1.4. How Did the Working Community Affect P5?

Physical conditions of the working community of P5 were explained before. Therefore, the focus in this section is on the professional environment of the working community. First, the working community of P5 is described in detail, and then, the effects of the working community on P5 are elaborated.

4.2.1.4.1. A Community or a Community of Practice

As mentioned earlier, Wenger (1998) describes three essential dimensions to be a community of practice (CoP): *Mutual engagement, joint enterprise, and shared repertoire*. The existence of these dimensions in the working community of P5 is explored in this part of the study. As explained in detail below, the working community of P5 lacked all three dimensions in general and in reform-oriented teaching specifically. Therefore, it was considered as a community rather than a community of practice.

4.2.1.4.1.1. Mutual Engagement in the Working Community of P5

In the working community of P5, the teachers' meeting room seemed to be the only place in which the mutual engagement of teachers could occur. In teachers' meeting room, teachers talked about daily life situations (e.g. P5_FN1; P5_FN4; P5_FN7; P5_FN8), engaged with their cell phones (e.g., P5_FN1; P5_FN3) or had a quick bite (e.g., P5_FN1; P5_FN5). However, during the observed weeks, it was commonly noted that there was no educational discussion and/or knowledge sharing among the teachers (e.g., P5_FN1; P5_FN2; P5_FN3; P5_FN5). The interview made with P5 supported this observation.

> *In teachers' meeting room, everything but educational issues is talked. We never talk about to solve the problems of the school or students […].* (P5_I3)

> *[…] At first, I found odd not to talk about such [educational] issues with other teachers. Before starting to the profession, I had thought we were going to talk about mathematical activities, I was going to learn new stuff. But, it never happened. […] For instance, I am doing a Master's study, but none of the teachers asked me anything about the topic of my thesis […].* (P5_I3)

The only time observed that there was an educational conversation was in the 6th week. However, it cannot be considered as a conversation that supports reform-oriented mathematics teaching.

> *[P5 told the other mathematics teacher that she was going to teach transformational geometry in the next lesson. P5 indicated that the topic might be difficult for some of the students in the 8th grade].*
> *Other Teacher [OT]: I think that you should just give the formula and show the question types for each formula. Otherwise, they are not able to solve the questions.*
> *P5: I had been taught with such a method in the middle school, and had problems to visualize them [geometrical shapes]. Thus, I will try to visualize the topic with activities.*
> *OT: I said that for your own sake. How are you going to make an activity with 50 students?* (P5_FN6)

P5 criticized the lack of mutual engagement among the colleagues in her working community and thought that it was because of the lack of belief in the students' ability to learn.

> *[…] It is believed that the students in our school cannot be successful whatever is done. In one of the conferences I participated, the speaker indicated that student success in low SES schools is 1.6 % whereas it is around 50-60% in high SES schools. Is it because of the students' lack of intelligence? Of course, it is not. It means that, in these schools [low SES], we [teachers and administrators] are not capable enough. We [teachers and administrators] always complain about students, but we need to ask ourselves whether we work together and put enough effort to overcome these problems.* (P5_I3)

There was no mutual engagement between teachers and administrators observed during the time of the study. On the contrary, when P5 asked the help of administrators to solve the problems that arose between new coming immigrant students and the other students, she stated that the administrators did not pay attention to the problems (P5_FN9). In

another time, P5 asked the permission of the administrators in order to participate in an in-service training of MONE, they did not want P5 to participate in that training (P5_FN6).

In addition to the lack of mutual engagement among teachers, and between teachers and administrators, there seemed to be lack of mutual engagement between teachers and parents. When there was a parent-teacher meeting, P5 indicated that approximately 15 parents out of 50 parents in each class participated in that meeting and mentioned that most of the parents did not pay attention to these meetings (P5_FN3).

In brief, it could be claimed that there was a lack of mutual engagement for educational practices in general, and reform-oriented practices specifically—among teachers, between teachers and administrators, between teachers and parents—in the working community of P5.

4.2.1.4.1.2. Joint Enterprise in the Working Community of P5

In the working community of P5, no evidence for the reform-oriented methods of teaching was observed and/or inferred. P5 supported this claim and indicated that the other teachers, including the other mathematics teachers, applied traditional methods (P5_I3; P5_FN3). Recounting what P5 said in the second interview might also be beneficial to understand the school administrators' views on learner-centered teaching.

> *When we were doing an activity, the school principal came to the classroom for a reason. He thought that we were playing instead of teaching. Because he does not have any knowledge of student-centered teaching.* (P5_I2)

Furthermore, the school principal did not want to give permission to participate in an in-service training related to the use of technology in mathematics teaching (P5_FN6). Although there is no data about the school administrators' beliefs about teaching methods, based on such events, it was inferred that reform-oriented teaching was not the priority of the school administrators.

In terms of classroom management, authoritarian teachers were appreciated both by P5's colleagues and administrators in the working community. For instance, in the teacher's meeting room, teachers were talking about one of their colleagues and appraised his classroom management (P5_FN10). They indicated that his classes were the best in terms of classroom management since the students did not talk at all in his classes and were afraid of him. Similarly, P5 mentioned that school administrators suggested her to hold the above-mentioned teacher as an example, and behaving tough and taking a hard line with her students (P5_I3; P5_FN9).

Observations indicated that there were some teaching related beliefs and intentions supported by the school administrators and some of the teachers (such as behaving tough, using teacher-centered methods). However, such beliefs and intentions cannot be considered as a joint-enterprise of a reform-oriented working community. Furthermore, based on the data obtained from P5 and her classes, it was clear that such beliefs and intentions were not adopted by P5 that showed that they were not the joint enterprise for P5.

4.2.1.4.1.3. Shared Repertoire in the Working Community of P5

Since there was a lack of mutual engagement and joint enterprise in general and in reform-oriented teaching specifically, it was unlikely to have a shared repertoire in the working community of P5. Interviews and observations supported this claim. As recounted earlier, P5 mentioned that even if she requested mathematics teaching materials from the school administrators, she could not get materials (P5_I1; P5_I2). Furthermore, even if she tried to develop materials by herself, she was still not supported by the school administration. For instance, in one of the 8^{th} grade lessons, prisms were developed via using daily life materials. P5 wanted to store them to be used at the following times; however, school administrators indicated that there was no place to store such materials in the school (P5_FN7). In a similar vein, although there were smartboards in each class, teachers were

not allowed to use them in case of the possibility to be broken (P5_FN3; P5_I3). Therefore, it is possible to claim that in addition to the lack of shared repertoire for reform-oriented teaching, attempts to develop such a repertoire were not supported in the working community of P5.

4.2.1.4.2. The Effects of the Working Community on P5

As explained above in detail, the working community of P5 cannot be described as a CoP in general and supportive in terms of reform-oriented teaching. The obtained data consistently showed that there were negative conditions for reform-oriented teaching, and the analysis revealed that P5 was affected either negatively or—surprisingly—positively by those negative conditions as reported below.

4.2.1.4.2.1. Negative Impacts

The poor physical conditions of the classrooms and the school such as crowded classes, poor conditions of the teachers' meeting room were mentioned before. When P5 asked about such conditions, she mentioned about the negative physical impacts on her.

> *For sure, it affects a lot. It might be undermining my performance. […] In the simplest term, I got tired. After a tiring a class, there is no place to take a rest, thus you have to go to next lesson without a little rest.* (P5_I3)

Furthermore, limited physical conditions seemed to affect her teaching methods. For instance, even if she wanted to benefit from technology in her classes, she was not able to do it.

> *Even if I requested a few times, he [the school principal] did not let me to use the smart boards. He was afraid of whether the smartboards are broken. I asked the related unit [in the Ministry of National Education] about what happens in case of technical problems. They told me that there are staff to deal with such problems. However, I could not convince him. [Researcher: I know you attend in-service trainings on technology-supported teaching. Does the school principal know about that?] I think he does not know about the topic of the conferences and trainings I attained. He is not interested in.* (P5_I3)

The lack of mathematics-teaching material seemed to negatively affect P5's intended teaching practices.

> *[In an 8th grade lesson] We calculate the pyramids' volume via using this formula: V= (BA x h) / 3. [After writing volume formulas for different types of pyramids on the board] Actually, if we had volume models for prisms and pyramids, I wanted to use them to explore the formula. By filling up water, we would explore that pyramids' volume is equal to the one-third of the prism that has the same base.* (P5_O10)

When P5 asked about the lack of material, she talked about some of its negative impacts on her teaching.

> *[…] Since we do not have any materials, I could only use the student-made/brought materials to do activities. It is a limitation for me. For instance, we do not have any Geoboards. If we had, I would do activities with using it. I had great difficulty to help students to conceptualize [the concept of] height. If we had Geoboards, it would be easier. When I find alternatives I use these alternatives, but sometimes I am not able to find any alternatives.* (P5_I3)

The classroom management problems due to the adaptation problems of immigrant and inclusive students were already mentioned before (e.g., P5_O2; P5_O5). In the interview, P5 was asked about whether she attempted to solve these problems by seeking help.

> *There was no one to help me on this issue. I asked the help of school administrators on the issue related to immigrant students but they did not pay attention. Furthermore, they even did not listen to my solution suggestions […].* (P5_I3)

> *[For some of the inclusive students] I asked the help of school principal. Their suggestions did not work at all to solve the problems. Then, they tried to talk to these students but it did not work, too. They are also helpless on this issue.* (P5_I3)

When P5 asked about her mutual engagement with the other teachers to solve such pedagogical problems:

> *Unfortunately, we do not work collectively to solve such problems. Everyone is individually struggling to get over the problems.* (P5_I3)

All the problems P5 experienced in her working community caused her to feel negative emotions.

> *[…] When people do not appreciate your work, you begin to lose your motivation after a while. It is something important for a teacher. I mean when you are in the minority and the rest is teaching in a different way than your beliefs… Even if you know that you are on the right way, you get upset.* (P5_I3)

> *[Ministry of National Education requested P5 to be an instructor in one of the in-service trainings. Due to the paperwork, there was a need for the approval of the school principal] I lost sleep for days because of this getting permission procedure. Since the Ministry of National Education requested it, there was no option to not give a permission. I already knew about that. Yet, thinking about what he was going to tell me was annoying. Because you are talking with someone who does not understand how important it is for a teacher to improve her/himself. In this respect, I am not happy here [in her working community]. As a teacher, you try to improve yourself, but they do not appreciate it. Even, they do not support doing it.* (P5_I3)

In brief, the dimensions of the working community of P5 seemed to have some negative impacts on her. These negative impacts could be summarized as choosing more teacher-centered teaching in some cases because of the limited repertoire for learner-centered activities; having classroom management problems of because of the lack of professional support she needed, and feeling negative emotions because of the lack of mutual engagement and joint enterprise in her working community.

4.2.1.4.2.2. Positive Impacts

As explained above in detail, the professional environment in the working community of P5 cannot be considered as supportive, especially for reform-oriented teaching. However, in some cases, these negative conditions did not have negative impacts on P5. On the contrary, P5 succeeded in turning some of the negative situations into positive ones. P5 was also aware of this situation.

> *[…][Referring to the negative conditions in the working community] It leads you to develop solution strategies. It improves your problem-solving skills. Thus, it has both positive and negative outcomes […].* (P5_I3)

These problem-solving skills were often observed during the classes of P5. For instance, it was observed that P5 chose to develop materials with her students, such as cutting paper to make counters (P5_O3), and fraction cards (P5_O2); constructing prisms via spaghetti and play dough (P5_O8), because there were no materials for reform-oriented mathematics teaching in her working community. When P5 was reminded about her such attempts, she explained her intention on such practices.

> *Even if there were materials in the schools, I would still make some of the materials with the students. I mean, even if we had prism models, I would do the spaghetti activity. It was a good activity to explore. However, if we had counters, we did not have to waste time to cut them from construction papers. So, most of the time my such practices were because of the obligation, but sometimes it was an intentional choice […].* (P5_I3)

In a similar vein, when there were not enough materials to do the activity individually, she immediately modified the activity to a group work activity and/or divided available materials to all class and modified the activity sheet according to available materials (e.g., P5_O3; P5_O6; P5_O10).

Since P5 could not mutually engage with her colleagues and school administrators, she participated more in the communities outside of her working community.

> *I know how the teaching should be. I try to apply such methods in my classes, and I try to improve myself in line with these competencies. However, such truths are not accepted and appreciated in my working community. I started to question myself after spending a while in my working community. Therefore, all the in-service trainings, seminars, and conferences were highly important for me. They enabled not to lose my motivation to teach in that way [learner-centered]. If I had not been in such communities and stayed only in my working community, I would possibly start to think that I was wrong [in terms of teaching beliefs and intentions]. In that sense, participating in teacher development programs outside of the school was crucial for me as a teacher.* (P5_I3)

Participating in communities outside of the working community not only helped P5 to professionally develop herself, but also enabled her to have a chance to work in a different working community. At the end of the semester, P5 had a good offer from another public school to transfer her in the next academic year, and she accepted that offer. P5 met the

school administrators of her new working community in the trainings she participated. As indicated by P5 [based on the personal conversations made in the following year], her new working community has significantly better physical conditions and shared repertoire for reform-oriented teaching; joint enterprise and mutual engagement in line with reform-oriented teaching.

In brief, in some cases, P5 was able to not and/or minimally be affected by negative conditions in her working community. Furthermore, she was able to develop skills to turn some of the negative conditions into positive such as being flexible in teaching, participating reform-oriented communities outside of the working community.

4.2.2. The Case of P11

In this part of the study, the 3rd and 4th research questions of the study are explored for the case of P11. Similar to the procedure applied for P5, the first two interviews are used to infer the perceived mathematics teacher identity of P11. Then, the observations made in the working community of P11 and the 3rd interview conducted with him are used to explore his actualized mathematics teacher identity. Furthermore, the consistency between his perceived and actualized mathematics teacher identity, and his working community's effects on him are discussed.

4.2.2.1. Perceived Mathematics Teacher Identity of P11

P11 indicated that he changed a few schools during the elementary school years, and described his school success as unsatisfactory in these years. This lack of prior knowledge seemed to cause a poor beginning in terms of mathematics in the middle school years. However, he was successful to change this poor beginning and began to have a good relationship with mathematics during the middle school years.

> *The conditions of my first elementary school were not good at all. Therefore, I had to change a few schools for the elementary school. When I came to my last*

> *elementary school, I was far behind of my classmates. […] In the 6th and 7th grades, I was not good at mathematics. However, in the 7th grade, my brother started to teach me mathematics individually [after school]. It was highly beneficial for me; afterward, I became so successful in mathematics in the rest of the 7th and 8th grades. […] In the high school, I was also successful in mathematics. In the summer before the last year of the high school, I had private tutoring classes. In that summer, I had learned all the content of last year's mathematics curriculum before the semester started. Therefore, I was successful in mathematics in the university entrance examination […].* (P11_I1)

Private tutoring teacher seemed to be a role model for the P11's choice of mathematics teaching profession. Furthermore, he referred to the content knowledge when recounting the positive sides of his mathematics teachers. He seemed to appreciate his mathematics teachers who solved difficult and various type of questions.

> *That teacher [private tutoring teacher] consciously or unconsciously affected my choice to be a mathematics teacher. He was suggesting me to have mathematics education at a good university.* (P11_I1)

> *My mathematics teacher at the private teaching institution [called "dershane" in Turkish context] was good at mathematics. He was solving any type of questions; I think his content knowledge was good.* (P5_I1)

> *[…] My mathematics teacher at the first two years of high school was a good teacher. In terms of content knowledge, I find myself similar to him. He was solving good questions in the class. I mean, he asked difficult and challenging questions. Our geometry course teacher [in high school] was also good. He enabled us to solve difficult questions by continuously solving difficult questions at the lesson.* (P11_I1)

P11 described his experiences in TEC for the content domain as moderately sufficient for middle school level and mentioned that they focused more on the didactics rather than the content.

> *Most of the content courses we took at the university help to high school, not to middle school. We took calculus classes, linear algebra courses and these are beneficial for the high school. I mean we did not learn about exponentials. […] But, in the methods courses, we learned about how to teach that content. We learned about common misconceptions of students.* (P11_I1)

> *I had enough content knowledge when graduated, or at least, I felt in that way. However, I continuously learn [in the profession]. […] Maybe if someone asked me*

> *what a "research question" is, I might not be able to answer this question at the beginning of the semester. Nevertheless, I learned it from the 5th grade's textbook.* (P11_I1)

Similarly, P11 mentioned that he had the necessary curricular knowledge in TEC but continued to learn in the profession.

> *I knew the curriculum of the 5th graders very well, and I had a more or less knowledge about the other grade levels [6th, 7th, and 8th grades]. […] Now, I continuously check the curriculum […].* (P11_I1)

P11 mentioned that pedagogical knowledge and expertise could be acquired in the profession. Thus, he stated even if he had theoretical knowledge coming from his experiences in TEC, his main pedagogical knowledge has been developing in the profession.

> *[…] It is something that could be learned in the profession. Because it is not something simple. You try to remember the theoretical stuff you learned at the university, but it is difficult to remember during the instruction. Thus, I believe that it could be learned in the class and I am trying to do so.* (P11_I1)

As recounted in one of the previous sections, P11 mentioned his lack of knowledge in the professional participation domain before starting to the profession.

> *I did not have knowledge on this issue [the professional conditions of the schools]. Because you do not know in which school you are going to work. […] I did not know about the professional environment of the school.* (P11_I1)

P11 mentioned that there is no one best method for teaching mathematics. He believes that teaching method should be differentiated for different student profiles, and teaching the logic of the mathematics should be the aim.

> *If there are 20 students in your class, there are 20 best ways to teach mathematics. Thus, I cannot say there is one the best method. […] For instance, some students do not like to write whereas some of them understand better when they write […].* (P11_I1)

> *You cannot teach mathematics only giving them [the students] the formula. They need to understand the logic behind [the formula or concept] first. Thus, I want*

> *them to think about and understand the question first before solving it. If you only solve the question, they cannot understand.* (P11_I1)

P11 indicated that his beliefs about teaching mathematics were mostly developed in the profession.

> *My thoughts were developed in the practicum times and in the profession. At the university, I did not think about it much.* (P11_I1)

P11 started to work as a mathematics teacher when he was in the TEC. For a few years, he worked in private teaching institutions [dershane] and had several private tutoring students (P11_I2). After the graduation, he chose to work in private schools instead of public schools. After working a year in a private school, he started to work in another private school in his second year in the profession. He described his working community as having limited physical conditions and average student success.

> *Its physical conditions are limited. It should have a better garden and science laboratory. […] When compared with the other private schools, you can say that it should be better […].* (P11_I2)

> *It [the success of students] is average. It can be better but now, it can be described as moderately successful.* (P11_I2)

The working community of P11 includes both middle school grade and high school grade levels ranging from the 5^{th} to 12^{th} grades. P11 has been instructing two grade levels: 5^{th} and 11^{th} grades. Thus, he has been working in both middle and high school levels in his working community.

Even if it was limited, there seemed to be a mutual engagement in the working community of P11. Furthermore, there seemed to be a positive professional environment.

> *We have a good relationship with the school administrators. There is a friendly interaction among the teachers and administrators.* (P11_I2)

> *[…] Sometimes, Mr. Demir (pseudonym for the school principal) comes and observes my classes, gives feedbacks for the classes in high school.* (P11_I2)

> *[…] There is a lack of the feedbacks in middle school level. Mr. Demir is knowledgeable in high school level but not in middle school level. We have very good teachers in high school mathematics but they graduated from mathematics department, not from the mathematics education department. Thus, they do not know about activities. […] I can interact with the other middle school level teacher, but so far, we could not do it much.* (P11_I2)

> *[In middle school] we met monthly for the [mathematics] department teachers' meeting. We met three times in this semester so far […]. In the meeting, the head of the mathematics department told us about the meeting that he did with the school principal. We talk about what to do, what not to do to increase the success of students. We discuss the results of the exams […]. (P11_I2)*

However, P11 did not seem to have enough knowledge about the other teachers' mathematics teaching methods.

> *I know that the other teacher is using smart notebooks in her instruction. All I can say about it [the other teachers' mathematics teaching methods] is that I do not know much.* (P11_I2)

In the working community of P11, seminars related to education seemed to be a part of the shared repertoire.

> *Even if it is not directly related to the mathematics teaching, I participate in the seminars organized by the school. Either the instructor comes and talks about educational issues, or we work on some concepts and make presentations on those days. […] I cannot remember all the topics but one of them was about developing mind maps.* (P11_I2)

In addition, P11 indicated that he has a good relationship with the parents of his students.

> *I have a good relationship with the parents of my students. I sometimes visit their homes. [In a response to a query about the topic of such visits] I give suggestions on the effective ways of working at home and they talk to me about their child. It helps to know the students better*. (P11_I2)

When P11 was asked about his teaching practices, his descriptions were mostly in line with the teacher-centered practices even if he indicated his intention of applying more learner-centered methods in his classes.

[…] sometimes, I prepare presentations and instruct by using them. I mostly use direct-teaching. I could not do activities much. I wish I could do […]. (P11_I2)

[…] I saw my friends on Facebook and they are applying activities. I wish I could also use activities but I could not. I ask myself how they are able to do it and I am not […]. (P11_I2)

Based on P11's statements, it can be claimed that there were various reasons for not applying reform-oriented methods such as limited personal time to develop learner-centered activities, limited repertoire for learner-centered activities developed before, and the lack of personal motivation.

I have a lack of time. Because, when I am at the school, I always have a class. I have maybe only 3 hours [at school] apart from the class hours. During that time, I want to rest. I wish I had more time at the school to get prepared for my classes […]. (P11_I2)

I believe that I need fewer class hours. I do not want to work at home. Home is not for doing that; it [preparation for the classes] should be at the school […]. (P11_I1)

[…] at home, I want to have a rest. I want to chat with my wife; I want to listen to music […]. (P11_I2)

I want to be more active as a teacher. I want to teach better. Nevertheless, I am not that good yet. I do not know the reason. I need to work harder. Maybe I make excuses not to do that. I need to explore more; I need to see more activities related to the content […]. I make excuse as the lack of time, but maybe it is something related to my internal motivation. I do not know […]. (P11_I2)

Actually, I think that I might not have paid enough attention [to the coursework in TEC] when I was at the university. I studied, but I wished I studied more at the university. I did not know it would be so important when I start the profession. (P11_I2)

Even if P11 did not instruct the 8th graders, he was asked about his views of TEOG and how his teaching would be if he was instructing the 8th graders.

In one of the seminars at the school, the lecturer told that, based on the TEOG research results, the students who were taught with activities and conceptually understood the topic were more successful than the students who were taught with drill and practice method. I both agree and disagree with it. I had so many students so far [including his private tutoring students] and some of them succeed only by

> *using drill and practice method. Sometimes, the best method might be the oldest method. If the students practice enough, they can already conceptually understand it […]. [If I was teaching 8th graders] I would not do activities and would practice more. I would not do the things like activities that would take so much time.* (P11_I2)

Based on all the professed experiences of P11, it was inferred that he developed "Traditional-Practice Mathematics Teacher Identity". In this development, his experiences in communities prior to TEC (such as own studentship period and working experiences as a private tutor) seemed to have some impacts. On the other hand, based on the experiences in TEC, he had some intentions to apply more reform-oriented mathematics teaching methods. However, he could not do that because of various perceived reasons (e.g., lack of time, lack of internal motivation and reform-oriented teaching personal repertoire). Based on what he indicated, it was inferred that his working community has some possibly supportive conditions to develop reform-oriented practices (e.g., mutual engagement of administrators and teachers, in-service training opportunities). Nevertheless, the working community of P11 also seemed to have unsupportive (e.g., intense working hours) conditions. In this relatively supportive working community, the teaching practices of P11 seemed to be affected by the unsupportive conditions rather than the supportive conditions.

4.2.2.2. Actualized Mathematics Teacher Identity of P11

P11 was observed for 10 weeks (twice a week, 6-8 hours a day) during the Fall Semester of 2015-2016 academic year. Although P11 was teaching in the 5th and 11th grade levels, he was only observed during his three different 5th grade classes since the focus of the study was on middle school mathematics teachers. A similar procedure with P5 was followed for P11: Observation notes and observation reports were taken regularly, and an interview was conducted after the observation period ended. Therefore, the main data sources for this part are the data obtained from the observations and the last interview.

4.2.2.2.1. Physical Conditions

The working community of P11 was located in one of the central neighborhood of Ankara. The school consisted of three buildings: One was devoted for kindergarten and elementary school, the other one was devoted for middle and high school grades, and the last one was the Sports Hall that was devoted for the Physical Education Lesson. Other than sports hall, the other two buildings had five floors. In the middle of all these buildings, there was a playground in which students spent their break times.

In the middle and high school building, the first two floors were devoted for middle-grade levels (5^{th} to 8^{th} grades), the 3^{rd} and 4^{th} floors were devoted for high school grades (9^{th} to 12^{th} grades), and the last floor was devoted for school lunch hall. On the hallways outside of the classrooms, there were cabinets devoted for each student to keep their books and personal belongings. Furthermore, there were boards on which educational (e.g., suggesting to smile, being polite) and instructional (e.g., English meaning for some of the Turkish words) messages or work were presented. Employees who were responsible for the cleaning were commonly observed while they were working, and both classes and hallways could be described as clean and neat all the time.

In each classroom, there were approximately 20 students. The size of the classrooms could be described as medium but sufficient for 20 students. There were two boards in each classroom: One was a traditional whiteboard, and the other one was a smart board. Similar to the hallways, there were boards in the classes to be used to present the educational and instructional works.

The teachers' meeting room was large and there was a big round table in the middle. There were chairs for teachers located around this table. Furthermore, there were cabinets for each teacher. In that room, there were two desktop computers to be used by teachers. In addition to the teachers' meeting room, there were a few more rooms for the meetings of teachers (such as department teachers' meeting and meeting with parents).

The physical conditions of the working community of P11 are given to illustrate the context where the teaching practices of P11 occurred. The next section focuses on the teaching practices of P11 in order to explore his actualized mathematics teacher identity.

4.2.2.2.2. Teaching Practices of P11

The mathematics lessons of P11 can be mainly described in two parts: Instruction of the topic and practicing. In the instruction part, P11 used to start the lesson by asking students their views about the topic of the day. For instance, in the time measurement topic, he asked what they thought when somebody said "time" (P11_O4); in the data representation and analysis topic, he asked whether the students heard the word "data" before (P11_O6); and in the research question development topic, he asked students whether they had ideas on what a research question would be (P11_O7). After hearing students' views, P11 summarized students' views and explained the topic to the students. Then, they started to practice related to the topic. The practicing part can be described as the longest part of P11's mathematics classes. First, P11 solved the questions related to the content, and then, he asked questions to students to solve. For instance, in the time measurement topic, he started to solve questions about the transformations of minutes to seconds and vice versa (P11_O4). Then, he asked questions to be solved by the students (such as, how many seconds is equal to 5 minutes and 24 seconds?). In the students' practicing part, first, students tried to solve the question individually, and then, one of them was selected to show his/her solution on the board (e.g., P11_O1; P11_O2; P11_O4; P11_O7; P11_O10). Some of the questions asked in the practicing part are given in Figure 4.4. below. These questions were either written by P11 to the board or already written on the students' textbooks. As can be seen in the Table 4.4., the questions asked in the practicing part could be considered as an example of drill and practice method, rather than working on challenging and/or inquiring questions. Furthermore, it should be noted that similar type of questions were asked repetitively (see Table 4.4.).

Table 4.4. *Examples for the Teaching Practices of P11*

Week	Grade Level	The Related Objective	The Asked Question/Problem
1	5th	Solving word problems that require arithmetic operations	In a farm, there are 471 sheep and the number of cows is 300 more than the number of sheep. How many sheep are on this farm?
1	5th	Solving word problems that require arithmetic operations	In a water tank, there are 1235 liters of water. How much water will there be if 200 liters of water is added to the tank?
2	5th	Solving word problems that require arithmetic operations	250 ₺ is shared between two brothers. The older brother takes 50 ₺ more than the younger brother. Then, how much Money does the younger brother take?
2	5th	Solving word problems that require arithmetic operations	250 ₺ is shared between two brothers. The older brother takes 50 ₺ less than the younger brother. Then, how much Money does the younger brother take?
3	5th	Solving word problems that require arithmetic operations	In a class, the number of male students is 3 times more than the number of female students. If there are 24 male students more than the female students in that class, how many students are there in total?
4	5th	Time measurement and transformations among the time measures	What is the sum of 2 hours 40 minutes and 1 hour 50 minutes?
4	5th	Time measurement and transformations among the time measures	[Fill the blanks] 240 minutes = ……. hours 135 minutes = … hours … minutes 270 hours = … days … hours
5	5th	Time measurement and transformations among the time measures	Baris was born on 25th of September, and Emel was born on 1st of April. How older is Baris than Emel?
6	5th	Time measurement and transformations among the time measures	How many days are there between June 13th 2013 and November 28th 1995?
7	5th	Establishing and creating research questions	Are the following items research questions? (i) What is the capital of Turkey? (ii) What is the most favorite fruit of the students in this class?
8	5th	Data display	Show the most favorite colors of the students in this class via frequency table and column graph.
9	5th	Solving word problems that require arithmetic operations (In general review)	Ahmet has 380 ₺ and Halil has 330 ₺. How much money should Ahmet give to Halil in order to have equal money?
9	5th	Exponentials (In general review)	Calculate the following equations: (i) $4^3 = \ldots$ (ii) $5^2 = \ldots$
10	5th	Solving word problems that require arithmetic operations (In general review)	Neil Armstrong was born on 5 August 1930 and he landed on the moon on 20 June 1969. How old was he when he landed on the moon?

In addition to the questions being asked in the class, P11 gave homework to students in which there were questions similar to the ones given in Figure 4.4. The homework was given from four of the sources (two of them were instructional textbook whereas the other two of them were workbook) that P11 used throughout the semester. The intensity of the homework differed: 4 pages (P11_O4), 7 pages (P11_O7), and 25 pages (P11_O10) of questions to solve. In checking the accuracy of the students' answers, P11 read the answer key at the next class hour. If many students did not solve the question or if one of the students asked to solve a question, it was solved on the board by one of the students or P11. This process might even last for two class hours (e.g., P11_O2; P11_O6). When P11 asked about the practicing and homework checking period in his class, he mentioned the importance of practicing in the teaching of mathematics.

> *I think it [practicing] is very important […]. Students need to practice a lot to be able automatically to solve any type of question. Nobody can say that I can solve any type of question by only reading the topic. There is a need for mechanization by solving questions as much as possible. (P11_O2)*

For some of the homework questions, the answer key was incorrect. These questions were established through students' objection when P11 read the answer key to the students (P11_O1; P11_O6; P11_O10). In such cases, P11 solved the question on board and corrected the answer key. However, it might be beneficial to bear in mind that there was a threat to overlook such questions if none of the students objected to the answer key. Furthermore, some of the questions in homework had not been taught yet, and the students told P11 that they could not solve these questions (P11_O1; P11_O10).

In solving the questions, it was observed that most of the students wanted to solve the question on board (e.g., P11_O1; P11_O2; P11_O5; P11_O8). In that sense, student participation in the practicing part could be considered as high. Furthermore, P11 always asked students whether there was an alternative solution for the question, and students shared if their solution method was different than the method on the board (e.g., P11_O1; P11_O3; P11_O7; P11_O10). In contrast to such positive sides, it was observed that P11

and/or the students sometimes did not pay enough attention to the use of proper mathematical language in solving the questions (see Table 4.5.).

Table 4.5. *Examples for the Possible Threats for Misconceptions*

Week	Question	Solution (by whom)	The Mathematical Issue
1st	There are 1235 liters of water in the pool, and 200 liters of water added. What is the total amount of water in the pool? Solve it in your mind using arithmetical shortcuts.	1235 + 200 1200 + 35 + 200 1400 + 35 = 1435 (by P11)	The use of equality sign
2nd	Arda has 50 ₺ more than Omer. Their total money is 250 ₺. How much money each of them has?	250 – 50 = 200 200 ÷ 2 = 100 Omer:100 Arda:150 (by P11)	Lacking units (in this case, currency)
6th	What is the time difference between 17:05 o'clock and 15:15 o'clock.	17 05 — 15 05 01 50 (by one of the students)	Lacking units (in this case, hour and minute signs)

In the observed weeks, there were only two attempts to use rather learner-centered activities. One of them was related to the time measurement topic. In the activity sheet, there were blanks to be filled with students' daily life activities (such as arrival at home and dinner time). P11 distributed the activity sheet to the students and wanted them to take notes about the questions in the activity sheet. In each of the three 5th grade classes, there were students who forgot to bring the activity sheet in the next class hour. Thus, P11 postponed the activity to the next week's lesson (P11_O4). However, in the next week, a few students forgot to bring the activity sheet. Therefore, P11 did not use that activity sheet in that week and in the remaining weeks as well (P11_O5). Although P11's first attempt was failed, he was successful to apply a hands-on activity in his second attempt. The activity was related to the data analysis and display topic, and students were required to write a research question that they wanted to investigate. They were supposed to ask the research question to people, analyze the responses, and represent it with the data display methods they learned (P11_O8). During one week, it was observed that students used different data collection tools in line with their research question: Some of them used Facebook; some of them asked their classmates during the class breaks; and some of them

asked to their teachers in teachers' meeting room (P11_O9). Then, they prepared a display book and gave it to P11 to be assessed. During this activity, students seemed to be motivated for their project (P11_FN9). P11 was also satisfied with this activity.

> *I could not do activity much during the semester. I could only do one activity that was related to time measurement topic. […] Actually, it was nice. Students asked each other, to their families, they individually worked on it. I liked that activity.* (P11_O3)

In line with the observations, P11 also indicated that he could not use learner-centered activities much during the semester. He was asked about the possible reasons for it and he mentioned first about the lack of time to prepare such activities.

> *I had lack of time to investigate and prepare such activities. I am teaching 35 hours in a week and it is too much. I need spare time at the school to plan such activities. It was not like that in my previous school. I was teaching 25 hours and I had out of class time at that school.* (P11_I3)

However, when he was asked about his teaching practices in his previous working community, he indicated that it was similar to his current teaching practices.

> *[…] I cannot say that I applied more activities there [previous working community]. It was similar. Maybe I do not feel ready to apply learner-centered activities. My internal motivation to apply learner-centered teaching might be low. Since I did not have a learner-centered instruction in my studentship time, I might not feel motivated to apply it [learner-centered methods].* (P11_I3)

Since P11 mentioned his lack of efficacy to apply learner-centered activities, he was asked about the effectiveness of his experiences in TEC related to learner-centered instruction. He indicated that he could not gain enough expertise in TEC.

> *It was not enough. We did not apply student-centered activities in real class settings enough. […] Maybe we [as pre-service teachers] did not pay enough attention to it [learner-centered teaching practices]. 70-80 per cent might be due to the personal reasons and the rest might be due to the limited practicing opportunities.* (P11_I3)

In the observed weeks, the positive class environment was noted almost in every class. It was observed that P11 called the students with warm addressing words (e.g., P11_O2;

P11_O6; P11_O10); and either P11 or the students made jokes and laughed together (e.g., P11_O2; P11_O4; P11_O6; P11_O7; P11_O10). P11 indicated that such a positive class environment was deriving from his personal characteristics.

> *It is something that occurs naturally. I do not want to be angry-looking, nervous in the class; I want to make jokes instead. So, it is something that is a part of my characteristics.* (P11_I3)

Caring and nurturing characteristics of P11 was also observed in some cases. For instance, when one of the students had a low score from the test, he individually asked to the student at the break to learn if there was a problem (P11_O7); and he gave money to one of the students who forgot to bring his lunch ticket (P11_O4).

P11 commonly motivated his students to participate in the lesson and share their solutions and/or the parts they did not understand. When students did not understand something they could easily ask in the lessons of P11 (e.g., P11_O3; P11_O9). P11 commonly motivated students to solve the question on board even if they could not solve by themselves and helped them on the board by giving clues (e.g., P11_O1; P11_O4; P11_O9). In the interview, P11 indicated that he wanted every student to participate in class and gain confidence.

> *[…] I always believed that there is a lack of confidence in mathematics. I mean, it is true in general. In order to gain this confidence, I want all my students to participate in the lesson and motivate them.* (P11_I3)

When all the teaching practices of P11 are taken into consideration, P11's actualized mathematics teacher identity could be considered as "Traditional-Practice Mathematics Teacher Identity". There was a close relationship with him and his students, and there was a positive class environment in which students actively participated. However, this participation was driven by P11 to solve repetitive types of questions. Since P11 believed that practicing much would enable conceptual understanding, most of the class time was devoted to practice and homework. However, as explained in detail above, these questions were not in line with the reform-oriented practices in which more inquiry type questions

are suggested. Furthermore, in the instructional part, P11 chose to explain the concepts himself rather than enabling student exploration.

4.2.2.2.3. Actualized Teacher Identity of P11: A Summary

The mathematics teaching practices of P11 repeated over the observed weeks. At the beginning of a new topic, P11 asked the students to talk about their previous formal and informal knowledge related to the topic. After the students' explanations, P11 started to explain the topic to the students. They continued to the lesson by practicing on the content they learned. The practicing part was the main part of P11's mathematics classes. P11 wanted students to practice as much as possible and believed that it would enable the students to understand the topic well. On the other hand, he indicated his intention to apply learner-centered methods more in his classes. He mentioned that intense working hours prevented him to investigate and get prepared for learner-centered instruction. However, further interview questions enabled to explore that the main reasons for not applying learner-centered methods were mostly personal rather than the working community-related issues. His lack of repertoire to apply reform-oriented mathematics lessons and his lack of strong beliefs and intentions on the benefits of such methods seemed to prevent him to apply reform-oriented mathematics teaching methods. Thus, he relied on the methods when he was a student and seemed to develop a "Traditional-Practice Mathematics Teacher Identity".

4.2.2.3. Perceived vs Actualized Mathematics Teacher Identity of P11: How consistent?

In the previous sections, perceived and actualized teacher identity of P11 were explained in detail. Professed experiences of P11 showed that although his success in mathematics during elementary school years was not high, his relationship with mathematics was improved in middle school years and continued to improve during the high school years. In the studentship years, P11 seemed to pay attention to the content knowledge of his own mathematics teachers. P11 described his experiences in TEC sufficient for didactics and

curriculum domains; limited for pedagogy, content, and professional participation domains. Furthermore, he mentioned that he had limited opportunities to practice reform-oriented teaching methods in real class settings during the pre-service years. P11 mentioned that he wanted to apply learner-centered methods during the in-service years but could not do it as much as he wanted. It was inferred that both personal (lack of motivation) and working community-related issues led to the mismatch between the earlier intentions and current practices of P11. In brief, it was concluded that P11 developed "Traditional-Practice Mathematics Teacher Identity".

P11 was observed for a semester in his 5^{th} grade classes and in his working community. During the instruction, P11 was generally responsible to deliver the content. In other words, the content was delivered through teacher-centered explanations rather than student-centered exploration. It was also observed that P11 preferred to do practice as much as possible in his classes. Most of the class hours were devoted to the practicing sessions. On the other hand, his relationship with the students and the class environment were described as "positive" during the observed weeks. He wanted every student to participate in the class and share his/her thinking and solution method. Interview with P11 showed that his intentions of mathematics teaching showed differences. On the one hand, he wanted to practice as much as possible and wanted his students to solve any kind of questions related to the topic. He believed practicing much would enable students to conceptually understand the topic. On the other hand, he wanted to apply learner-centered approaches more. However, the reasons that prevented him to apply learner-centered approaches was not clear from the perspective of P11. He mentioned first about intense working hours in his working community. Although he had a point on this claim, further interview questions showed that the main reason was related to himself. His beliefs were more in line with traditional methods rather than reform-oriented methods, and thus he did not develop a rich repertoire of reform-oriented practices yet. With all the observations and interview data were taken into consideration, his actualized mathematics teacher identity was described as "Traditional-Practice Mathematics Teacher Identity".

As explained in detail above, there was a consistency between the perceived and actualized teacher identity of P11. Therefore, it is possible to conclude that P11 made true reflections on his teaching practices. Nevertheless, it should be noted that observations and the final interview enabled to have a clearer picture on the mathematics teacher identity of P11. In exploring perceived mathematics teacher identity of P11, it seemed that P11 developed some beliefs in line with the reform-oriented practices, but he was not able to teach in line with these beliefs. However, observations and the final interview showed that he has stronger beliefs and intentions in line with traditional mathematics teaching methods (e.g., practicing much) and he taught in that way. His experiences before TEC seemed to have a strong impact on him. Even if his experiences in TEC challenged these beliefs and intentions, it did not seem to be enough. Therefore, even if there was a consistency among the perceived and actualized teacher identity of P11, the second part of the study enabled to have a better understanding of the mathematics teacher identity of P11.

In brief, the analysis of data collected through multiple methods to explore P11's mathematics teacher identity enabled me to claim that he developed "*Traditional-Practice Mathematics Teacher Identity*". The effects of the working community are explored next.

4.2.2.4. How Did the Working Community Affect P11?

In order to have a better understanding of the working community's impact on P11, there is a need for understanding the dimensions in his working community. Therefore, the existence of the essential dimensions of a CoP in the working community of P11, and then how these dimensions affected P11 are discussed in this part of the study.

4.2.2.4.1. A Community or a Community of Practice

Wenger (1998) claimed that the existence of mutual engagement, joint enterprise, and shared repertoire are the essential dimensions of a CoP. As explained in detail below, there were mutual engagement, joint enterprise, and shared repertoire in the working community of P11. Thus, it was possible to identify the working community of P11 as a CoP.

4.2.2.4.1.1. Mutual Engagement in the Working Community of P11

During the observed weeks, the administrator who was responsible for the middle grades, the school counselor teacher, and the head teachers of all three 5th grade classes (P11, English, and Science Teachers) came together weekly. These meetings were called as "Coaches' Meeting" in the working community and were held for each grade level. Since P11 was the head teacher of one of the 5th grade classes, Coaches' Meeting for 5th graders were observed regularly.

Coaches' Meetings were always held in a friendly and positive environment (e.g., P11_O1; P11_O8; P11_O10). In these meetings, 5th grade classes' success in general, the views of the participating teachers and administrator were discussed (e.g., P11_O2; P11_O8; P11_O10). Furthermore, sharing of student knowledge was commonly observed during these meetings. The school's counselor teacher commonly guided this sharing of knowledge. For instance, she explained how the teachers should communicate with their students in general (P11_O6); shared the results of distraction test for a student (P11_O10); gave suggestions to improve the motivation of a student who had some issues recently (P11_O5); sought the in-class behaviors of a students who had been diagnosed as hyperactive and gave suggestions to the teachers (P11_O2); and gave suggestions to improve the adaption of a student who had been transferred to the school recently (P11_O10). Teachers also shared their suggestions with the other teachers in the meeting based on their in-class experiences. For instance, the English Teacher mentioned that she

wanted students to write anonymous letters on what they liked and disliked related to the course. She mentioned that it was beneficial to reflect on her practices and suggested other teachers doing so (P11_O4). Similarly, in another meeting, P11 mentioned that he tried to put a successful and an unsuccessful student side by side in the seating plan in order to increase the collaboration among them (P11_O1).

In addition to the mutual engagement among teachers in Coaches' Meeting, there was a mutual engagement with P11 and some other teachers as required by the working community. For instance, P11 individually met with the counselor teacher for a general review of the semester (P11_O10); showed the examinations he prepared to the school's educational measurement and assessment teacher in order to be reviewed, and analyzed the exam scores together (P11_O3; P11_FN6); and had a meeting with all the head teachers in middle school level to discuss about the issues in general (P11_O5).

As supported with the working community of P11, there was a mutual engagement between teachers and parents. This engagement took place in several ways: Parents' meeting at the school (P11_FN5); informal activities involving parents (such as breakfast) outside of the school (P11_FN10); head teacher's visit to parents' homes (P11_FN2; P11_FN5); and using an online system to inform parents about their children (such as homework and test scores) (P11_O1; P11_O7; P11_O8). Furthermore, the school counselor teacher communicated with the parents in case of a specific need (e.g., P11_FN5). Close interaction with parents seemed to help teachers to have a better knowledge of their students, and teachers shared this knowledge with each other during Coaches' Meeting (e.g., P11_O7; P11_O8; P11_O10).

Although it was not as frequent as the above-mentioned mutual engagements, there was a mutual engagement among mathematics teachers in department teachers' meeting (P11_FN6), and among all head teachers in different grade levels (P11_O5). These meetings were held only one time during the observed weeks; there was no chance to observe these meetings.

In brief, it is possible to claim that teachers, administrators, and parents mutually engaged with each other during the semester in P11's working community. Based on the observations, it was possible to claim that there was a knowledge sharing in these engagements that made such engagements a real mutual engagement rather than a formal procedure.

4.2.2.4.1.2. Joint Enterprise in the Working Community of P11

In one of the meetings, the school administrator indicated that "*We want to educate students who can think, inquire, and learn in a meaningful way*" (P11_FN4). Therefore, the general joint enterprise in the school can be considered as in line with the reform-oriented practices. One of the ways to achieve the joint enterprise in the working community was accepted as being knowledgeable about each student. Therefore, as explained in detail above, teachers, parents, and administrators were in a close interaction with each other. They discussed the problems of individual students, shared knowledge about individual students, and came up with solution plans in case of individual problems (e.g., P11_O1; P11_O4; P11_O6). In other words, there was sharing of knowledge, commitments, and intentions related to the pedagogy domain in line with the joint enterprise of the working community of P11.

During the observed weeks, there was no clearly articulated joint enterprise for didactical approaches in order to improve student success. However, some of the practices and conversations of the other teachers gave some clues on their preferred didactical approaches in their lessons. For instance, during the Coaches' Meeting, the Science Teacher indicated that she used hands-on activities in her classes (P11_O4). Some of the observed events supported her claim such as, developing water cycle models and representing them on the hallways (P11_FN7), and having a contest to design a parachute by benefitting from scientific facts (P11_O6). Similarly, during the Coaches' Meeting, the English Teacher mentioned that she lacked time since the student-centered activities took more time than she anticipated (P11_FN6). Some of the supporting observed evidence

might be representing student prepared posters in the 5th grade classes (P11_O10); developing models representing students' environment and describing it using English (P11_O8); and organizing a fair in the school in which only speaking in English was permitted for the students and customers (P11_O10). Moreover, student-prepared posters in the Social Science and Turkish lessons were observed on the boards of hallways (P11_O7; P11_O10). On the other hand, hands-on activities did not seem to be used in mathematics classes. As explained in detail above, P11 did not benefit from reform-oriented practices in his classes. Similarly, what the 6th grade mathematics teacher told to the other teachers in the teachers' meeting room could be considered as a sign of her traditional mathematics teaching practices.

> *[In the teachers' meeting room, the Education of Religion and Ethics Teacher was talking about a method she used in her classes. The method was using educational games and giving star stickers to the students who were successful at the game. She mentioned that such games motivated her students to participate in class] I [6th grade Mathematics teacher] also wanted to give stars to the students, but could not find anything to be rewarded. I am talking all the time and they are just listening to me [The Education of Religion and Ethics Teacher supported the mathematics teacher and said, "Your course might not be appropriate to use activities and games. You might not have time for doing that, you are right".]* (P11_FN5)

Mathematics teachers including P11 (and some other teachers in different departments) in the working community put extra hours after the regular school hours in order to improve student success. Therefore, it is possible to claim that mathematics teachers also internalized the joint enterprise of improving student success, but their teaching methods might be different from the other teachers in different subject areas.

4.2.2.4.1.3. Shared Repertoire in the Working Community of P11

The working community of P11 had a shared repertoire including both in-school and out-school practices. Some of the earlier mentioned in-school practices that can be considered as a part of the sharing repertoire of working community were Coaches' Meeting, forms related to students and parents that were discussed in Coaches' Meeting, after-school

seminars for teachers, Head Teachers' visits to parents, and using an online system to monitor the students' work (such as homework and grades).

Another in-school practice that was a part of the shared repertoire was school-wide examinations that were held monthly (P11_O3). In these examinations, there were multiple choice questions in Mathematics, Science, Social Sciences, Turkish, and English (similar to the nature of TEOG). The results of these examinations were both analyzed with educational measurement and assessment teacher of the school and also discussed during the Coaches' Meeting (P11_FN4; P11_I3). Therefore, both these examinations and the results of the examinations could be regarded as a part of the shared repertoire. Another observed practice that could be interpreted as a part of the shared repertoire was "Reading Hour". Every day between 9:20 and 9:45, all the people in the school read their books (P11_FN1). Not only students and teachers in the classes, school administrators, secretary, employees responsible for cleaning, and for canteen (P11_FN4; P11_FN5). When asked about this practice, one of the teachers in the teachers' meeting room indicated that "Reading Hour" had been applied for three years, and aimed to gain the reading habit for the students (P11_FN1). P11 seemed to benefit from this shared repertoire of the working community.

> *It [Reading Hour] is a very good practice. Students need to gain reading habit. This practice helped me a lot. I am also reading with them, and it helped me to gain a reading habit. If there was no such a practice, I might not read that much. Therefore, I think that it might also help to the students.* (P11_I3)

Not all the in-school activities that were part of the shared-repertoire was instructional. There were activities that were not directly related to the instruction. For instance, seventy-seventh day of the semester was celebrated in the school since the school's slogan contained the number of seventy-seven (P11_FN5). On the seventy-seventh day of the semester, seventy-seventh students who entered in the school was rewarded (the school bag was the reward for that semester). Furthermore, all the teachers and students celebrated this day by songs and dances. P11 was among the teachers who played a musical instrument in the celebration.

There were also some other out-of-school activities among the shared repertoire of the school. Organizing weekend and semester break trips for students, meeting with parents at the weekend in some organizations (e.g., breakfast), and lunches and/or dinners in which all the teachers and administrators participated might be examples for such practices (P11_FN2; P11_FN8; P11_O10). Such practices aimed to improve the relations and communication between teachers and students, teachers and parents, and teachers and administrators.

In brief, the working community of P11 had a shared repertoire in line with its joint enterprise. Furthermore, newcomers such as P11 seemed to benefit and contribute to this repertoire.

4.2.2.4.2. The Effects of the Working Community on P11

As explained above the working community of P11 can be considered as a Community of Practice. Even if it cannot be described as fully reform-oriented CoP, it had some practices in line with the reform-oriented teaching. The analysis showed that there were some positive and negative impacts for P11 in his teacher identity development process. Furthermore, it was also inferred that P11 was unable to benefit from some of the possible factors since he either ignored such opportunities or he was not aware of them. All these possible impacts are discussed below.

4.2.2.4.2.1. Positive Impacts

In the working community of P11, there was a rich collaboration among the members of the working community to know students better and help them to learn better. As previously indicated, this collaboration mostly occurred in Coaches' Meeting, and in teachers' meeting room. For instance, in one of the Coaches' Meeting, they discussed about the distraction problem of a student and tried to come up with solution offers (P11_O1). They decided to change the seat of the student and give more responsibility

during the lessons. In the next weeks, it was observed that the students participated in the mathematics lessons more (P11_O2; P11_FN2; P11_FN3). In another Coaches' Meeting, the counselor teacher mentioned about the reading problem of a student and how negatively he was affected from this problem (P11_O3). She suggested the teachers to create opportunities for the student to read more to help him to gain confidence. In line with this suggestion, P11 asked the student to read a question aloud in the next class observed (P11_O4). As can be seen from the above mentioned classroom evidences, the collaboration among the teachers to know students better had some influences on the teaching practices of P11. He was also aware of this impact and mentioned about it during the interview.

> *I know my students well. I know them based on their in-class behaviors. […] As teachers, we also talk about students in Coaches' Meeting. […] it helps me to know students better.* (P11_I3)

> *It [Coaches' Meeting] is a very beneficial activity. There is a knowledge interchange about the students; we take some common decisions about the students […].* (P11_I3)

Similarly, P11 mentioned that a close interaction between the parents and teachers enabled him to gain a better knowledge of his students.

> *I think that having a close relationship with the parents is something good. [In a response to a query about whether he had ever taken advantage of having close relationship with the parents] I had more knowledge about my students and it helped me especially for a few students in classes […].* (P11_I3)

Furthermore, P11 mentioned about the positive impacts of the collaboration he made with the educational measurement and assessment teacher of the school.

> *I think it is beneficial. We can analyze the students' performance better. We can see which parts were not understood, how successful students were in the exams. I believe it is a very good practice [In a response to a query about whether this practice had some impacts on his teaching]. Yes, for instance, I made extra classes to solve the questions that could not be solved by many students.* (P11_I3)

During the observed weeks, there was a positive environment in the working community of P11, and that was confirmed by P11. Such a positive environment seemed to have some positive emotional impacts for P11.

> *[…] Personal relation in the school is really warm. In my previous school, one of the teachers' brother had an accident and the teacher went to the hospital. However, the school administration called him back and he had to make a lesson while crying. However, it is different in my current school. For instance, my wife was sick and called me to get her to the hospital. The school principal let me to go immediately. Furthermore, he called me that night to ask about how my wife was. I believe that personal relations are really important in a working community and I have the conditions one might expect from a working community. My previous school was not like that […].* (P11_I3)

> *In my previous school, if a parent is not happy from you, they [school administration] support the parent, not the teacher. However, in my current school, if a parent has a problem about a teacher, they [school administration] try to solve the problem, but also support the teacher […].* (P11_I3)

> *Starting from the beginning times, everybody in the school helped me for the adaptation. We are in a lot of sharing and it is a good thing. I feel good [in the working community], I feel myself as a part of the school.* (P11_I3)

In brief, some of the practices in the working community of P11 seemed to have positive impacts on P11 and his teaching practices. These positive impacts were mostly related to knowing the students better. Furthermore, positive environment in the working community of P11 seemed to support him emotionally in his participation in the working community.

4.2.2.4.2.2. Negative Impacts

The most negative impact mentioned by P11 was the intense working hours in his working community. P11 mentioned several times that he could not find enough time to prepare student-centered activities more.

> *Because of the lack of time, I could not investigate student-centered activities much. It is too much to have 35 hours of class [in a week]. There are no necessary conditions to be prepared for such activities […].* (P11_I3)

Furthermore, there seems to be lack of mutual engagement among the mathematics teachers in the working community of P11. Although mathematics teachers met once a month in department teachers' meeting, P11 indicated that these meetings were far from being beneficial.

> *I wish mathematics teachers spend time together similar to the time we spend in the Coaches' Meeting. In my previous school, we were doing that. However, here, we meet in department teachers' meeting once a month or one and a half months. It continues 20 minutes and everybody wants to leave as soon as possible. It is a kind of procedural work. It would be better if we discuss and collaborate.* (P11_I3)

One of the reasons for having limited mutual engagement among mathematics teachers might be that every mathematics teachers was responsible from a different grade level. In the school, P11 was teaching in 5^{th} and 11^{th} grades, one of the other mathematics teachers was teaching 6^{th} grade, and the other mathematics teachers was teaching in 7^{th} and 8^{th} grades. In the teachers' meeting room, 6^{th} grade mathematics teacher talked about this policy in the working community (P11_FN3). She mentioned that it has both advantages and disadvantages. As the advantages, she mentioned that teacher could use the same teaching practices in different classes of the same grade level. As the disadvantages, she mentioned about the lack of mutual engagement among the mathematics teachers because of instructing different grade levels. P11 also mentioned about this issue in the interview.

> *[…] It might be better if two teachers teach 5^{th} graders. So, we can discuss together about what to do. But now, I am teaching 5^{th} graders. What can I share with the teacher who is teaching 8^{th} graders?* (P11_I3)

It is possible to claim that even if the working community of P11 held the dimensions of a reform oriented community, there was no reform oriented mathematics community which limited developing reform-oriented mathematics teaching practices.

Furthermore, P11 mentioned that teaching in both middle and high school grade levels negatively affected him.

> *[Teaching 5th and 11th graders] prevents me to focus on one level. Since I could not focus on middle school level, I could not search for materials and that kind of stuff. I could not pay enough attention neither to middle school nor to high school.* (P11_I3)

In brief, some of the working community organization related issues such as having intense working hours, and teaching in both middle and high school grade levels seemed to negatively impact P11. Furthermore, lacking mutual engagement among mathematics teachers seemed to be a factor that did not support P11 to improve his mathematics teaching.

4.2.2.4.2.3. Positive Factors with No Impacts

During the observed weeks, it was noted that some of the possible positive impacts of the working community did not have any impact on P11. In other words, there were some situations with potential positive impacts for P11, but he did not seem to benefit from these situations.

As previously indicated, there were school wide examinations in the working community. The results of these examinations were analyzed with the educational measurement and assessment teacher of the school, and discussed in the Coaches' Meeting. Although P11 interpreted this practice as satisfactory to interpret the success of the students in a better way, he did not seem to use such examinations as a way of self-reflection.

> *I am not affected by these examinations. There were not many students who scored very low in these examinations. I do not interpret myself as successful or unsuccessful based on the scores […].* (P11_I3)

In the teachers' meeting room and Coaches' Meeting, there were some clues about teachers' teaching methods. As previously indicated, some of these practices were in line with the reform-oriented practices. Although P11 mentioned his intention to apply learner-centered methods more, he did not ask for suggestions from the other teachers he interacted. Furthermore, he did not want other teachers to talk about his teaching.

> *[In the Coaches' Meeting] there is an interaction about the students. It is the good side. On the other hand, they sometimes talk about your teaching and want to give suggestions. It is the bad side. [In a response to a query about what kind of suggestions the other teachers gave to him] Do that, do not do that, those kinds of suggestions. I do not pay attention to them, I teach according to what I believe is correct.* (P11_I3)

It is possible to claim that even though P11 benefitted from the interactions related to students, he did not benefit from the interactions related to himself as a teacher. If P11 had paid more attention to the reflections related to the teaching, it might have helped him to improve his teaching and himself as a teacher.

CHAPTER 5

DISCUSSION

In this chapter, the findings of the study are discussed. In more detail, perceived mathematics teacher identities, the influential factors on the mathematics teacher identity development process, the consistency between perceived and actualized mathematics teacher identities, and working communities' influences in the mathematics teacher identity development process are discussed in this chapter. The discussion of findings and the recommendations for the teacher education communities (TEC), working communities (WoC), Ministry of National Education (MONE), and researchers are woven into together throughout the chapter. Notwithstanding the limitations of the current study, recommendations for the further research are also discussed in the last part of the chapter. The chapter ends with the concluding remarks for what the current study taught me as an early career researcher and teacher educator on the mathematics teacher identity development.

5.1. Perceived Mathematics Teacher Identities: No Completely Reform-Oriented Mathematics Teacher Identity among the Participant Teachers

In the current study, it was explored that 7 of the participant early career middle school mathematics teachers developed "Traditional-Practice Mathematics Teacher Identity" whereas 4 of them developed "Hybrid-Practice Mathematics Teacher Identity". However, there was no participant who developed a complete "Reform-Oriented Mathematics Teacher Identity". The Ministry of National Education, and consistently, mathematics teacher education departments of the universities in the national context clearly focused on teaching mathematics in line with the reform-oriented practices as starting from 2006 (see MONE 2006; 2013; 2018). Therefore, not finding reform-oriented mathematics

teacher identity among the participant teachers could be interpreted as a negative factor for the implementation of curricula and there is a need for understanding the reasons for such a finding.

Some of the teachers who were identified as having Traditional-Practice Mathematics Teacher Identity mentioned that they applied reform-oriented practices, but failed in their attempts. This failure seemed to move them for more teacher-centered approaches in their further practices. In other words, they began to apply traditional approaches which eventually have led them to develop Traditional-Practice Mathematics Teacher Identities. There might be—at least—three possible reasons for this failure, and then, developing Traditional-Practice Mathematics Teacher Identity: (i) Their education in the teacher education program might not be sufficient to develop the competencies to apply reform-oriented mathematics teaching practices, (ii) their beliefs and intentions about employing reform-oriented mathematics teaching practices might not be strong enough, (iii) there might be no person and/or community that would help in case of their failure in reform-oriented practices.

First, it should be noted that all the participant teachers—regardless of the perceived mathematics teacher identity they developed—mentioned that there was a lack of opportunity to practice in real school settings during the teacher education program. This might be one of the reasons for not being able to develop the required competencies to apply reform-oriented mathematics teaching methods. In reform-oriented mathematics teaching, it is highly suggested to benefit from hands-on activities for students to help them develop conceptual understanding. The same suggestion should be applied to the training of pre-service teachers: They should have more hands-on activities, which are the teaching practices in real school settings, in the teacher education program, as suggested in the literature (e.g., Chong, Low, & Goh, 2011; Cooper & He, 2012). In other words, teacher educators should also benefit from reform-oriented practices in the training of pre-service mathematics teachers. One way to provide such opportunities might be school-based teacher education programs for pre-service teachers (Beauchamp & Thomas, 2011).

Second, after failing in reform-oriented teaching, applying traditional practices might indicate that these teachers did not develop strong beliefs and intentions of using reform-oriented mathematics teaching practices. Since the first time to meet with reform-oriented practices occurred in the TEC, it might be claimed that the effects of TEC on developing reform-oriented mathematics teaching beliefs and intentions were limited for these teachers. Teacher education programs seemed to be the only community that supported reform-oriented mathematics teaching since prior communities and their working communities were more in line with the traditional practices. Therefore, TEC has a crucial role in developing strong beliefs and intentions regarding the use of reform-oriented mathematics teaching practices. TEC should create opportunities repeatedly to challenge their existing beliefs to change with beliefs in favor of reform-oriented practices (Alsup, 2006). However, this role should not only be at TEC, and there should be additional CoPs developed by either WoC and/or MONE supporting reform-oriented beliefs and intentions. Participating in such CoPs have the potential to help teachers to develop reform-oriented beliefs and practices in the longer term (Chen & Wang, 2015; Hodges & Cady, 2012). Thus, participating in such multiple CoPs for a long time might help pre-service/early career teachers to develop stronger beliefs and intentions in line with the reform-oriented mathematics teaching.

Third, interviews with the participant teachers indicated that when these teachers failed in applying reform-oriented mathematics teaching methods, they did not have any support or mentor to overcome this failure, which is very important especially for early career teachers (Alsup, 2005; Flores & Day, 2006; Pillen et al., 2013). Therefore, the findings addressed the need to provide support for reform-oriented mathematics teaching of early career middle school mathematics teachers in their working communities by their colleagues and administrators. In order to improve the collaboration among the teachers, teachers are required to meet at department teachers' meeting in the national context. However, department teachers' meeting has not been effectively held in many schools in Turkey and interpreted as a procedural work rather than an opportunity for professional collaboration by the teachers (Güler, Altun & Türkdoğan, 2015). The participant teachers

also interpreted such meetings as unproductive. Therefore, it seems necessary to effectively hold such meetings in the national context. In order to do so, school principal and administrators have a crucial role. They should organize such meetings as an opportunity for mutual engagement among the teachers in line with the joint enterprise of the working community, and contribute to the shared repertoire of the working community. In other words, such meetings should be CoPs instead of being unproductive communities. Therefore, not only teachers but also school principal and administrators should be knowledgeable about the reform-oriented practices, and they should enable the necessary conditions to teachers to use such practices (Gresalfi & Cobb, 2011; Hodges & Cady, 2012). In other words, school principal and administrators should also have reform-oriented identities to support developing the reform-oriented teacher identities in their working communities. There should also be additional communities in which early career teachers meet with the other early career teachers who experienced similar issues with them (Alsup, 2006), and with the experts from the teacher education communities (Chen & Wang, 2015). Developing such communities might be problematic when there is a distance between the early career teachers and experts. Thus, developing online communities, as exemplified in the study of Hodges and Cady (2013), might be a solution.

Some of the teachers who developed Traditional-Practice Mathematics Teacher Identity did not even try to implement reform-oriented mathematics teaching methods in their classes. This might indicate their limited knowledge/experience to apply reform-oriented methods and/or weak belief in the effectiveness of such methods. Thus, as mentioned above, these teachers should repeatedly participate in CoPs, which support the development of requirements for reform-oriented mathematics teaching, in TEC and during the early years in the profession. Furthermore, as commonly mentioned by these teachers, their working communities were interpreted as inappropriate for such practices. There seems to be a need for organizing working communities as supportive of reform-oriented teaching. In so doing, both school principal and administrators, and MONE has an important role.

On the other hand, it was explored that even if some early career middle school mathematics teachers had the necessary knowledge, beliefs, and intentions to apply reform-oriented mathematics teaching, and has been developing related repertoire, they did not benefit from such practices in some cases. The reason was mostly contextual since there was a national examination in the 8th grade. There has been a national examination in the transition from middle school to high school for at least 20 years in the national context (ERG, 2017). Although the names of these examinations differed throughout the years, the nature of these examinations did not change much: There were multiple-choice type of questions in some "core" subject areas (such as Mathematics, Turkish, and Science) which should be solved in a limited time. The participant teachers also took such examinations in their transitions from middle school to high school. Therefore, it is possible to claim that they were well aware of the importance of such examinations in the national context. Furthermore, as evidenced in their statements, administrators, parents, and students requested that students be trained for this examination via practicing as much as possible. Similar pressures and its influences on the teachers were stressed in the other contexts as well. For instance, Chen and Wang (2015) mentioned about the importance of national examinations in the Asian context and indicated that the pressure coming from the students, parents, and administrators lead teachers to use test-oriented practices more. Similarly, Gresalfi and Cobb (2011) emphasized the role of state standards and state tests in some parts of the American context and indicated that the success in such exams is interpreted as an evidence for good mathematics teaching by school administrators. Such effects were evidenced in the current study, and it was seen that some of the teachers in the current study had to develop hybrid practices in their mathematics teaching that differed based on grade level. However, it should be noted that if these teachers were not teaching 8th graders, they could be considered as developing "Reform-Oriented Mathematics Teacher Identity". Furthermore, if the transition from the middle school to high school had not been organized in the current way in the national context, the participants might have shown similar teaching practices in all grade levels, and would have been considered as developing Reform-Oriented Mathematics Teacher Identity. Therefore, while the study explored these teachers' mathematics teacher identities

rigorously to the best extent possible, the influence of the immediate context of teaching on their identities limits the findings. Yet, the findings address how national context can influence teacher identities.

When considering identity and specifically teacher identity from a theoretical perspective, many researchers indicated that it is affected by contextual factors (e.g., Akkerman & Meijer, 2013; Beauchamp & Thomas, 2009; Beijaard et al., 2004; Gee, 2001; Van Zoest & Bohl, 2005; Wenger, 1998). In other words, based on the theoretical conceptualization of identity and teacher identity, there might be shifts in the identity based on the context of the teacher. However, no research study in the accessible literature exemplified such a shift in the teacher identity differing based on the context. In this regard, the findings of the current study can be considered as an important contribution to the literature since it exemplified how different practices in different contexts for the same teacher is possible. In the current study, it differed based on the grade level. Although the present study did not have sufficient data, a teacher's mathematics teacher identity might differ based on some other context criteria such as the topic to be taught or different classes in the same grade level.

5.2. Influential Factors on the Mathematics Teacher Identity Development Process

Personal characteristics, others' teacher identities, TEC, WoC, discipline, and educational policy affected the perceived mathematics teacher identities of participants in the current study. These factors are discussed individually based on the related literature findings. Moreover, recommendations to teacher education communities, working communities, MONE, and researchers in the field are given based on this discussion. At the end of this part, all the influential factors on the mathematics teacher identity are discussed together to have a general understanding of the early career mathematics teachers' mathematics teacher identity development.

5.2.1. Personal Characteristics

In the literature, the relationship between personal identity and teacher identity are interpreted with different perspectives. Some researchers considered personal identity and teacher identity as separate constructs having reciprocal influences on each other (e.g., Beijaard et al., 2004; Pillen, Beijaard, & den Brok, 2013). Some other researchers interpreted that professional identity and personal identity are subsumed in the teacher identity (e.g., Alsup, 2005; Beauchamp & Thomas, 2009; Sammons et al., 2007). In both of these perspectives, the link between one's personal identity and teacher identity is emphasized. The findings of the current study supported such claims and showed that there were similarities between how the participants perceived themselves as a person and as a mathematics teacher. Therefore, personal characteristics are considered among the influential factors for the development of mathematics teacher identity in the current study. However, it should be noted that teacher identity might also influence personal identity. Because, these two constructs are woven into together (Akkerman & Meijeer, 2013).

The link between personal characteristics and teacher identity implied the need to consider teachers' personal identities when aiming to change their mathematics teacher identities. Therefore, communities such as TEC, WoC, and professional development programs should be aware of the differences between the personal identities of each teacher or teacher candidate.

5.2.2. Others' Teacher Identities

In conceptualizing identity and teacher identity, others' identities are considered as having potential influences on the development of teacher identity since one is always in interaction with the others (see Van Zoest & Bohl, 2005; Wenger, 1998). Consistently, in the earlier studies, it was explored that teachers' own teachers might have some impacts on them such as the choice of the teaching profession, and how the teaching should and/or

should not be (e.g., Alsup, 2006; Flores & Day, 2006; Kasten, Jackson, & Austin, 2014; McCulloch et al., 2013). Alsup (2006) describes the experiences before the teacher education program as "12 to 16 year of apprenticeship of observation" to internalize the teaching profession. The findings of the current study supported this claim since it was explored that most of the participant teachers had role model teachers—mostly mathematics teacher(s)—who had some influences in shaping their mathematics teacher identities. However, the findings of the current study also showed that role model teachers should not necessarily be in the communities before TEC, they might be teacher educators from TEC and/or teachers observed during the practicum period. Therefore, creating opportunities to observe and meet with teachers and/or teacher educators who could be role model(s) in applying reform-oriented mathematics teaching practices might support early career mathematics teachers in their mathematics teacher identity development. Furthermore, role model teachers do not have to be expert teachers and teacher educators; they can be other early career teachers as well. Early career teachers seek to interact with the other early career teachers since they consider their experiences closer to their experiences (Alsup, 2006). Therefore, early career teachers who have been successful in applying reform-oriented practices should share their experiences with the other early career teachers in physical and/or online CoPs organized by MONE.

5.2.3. Teacher Education Community

In the related literature, there seems to be inconsistent results on the effects of teacher education programs on the teacher identity development since some of them explored the weak impact of teacher education programs (e.g., Flores & Day, 2006) whereas some of them explored the strong impact of these programs (e.g., Ponte & Brunheira, 2001). The same teacher education program might have different impacts on different teacher candidates (e.g., Ma & Singer-Gabella, 2011). Nevertheless, another reason for the inconsistent results might be that researchers focused on different dimensions of teacher identity when considering the effect of teacher education programs on the developed teacher identities. For instance, Flores and Day (2006) mentioned the weak impact of

teacher education programs on participants' teacher identity development process. However, in their study, it was seen that participant teachers mostly criticized their teacher education programs because of the limited preparation for the realities of the working communities such as the bureaucratic nature, heavy workload, and assessment criteria. In other words, the weak impact of the teacher education program was mostly related to the professional participation domain in the teacher identity. On the other hand, Ponte and Brunheira (2001) exemplified how the practicum period in the teacher education program positively contributed the teacher identities of pre-service mathematics teachers. In their study, this positive impact was mostly related to developing knowledge about their future students, in other words, related to the pedagogy domain in their teacher identities. As exemplified in the findings of these studies, when considering the effects of TEC on mathematics teachers', different domains of mathematics teacher identity should be taken into consideration. In the current study, it was seen that TEC has relatively more impact in some domains (such as content, curriculum, and didactics domains) whereas relatively less impact on some other domains (such as pedagogy and professional participation domains). Therefore, supporting the development of reform-oriented mathematics teacher identities might start with identifying the strength of the influence of TEC on the dimensions of mathematics teacher identity and focus on less influential dimensions in order to support pre-service teachers' mathematics teacher identity.

5.2.4. Working Community

It was emphasized in the literature that working communities might have both positive and negative effects on teacher identity development (Beauchamp & Thomas, 2009). Working communities' expectations from teachers and the resources offered to teachers might lead to either easy or painful beginnings for early career teachers (Flores & Day, 2006; Gresalfi & Cobb, 2011). In the current study, most of the teachers mentioned about how unsupportive working conditions in their working communities led them to apply traditional practices more in the teaching of mathematics. Therefore, changing

unsupportive working conditions into supportive ones should be among the primary aims of the national education policy and MONE.

On the other hand, participant teachers often emphasized that they were learning from their experiences in the profession, and thus, continuously re-shaping their mathematics teacher identities. Most of the time, they referred their learnings about their students, curriculum, and educational contexts. This might be considered as an expected finding because one learns from his/her practices and shapes his/her identity by the effects of such experiences (Wenger, 1998). However, it should be noted that when the early career teachers do not get enough mentorship and support from their working communities, they have to develop idiosyncratic solutions to their problems (Flores & Day, 2006). Therefore, even if the early career teachers learn from their experiences individually, there should also be colleagues and administrators in the working community to give support when they need. Administrators and rather experienced teachers, on the other hand, might not be prepared for such a support role. The findings of the study might address that training should be provided to prepare teachers and administrators for how they might support early career teachers in order to have functioning reform-oriented working communities.

5.2.5. Discipline

The discipline that teachers teach is claimed to have a potential influence on teaching practices and teacher identity since each discipline might have their own particular competencies and appraisals related to the teaching (Beauchamp & Thomas, 2009; Grootenboer & Ballantyne, 2010). However, how the mathematics discipline might be influential on the mathematics teachers' identities have not been explored in the accessible literature. In this regard, the findings of the current study might contribute to the existing teacher identity-related literature by showing how participant teachers perceived themselves as teachers of mathematics. It was explored that they interpreted being a mathematics teacher as something prestigious and they felt valued. On one hand, feeling valued as a teacher might be interpreted as a positive factor since most of the teachers

around the world felt undervalued by the society (see OECD, 2014). On the other hand, such identifications about being a mathematics teacher might limit mathematics teachers' interaction and collaboration with the teachers from other disciplines and/or school administrators since they might not interpret these teachers as legitimate colleagues to be mutually engaged.

Although the findings of the current study contributed some insights on the potential influences of the discipline on mathematics teacher identity development, it should be noted that the findings are limited. There is a need for further studies with mathematics teachers from different contexts and with teachers from different disciplines in order to explore how teaching *mathematics* influences teachers' mathematics teacher identity and how other fields of study influence the teacher identity specific to those fields. Thus, there might be a better understanding on the role of discipline on teacher identity development.

5.2.6. Educational Policy

The training of teacher candidates and the practices of teachers cannot be considered independent from the educational policies, and thus, it can be claimed that educational policies frame the process of becoming a mathematics teacher in the most general sense (Brown & McNamara, 2011). In the current study, the most explicit impact of the educational policy on the mathematics teacher identity development of participant teachers was seen on the policy related to students' transition from middle to high school. Centralized nationwide examinations seemed to have a significant effect on the participant early career middle school mathematics teachers. As recounted earlier in this chapter, such examinations/assessments are held in other contexts as well (see Chen & Wang, 2015; Gresalfi & Cobb, 2011). Therefore, researchers should take the effects of such educational policies into consideration when examining the developed teacher identities and teacher identity development process.

The study revealed how incongruent education policies might influence the development of teacher identity. On one hand, MONE and teacher education programs support the use reform-oriented mathematics teaching and aim to train teachers and teacher candidates to develop reform-oriented mathematics teacher identities. On the other hand, the transition from middle school and high school—and also, from high school to university—are held through centralized examinations which led teachers to use drill and practice because of the pressure they felt for the success of their students in such examinations. Therefore, educational policies should be organized consistently releasing teachers from such pressures, and rather supporting reform-oriented practices more.

5.2.7. A Summary on the Influential Factors on Mathematics Teacher Identity

Teacher identity, specifically mathematics teacher identity, development seems to be a long and complicated process. It seems to start from teachers' elementary school years and it continues through the profession. As explained above, there are multiple possible influential factors (such as personal characteristics, others' teacher identities, the experiences in TEC and WoC, the discipline that is being taught, and educational policy where the teaching occurs) in this long process.

As mentioned in the literature (e.g., Beijaard, Meijeer, & Verloop, 2004; Van Zoest & Bohl, 2005), the findings of the current study supported the view that both individual and contextual factors take part in the mathematics teacher identity development. Even, each of the explored influential factors has both individual and contextual dimensions. For instance, one might think that personal characteristics could be considered as an individual factor in the teacher identity development process. However, in the development of personal identity, one is also affected by the context s/he has been and the others in that context (Akkerman & Meijer, 2013). Therefore, neither mathematics teacher identity nor the influential factors in the mathematics teacher identity development should be considered as totally individual or contextual.

5.3. Actualized Mathematics Teacher Identities of P5 and P11: The Consistency between Perceived and Actualized Mathematics Teacher Identities

Two early career middle school mathematics teachers' actualized mathematics teacher identities were investigated in the current study: P5's actualized mathematics teacher identity was explored as "Hybrid-Practice Mathematics Teacher Identity" and P11's actualized mathematics teacher identity was explored as "Traditional-Practice Mathematics Teacher Identity". Furthermore, it was explored that there was a congruence between the perceived and actualized mathematics teacher identity of these two teachers. All these findings are discussed in this part of the study.

5.3.1. Actualized Mathematics Teacher Identity of P5

The findings of the current study indicated that classroom practices of P5 showed evidence of developing "Hybrid-Practice Mathematics Teacher Identity". In the 5th and 6th grade classes, P5 benefitted from reform-oriented mathematics teaching methods. However, in the 8th grade classes, she mostly benefited from teacher-centered methods.

First, it should be noted that the WoC of P5 could not be considered as a supportive WoC for reform-oriented mathematics teaching. Neither the physical conditions nor the professional environment was in line with the reform-oriented dimensions. In more detail, the number of the students was between 40 and 50, there were immigrant students who had some adaptation problems in some of her classes, and there were at least 2-3 disadvantageous students in her classes. Furthermore, even if she tried, she could not collaborate with her school administrators and colleagues in order to apply reform-oriented teaching. Despite all these negative conditions, P5 was successful to apply reform-oriented methods in her 5th and 6th grade classes. One of the reasons for being able to use reform-oriented mathematics teaching methods seemed to be her experiences in TEC. She indicated that she met with reform-oriented mathematics teaching methods in TEC, and developed the basis for her vision of mathematics teaching in those years.

Consistently, she developed the required knowledge and repertoire to implement reform-oriented mathematics teaching during the years in TEC. P5 did not stop making efforts to improve herself in reform-oriented mathematics teaching after she graduated. She continued to participate in the other reform-oriented CoPs such as in-service training, conferences, and seminars in the profession. Participating such CoPs in the profession are interpreted as a crucial source to support developing reform-oriented mathematics teacher identity (see Bohl & Van Zoest, 2002; Hodges & Cady, 2012). P5 also seemed to benefit such CoPs, especially because she could not collaborate with her colleagues in her working community. Her unsupportive working community seemed to lead her towards seeking CoPs where she would receive support and professional development opportunities. Such a perseverance for finding CoPs might be considered as the influence of her personal characteristics and her initial mathematics teacher identity within the limited findings of this study.

Although she successfully benefitted from reform-oriented practices in her 5^{th} and 6^{th} grade classes, she did not use such practices in her 8^{th} grade classes. When her strong beliefs of using reform-oriented practices were taken into consideration, I interpreted that there are "*reasons*" rather than "*excuses*" for the mismatch between the practices of P5 in different grade levels. One of the most important reason was the national examination held for the transition from middle to high school. This examination created a pressure for the teachers since they felt responsible for their students' success in this examination. As explained before, there was also pressure coming from the administrators, parents, and students to be trained only for the examination. This result could be interpreted as a strong evidence for how strongly educational policies might affect teachers' in-class practices. Even a teacher who had strong beliefs and repertoire to apply reform-oriented mathematics teaching could not resist such pressures.

Zeymblas (2010) underlined the importance of emotions in the teacher identity development process and emphasized that teachers have emotional needs in this process. The story of P5 supported this claim and illustrated how important emotions are in the

early years in the profession. Throughout the observations, it was clear that she was frustrated and exhausted because of the unsupportive conditions in her WoC. In addition to the lack of professional support, there was a lack of emotional support for P5, and that could be interpreted as a negative factor in developing reform-oriented mathematics teacher identity. Yet, she might have also benefitted from the CoPs in which she was involved in terms of emotional support.

In brief, exploring mathematics teacher identity of P5 showed that the foundations of a reform-oriented mathematics teacher identity should be laid in TEC, and it should be supported in WoC and in other reform-oriented CoPs.

5.3.2. Actualized Mathematics Teacher Identity of P11

The observed classroom practices of P11 showed evidence of developing "Traditional-Practice Mathematics Teacher Identity". In his classes, teacher-centered methods were mostly used and most of the class time was devoted for practicing on the repetitive type of questions.

The working community of P11 was described as being relatively supportive. Because some of the working conditions were described as supportive (such as the CoPs in the WoC in order to increase the teachers' knowledge of students), whereas some of them were unsupportive (such as limited mutual engagement among the mathematics teachers) to apply reform-oriented teaching methods. However, it was seen that even if some of the working conditions in the WoC of P11 were in line with the reform-oriented teaching, his teaching practices were in line with the traditional mathematics teaching practices. In developing these practices, there seemed to be various factors influencing his practices. Having private lessons with either his older brother or private tutor specifically focusing on practicing when he was a student seemed to improve his success in mathematics classes. Furthermore, during the years in the TEC, he worked in private teaching institutions at the weekend and he had some private tutoring students during those years.

Private tutoring lessons with tutors and private tutoring institutions aimed to train students for the national examinations for the transitions from middle school to high school and from high school to university. Such experiences seemed to have strong impacts on P11's views and practices of mathematics teaching. On the other hand, P11 seemed to have some insights on the reform-oriented mathematics teaching methods as a result of his experiences in TEC. In the interviews, he mentioned the importance of differentiated methods based on different student needs and shared his intentions to apply learner-centered activities in his classes. However, with the help of observations and further interview questions, it was seen that such views were peripheral in his mathematics teacher identity. The experiences in TEC seemed to fail to challenge his strong beliefs on the role of drill and practice method to conceptualize the mathematical knowledge.

Even if some of the teachers are more resistant to change, it not impossible to change these teachers (Liljedahl, 2014). There is a need to repeatedly challenge their existing views of teaching during TEC (Alsup, 2006), and via in-service training and workshops (Liljedahl, 2014). Therefore, it can be claimed that the experiences in TEC was not enough to challenge P11's existing views of teaching mathematics. However, it is still possible to re-shape his current mathematics teacher identity in line with the reform-oriented practices via enabling him to participate in multiple and longitudinal CoPs supporting reform-oriented mathematics teaching.

5.3.3. The Congruency between Perceived and Actualized Mathematics Teacher Identities

In the teacher identity-related literature, some of the researchers claimed that teachers' perceptions about themselves enable to explore their teacher identities (e.g., Beijaard, Verloop, & Vermunt, 2000) whereas some of the researchers claimed that perceptions do not necessarily indicate the actual teacher identities (e.g., Van Putten, Stols, & Howie, 2014). Therefore, the consistency among the perceived and actualized mathematics teacher identity was investigated for two early career middle school mathematics teachers

in the current study. The findings indicated that there was a consistency to a considerable extent among the perceived and actualized mathematics teacher identities of these two teachers.

In the study of van Putten, Stols, and Howie (2014) there was an inconsistency between the perceived and actualized mathematics teacher identities of pre-service mathematics teachers. The possible reason for the inconsistency was described as pre-service teachers' lack of reflection on themselves and their practices. Researchers indicated that pre-service teachers' perceptions about themselves were more idealistic, but their observed teaching practices were not in line with these idealistic perceptions. In this regard, the findings of the current study differed from the findings of that study. One of the possible reasons for the inconsistent findings might derive from the participants. Since the participants in the current study were in-service teachers, they might reflect better on themselves and their teaching practices when compared with pre-service teachers. Another reason might derive from data collection methods. Van Putten and her colleagues (2014) asked participant pre-service teachers to rank the importance of "*Subject Specialist, Teaching and Learning Specialist, and Carer*" in their perceptions about themselves as a mathematics teacher and an interview was conducted to discuss these rankings (p. 376). However, in the current study, the data were collected with multiple interviews to uncover participants' all perceptions about their experiences prior to the teacher education program, in the teacher education program, and in the profession. This enabled to have a detailed picture of each participant teacher: How s/he was a student, how s/he taught mathematics in the studentship period, how s/he described her/himself as a person, why s/he decided to be a mathematics teacher, how s/he interpreted the experiences in the teacher education program, what s/he believes about the teaching of mathematics, how s/he starts to teach in her/his classes, which sources s/he benefits from in designing her/his lessons, which methods s/he uses to teach mathematics, and how s/he described her/his interactions with the students. Therefore, instead of asking participants about "how do you see yourself as a mathematics teacher?", asking questions to uncover all related experiences might give a better understanding of their mathematics teacher identity. However, exploring

mathematics teacher identity based on analyzing such above-mentioned experiences is still dependent on the perceptions of participants. Thus, it should still be regarded as "*perceived mathematics teacher identity*". For instance, a teacher might indicate that s/he benefits from multiple sources in designing mathematics lessons, uses reform-oriented mathematics teaching methods, and creates a positive class environment in her/his classes but his/her teaching practices might be different than her/his perceptions.

Van Putten and her colleagues (2014) mentioned that exploring teacher identity only with interviews and questionnaires means, "*only looking at the half picture*"; thus, they emphasized the importance of observations to explore the actualized mathematics teacher identities (p. 390). Looking at the half of the picture seemed to enable me to make sense of the full picture in the current study. There was a congruency for the perceived and actualized mathematics teacher identities of P5 and P11. However, observations enabled me to have a better understanding of their mathematics teacher identities and influential factors on the development of their mathematics teacher identities. For instance, interviews with P11 enabled to explore that he used teacher-centered practices in his mathematics classes because of both working community and individual reasons. Observations helped to understand the nature of his teacher-centered lessons and showed how important drill and practice method was in his mathematics teaching. Furthermore, although the prior interviews indicated that both working community related and individual reasons played a role in developing traditional-practice mathematics teacher identity, the observations and the final interview enabled to explore that the individual reasons such as having a practice-oriented mathematics learning experiences, developing limited repertoire in the TEC, and weak beliefs for the reform-oriented mathematics teaching played the essential role in his traditional-practice mathematics teacher identity development. On the contrary, observations enabled to explore how P5 developed a strong repertoire on reform-oriented mathematics teaching, how she benefitted from this repertoire in her classes, and how the dimensions in her working community emotionally and professionally affected her.

In summary, it is possible to claim that participants' perceptions about themselves and their practices might give valuable insights on their mathematics teacher identity when they made true reflections, and appropriate data collection tools were used. However, it was also seen in the current study that observations and interviews based on observations made the picture clearer.

5.4. The Impact of Working Community in the Mathematics Teacher Identity Development

Working communities' potential impacts on the development of teacher identity were emphasized in the related literature. Theoretically, a working community might have positive and negative influences on a teacher since contextual factors play a critical role in the teacher identity development process (Beauchamp & Thomas, 2009; Van Zoest & Bohl, 2005). Although there is no research study in the accessible literature that specifically focused on the effects of working communities in the teacher identity development, many researchers stressed the moderating effects of working communities on teachers who participated in intentionally created CoPs (e.g., Gresalfi & Cobb, 2011; Hodges & Cady, 2013; Lieberman, 2009). In those studies, it was seen that if there was no congruency on the joint enterprise of intentionally created CoPs (such as in-service training, professional development programs) and the working community, teachers' experiences conflict and such a conflict had the potential to limit the effect of intentionally created CoPs.

One of the research questions of the study specifically addressed the impact of working communities on early career mathematics teachers' mathematics teacher identity via observing two teachers from two different working communities—one of the working community was described as unsupportive and the other was described as relatively supportive. The analysis revealed clues on the complicated effects of working communities on the observed teachers. Most of the observed evidence supported the claim that P5 was working in an unsupportive working community in order to develop reform-

oriented mathematics teacher identity. Negative conditions such as poor physical conditions, no mutual engagement among the teachers and among the mathematics teachers, and no support of school administrators on the professional development of teachers and the use of reform-oriented practices seemed to negatively influence P5—in terms of both emotions she experienced and her mathematics teaching practices. On the other hand, she was successful to resist to some of the negative conditions in her working community and used reform-oriented practices in her 5^{th} and 6^{th} grade classes. She was not totally affected by the negative conditions because she benefitted from the repertoire developed in TEC and participated in reform-oriented CoPs outside of the working community. In this respect, the story of P5 yielded two important findings related to the effects of a working community on a teacher: (i) unsupportive working conditions have negative emotional and professional influences on teachers which might prevent their reform-oriented mathematics teacher identity development; and (ii) even if there were negative conditions in a working community, teachers can resist to these negative conditions with the help of strong mathematics teacher identity they developed in TEC and other reform-oriented CoPs.

In contrast with the working community of P5, the observed evidence indicated that the working community of P11 could be described as a relatively supportive working community to develop reform-oriented mathematics teacher identity. In this working community, P11 felt as a part of the working community which supported him emotionally in the early years in the profession. Furthermore, there was a strong mutual engagement among the teachers in order to improve teachers' knowledge of their students. These theoretically positive conditions also had positive influences on P11 and his teaching. On the contrary, some negative conditions such as intense working hours and limited mutual engagement among mathematics teachers seemed to negatively affect P11. However, it was observed that P11 was not able to benefit from some of the supportive conditions in the working community. For instance, mutually engaging more with the teachers who seemed to benefit from reform-oriented teaching practices could have helped him to use reform-oriented mathematics teaching practices more. Furthermore, he would have

reflected on himself and his teaching practices via interacting more with the educational measurement and assessment teacher and counselor teacher. Similarly, he could have benefitted more from the technological opportunities in his classes to apply reform-oriented mathematics teaching practices, or from the student-centered activities in the textbook that were used in his classes. Rather, he preferred to use smart board as a traditional white-board, overlooked the student-centered activities in the textbook, and focused on practicing. Such missed opportunities indicated that even if there were some opportunities in the working community, teacher's awareness of these opportunities and knowledge and intentions for how to benefit from them seemed to be the key to benefit to the most extent.

In brief, it was seen that supportive conditions have some positive impacts whereas unsupportive working conditions have some negative impacts on the early career mathematics teachers' mathematics teacher identity development. Therefore, it is possible to claim that the findings of the current study supported to earlier literature and showed that working community might support and/or limit the development of the reform-oriented teacher identity. However, it also showed the effects of working communities are moderated by teachers' existing teacher identities: A teacher might resist to the negative conditions in the working community to some degree, or might not benefit from the supportive conditions in his/her working community. Therefore, it is crucial to enable working communities to have supportive conditions to develop reform-oriented teacher identities. As important as creating supportive working communities, developing strong reform-oriented mathematics teacher identities in TEC and supporting these identities via other CoPs in the profession are necessary for reform-oriented mathematics teacher identity development.

5.5. Limitations of the Current Study and Implications for Further Research

The current study focused on the phenomena of early career middle school mathematics teachers' mathematics teacher identities and mathematics teacher identity development. In line with this aim, eleven early career middle school mathematics teachers' perceived mathematics teacher identities and influential factors on the development of their perceived mathematics teacher identities were explored. Furthermore, two early career middle school mathematics teachers' actualized mathematics teacher identities, the consistency between their perceived and actualized mathematics teacher identities, and the impacts of their working communities in their mathematics teacher identity development process were explored. This exploration enabled to have some insights on early career teachers' mathematics teacher identity and its development. However, the current study has a number of limitations. In this part of the study, these limitations are discussed with the recommendations for further research.

In the current study, perceived mathematics teacher identities of participant teachers were inferred based on the multiple interviews conducted with them. Therefore, the analysis was dependent on the self-reports and it was assumed that they shared their honest views with me during the interviews. For instance, it was assumed that a teacher who explained her/his student-centered activities in her/his classes, or her/his beliefs on the importance of applying reform-oriented mathematics teaching methods, shared her/his real experiences and views.

The findings of the current study indicated that discipline that teachers teach was one of the influential factors in mathematics teacher identity development. The discipline and teacher identity relationship is not explored enough in the accessible literature. Therefore, more research studies focusing on this relationship might give us a better understanding of the role of the mathematics discipline in mathematics teachers' mathematics teacher identity development. Furthermore, if the relationship between the discipline and teacher

identity is explored for the other subject areas as well, it would be possible to compare how different disciplines have impacts on the developed teacher identities.

In the current study, all the pre-service teachers were graduated from the same teacher education program. As explained in the methodology part, this was a methodological decision in order to increase the similarities in experiences during the teacher education program since these experiences are interpreted as highly influential on the teacher identity literature. As a qualitative research study, this study did not aim to generalize the findings. Yet, it should be beneficial to bear in mind that if the participant teachers were chosen among the graduates from another teacher education program, the findings could have been different from the current findings. In the national context, conducting similar studies with the teachers who graduated from different teacher education programs would give us a better understanding on the phenomena of the early career middle school mathematics teacher identity and its development. With the help of such further studies, MONE and teacher education programs would have wider knowledge on the factors preventing early career teachers' reform-oriented mathematics teacher identity development.

One of the aims of this study was to explore the consistencies and/or inconsistencies between the perceived and actualized mathematics teacher identity. Exploring actualized mathematics teacher identities requires a long time. Therefore, only two teachers' actualized teacher identity and the consistency between their perceived and actualized mathematics teacher identities was explored in the current study. Even if there was a substantial consistency between the perceived and actualized mathematics teacher identities for these two teachers, there was no data for the remaining participant teachers. In further studies, it might be beneficial to work with more cases to have a better understanding of the consistencies and/or inconsistencies between perceived and actualized mathematics teacher identities.

In order to explore the potential influences of working communities on early career middle school mathematics teachers, two teachers from working communities with different characteristics were observed for almost one semester. My initial purpose was to choose one of the working community as completely supportive for reform-oriented teaching and the other one as unsupportive for reform-oriented teaching. Unfortunately, among the participant teachers' working communities, I could not establish a working community that was completely supportive for reform-oriented teaching. There was only one working community which was interpreted as relatively supportive. In further studies, mathematics teacher identity development in completely supportive working communities for reform-oriented teaching can be investigated. Furthermore, exploring the actualized mathematics teacher identity of the same teacher in different working communities would be beneficial to understand the effects of different working communities. For instance, it would be interesting to observe P5 in a supportive working community and P11 in an unsupportive working community.

Both perceived and actualized mathematics teacher identities were in the focus of the study and explored for some early career middle school mathematics teachers. However, I am well aware that teacher identity development continues lifelong. Therefore, it should be noted that explored mathematics teacher identities of participant teachers might change in the following years. In the current study, snapshots of their mathematics teacher identity for the time of the study and in their current working contexts were explored. Conducting longitudinal studies would give a clearer picture on their mathematics teacher identities and mathematics teacher identity development.

5.6. Concluding Remarks

The findings of the current study might contribute to the mathematics teacher education policies in the national context and mathematics education literature. Furthermore, I strongly believe that all this process contributed me as an early career researcher and teacher educator.

As an early career researcher who aims to conduct further studies related to the phenomena of "*mathematics teacher identity and its development*", I realized that there are no simple answers in understanding this phenomenon. All the process of mathematics teacher identity development seems to be complicated in which various factors play roles. Therefore, in this process I learned that when investigating mathematics teacher identities of in-service and/or pre-service teachers, researchers need to look from a broader perspective to in order to make sense of one's mathematics teacher identity. As researchers, we are taking snapshots of participants' teacher identities in our studies, but it is difficult to sufficiently interpret these snapshots unless the researcher knows about the participants' backgrounds.

As an early career teacher educator, I became more aware of my responsibilities in the training of pre-service mathematics teachers. As explored in the current study, teacher educators in the teacher education program could—and should—be role models for pre-service teachers. In order to be a role model in pre-service teachers' development of reform-oriented mathematics teacher identities, I need to be a reform-oriented mathematics teacher educator as well. Furthermore, the current study enabled me to see that there is a rationale behind each teachers' teaching practices and mathematics teacher identity. In order to understand this rationale, teacher educators should be knowledgeable about pre-service teachers in their teacher education programs. All the pre-service teachers come to the teacher education program with different life histories, and they have different needs in their mathematics teacher identity development process. It is unlikely to help pre-service teachers to develop reform-oriented mathematics teacher identities without making sense of their individual life histories and professional needs.

This research process not only enabled me to become more aware of my responsibilities, it also motivated me. I observed that how P5 could resist to unsupportive working conditions since s/he developed a strong reform-oriented mathematics teacher identity in the teacher education program. Therefore, I know that even if the professional conditions

are not supportive for teachers, teacher educators and/or researchers can change a teacher and that teacher can change the stories of many students.

Although the current study specifically focused on mathematics teacher identity development phenomena, the findings might also inform the teacher identity studies in the other content areas as well. Comparing and contrasting findings of the teacher identity studies conducted in different content areas might enable to have better understanding of teacher identity development phenomena.

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APPENDICES

A. First Interview Questions

Personal Characteristics and Experiences Prior to the Teacher Education Community
1. Could you tell me a little about yourself? [Who is Okan (name of the interviewee)? What does Okan like, what does not? Could you tell me about your personal characteristics? (quiet, ambitious etc.)]
2. Could you tell me about your family? [Do you have siblings? How was the environment you grow up?]
3. Could you tell me about your studentship years? [Which schools did you go for elementary/middle/high school? How were the opportunities/conditions of these schools?]
4. How would you describe yourself as a student? [How do you study (studying methods) for your lessons?]
5. How mathematics was taught to you in elementary, middle and high school?
6. How would you study (practicing as much as possible, taking notes etc.) for mathematics?
7. What were the positive and negative characteristics of your mathematics teachers that you remember?
8. Apart from your mathematics teachers, did you have a teacher who has an important effect in your life? [How? (here effects refer to both positive and negative effects)]
9. How did you decide to be a mathematics teacher?
10. What was your family's (parents, siblings) reaction to your decision?
11. Is there someone in your family who is a teacher? [If there is, do their opinions affect your views to become a mathematics teacher?]
Experiences in Teacher Education Program/University (comparing with the experiences in the profession)
12. When you graduated from mathematics teacher education program, how well did you know about the content that you are currently teaching?
13. Did you gain new knowledge about content (middle school mathematics content in Turkish context) in the profession? [What, how]
14. In the profession, is there any particular topic that you have experience difficulty?

15. What do you understand from mathematical knowledge? [Who can learn it, who cannot? How (when) did you developed these views (always thinking like this; developed in the profession; developed in the teacher education program)? What should be the purpose of mathematics teaching?]

16. When you graduated from mathematics teacher education program, how well did you know about the curriculum?

17. In the profession, have you gained new knowledge about curriculum? [What, how?]

18. Do you think that the topics in Turkish middle school mathematics curriculum are appropriate for students at that age level? [How (when) did you developed these views? How did you think about this issue when you were at the teacher education program and how do you think right now?]

19. When you graduated from mathematics teacher education program, how well did you know about the appropriate ways to behave to students? [Did you have enough knowledge on the contemporary learning theories, pedagogical theories?]

20. In the profession, did you gain new knowledge on how to behave to students? [What, how?]

21. Could share your ideas on how a teacher should behave to students to maximize their learning? [What should be the pedagogical idea on this issue? How (when) did you developed these views (always thinking like this; developed in the profession; developed in the teacher education program)?]

22. When you graduated from teacher education program, how well did you know the methodological approaches to teach the content to students? [Did you benefit from this knowledge in the profession?]

23. In the profession, did you gain new knowledge on the methodological methods of teaching the mathematical content to students? [What, how?]

24. Could you share your ideas on how mathematics should be taught at the middle school level? [On the contrary, how mathematics should not be taught? Why do you think so?]

25. How (when) did you develop these views? [What were you thinking when you graduated from university and what do you currently think?]

26. Do you think that teaching mathematics is different than teaching other courses (science, English etc.)?

27. When you graduated from mathematics teacher education program, how well do you know the characteristics of students at that age? [Did you benefit from your knowledge in the profession?]

28. In the profession, did you gain new knowledge on the characteristics of middle school students?

29. Do you think that mathematics teaching should be differentiated based on students' characteristics? [Different methods for different types of students… How was your view on this issue when you were in the teacher education program and how is it right now?]

30. When you graduated from teacher education program, how well did you know about the working environment (conditions, possibilities, expectations etc.) in which you are going to teach?

31. Did your experiences in the profession support your views? [If not, how was your experience?]

32. When you graduated from teacher education program, what did you think that about the expectations from you in your future working school? [Have you confronted with similar expectations in the profession?]

33. When you graduated from teacher education program, did you have knowledge about the different school environments? [Expectations, ideas that are supported in a school which supports teacher based approaches whereas learner-centered approaches.]

34. When you graduated from teacher education program, did you have knowledge of the views supported in different school types (learner-centered schools, teacher-centered schools, authoritative schools etc.)? [Did you gain new knowledge on this issue in the profession?]

35. Do you think that school's expectations from a teacher matters for effective teaching? [Could you compare your views in the teacher education program and your current views?]

36. Which courses in the teacher education program contributed (helped you improve yourself) you most as a mathematics teacher? [Why?]

37. Which courses in the teacher education program contributed you least as a mathematics teacher? [Why?]

38. What kind of lessons do you wish to have in teacher education program to help you in your current teaching? [What are these courses and why do you think that it would help you to be a better mathematics teacher?]

39. If you had a chance to change the content of courses in teacher education program, what would be these courses? [Why do you think that such a change would contribute you more as a mathematics teacher?]

B. Second Interview Questions

Experiences/Practices as a Mathematics Teacher and Mathematics Teacher Identity
1. What kind of methods do you use to teach mathematics in your classes?
2. Is this the method you want to use? [If it is not, what kind of method do you prefer to be using?]
3. If your students take TEOG examination, does it affect your methods of teaching mathematics? [Because of this examination, is there anything that you want to apply/use but could not?]
4. Do you prepare a plan before your math classes? [Do you make changes on the plan during the lesson?]
5. How do you start to lesson?
6. Which resources do you benefit to plan and organize your mathematics lessons?
7. How do you assess whether your students understand or do not understand the topic?
8. In different classes of the same grade, do you teach the subject in a similar way? [If it differs, how?]
9. In different classes, do you behave similarly to students? [If it differs, how?]
10. As a mathematics teacher, what are your stronger sides?
11. As a mathematics teacher, what are your weaker sides?
12. Do you think that you can improve the weaker sides of you as a mathematics teacher? [How?]
13. Do you see yourself as a teacher first or as a mathematics teacher first? [Do you think that is there a difference between being a teacher and being a mathematics teacher?]
14. As a mathematics teacher, what is your short-term and long-term aims? (short-term: in a few years; long-term: in 15-20 years)
15. If you think of yourself as a mathematics teacher, what do you think have an effect on you? To be able to understand what might have an effect on you as a mathematics teacher, I will list you some items. Please rate item's (statement in the item) effect on a Likert type scale from 0 to 5. Zero for the non-impact and 5 for the biggest impact and tell me a little about the reasons of this rate. Previous good teachers…… Previous bad teachers…… Teachers in your family or in your close environment….. Family members (who are not teachers)…..

	Friends (who are teachers and who are not)…..
	Expectations of society from a teacher…..
	Teacher education program (in terms of the courses you take)….
	Teacher education program (in terms of the teacher educators and your relationship with them)…..
	The teacher who was observed in teaching practice course……
	Teaching experiences in the profession….
	Middle school mathematics curriculum….
	Examination system in Turkey….
	Ages of student you teach for (between 11-15)….
	Socio-economic and cultural backgrounds of students….
	School type (Public vs Private)….
	Parents of your students….
	Other teachers in your school….
	School Administrators….
	Other…..
Working Community Related Experiences	
16. So far, in which schools did you work? For how long?	
17. How long have you been working in your current school?	
18. Could you tell me about the physical conditions of your school?	
19. Could you tell me about the socio-economic and cultural background of your students and their parents?	
20. How would you describe the general success of the students you teach for?	
21. Could you tell me about the personal relations among the colleagues and administrators in your school?	
22. How is your relationship with school administrators?	
23. What do your school administrators expect from you as a mathematics teacher?	
24. Do they (school administrators) collaborate with you to achieve their expectations from you?	
25. Do your school administrators have an effect on your in-class practices/decisions? [If they do, how?]	
26. Is there any other mathematics teacher working in your school?	

27. Do you think that is there a difference between being a mathematics teacher and being a teacher in a different subject area? [Do you feel such a difference in your school?]

28. How is your relationship with the other mathematics teachers in your school? [How often do you come together? What do you talk about when you come together? Is there collaboration among mathematics teachers in your school?]

29. Do you meet for the department teachers meeting? [How often? What do you talk about in these meetings?]

30. Do you have a common aim as the mathematics department committee? [What do you do to achieve this aim?]

31. Do you have knowledge about the methods that other mathematics teachers use in their classes? [How did you gain this knowledge?]

32. Do you have an interaction with the mathematics teachers outside of your school? (friends from the university, internet groups related to mathematics teaching, teacher educators at the university etc.)

33. Do you collaborate with teacher(s) in different subject areas in your school?

34. How is your relationship with your students' parents? [Do their views, statements affect your way of teaching mathematics?]

35. Do/did you have a mentor teacher in your first year in the profession? [Do you think that does/did s/he contribute to you as a mathematics teacher? If yes, how?]

36. Generally in teaching and specifically in mathematics teaching, how do you solve a problem that you faced with? [Is there anyone whom you seek help? Do their suggestions help you to overcome the problem?]

37. Do you attend to conferences/seminars related to mathematics education? [If you attend, does your school supports you? If you not, what would be the reaction of your school when you wanted to attend to such organizations?]

38. Could you tell me what happens in a regular seminar day? [*Before the start of fall semester and after the end of spring semesters, there are seminar days in each school which last two weeks.]

C. Third Interview Questions

Third Interview Questions for P5
1. I observed that your school's physical conditions are not so good. As far as I see, classes are crowded, teachers' meeting room is small and you do not have spaces to store the materials that are used in your math classes. Are these conditions affect you as a mathematics teacher? [If yes, how?]
2. When talking about your students, you use the word "my children". What are the reasons for calling them like this? [Do you think that you behave protective for your students?]
3. When you are talking with your students, I observed that you use a polite language. You explain what you liked and what you do not like (such as I did not like that you did not do your homework but appreciate being honest by explaining it to me) politely. Is this a conscious choice? [Do you think that talking with children as you do is important for a teacher?]
4. Do you think that the language you used in your classes affect students' communication with their friends and class environment?
5. In your classes, you and the students often make jokes and there is a positive class environment. Is it a purposeful attempt to make a positive class environment or is it something that occurs naturally?
6. When I compare your classes, I observed that the positive class environment in 8th grade lessons is less prominent than the other grade levels. Do you agree with my observation? [If yes, what are the possible reasons for such a difference?]
7. In your classes, you often motivate your students by saying: "I know that you can do it, I know that you know it". Do you think that motivating students to improve their participation is important? [In 8th grade classes, your motivation sentences are mostly related to TEOG. Do you think that such sentences motivate 8th grade students better?]
8. As far as I observed, there is a sequential process in your classes. First, you start a lesson by asking "What we have done in the last lesson?". After your students talk about it, you summarize what they have said. Then, either you start an activity or introduce a daily life situation and enable your students to discuss it. After this exploration process, you solve questions together in the class. Do you agree with my observations? Can we say that this is the general schema followed by you in your math classes? [If you do not agree, could you explain me the reasons for your disagreement? If you agree, what do you think about how do you develop such a teaching practice?]
9. In your classes, I observed that you ask questions to enable students to talk about the mathematical concepts. What is your aim on asking such questions?

10. In your questions, you both benefit from chorus answer and individual questions. When you ask individual questions, you sometimes choose a student who raised his/her hand and sometimes a student who have not raised his/her hand to talk. How do you decide on who will answer to your question?

11. I observed that you often use student-centered teaching practices in your classes. Hands-on activities, the use of material, and daily life discussions are among these practices [Recounting some of exemplary practices from her classes]. Could we say that P5's teaching methods are student-centered methods? [Is it your desired mathematics teaching method?]

12. When you are doing an activity, you walk around the class and interact with students. During these moments, what do you pay attention most?

13. How do you decide on the procedures that are followed in the activity? How do you get prepared for these activities?

14. You benefit from materials in your classes. Most of the time, these materials, such as construction papers, cube sugar, beans, and pillbox, are either developed or brought by the students. Is it because you do not have mathematics teaching materials in your school? [If yes, how does it affect you as a teacher? If no, what is your aim on such practices?]

15. Did you talk with the school administrators about the lack of mathematics teaching materials in your school? [If yes, how was their reaction? Did they help to overcome this issue?]

16. Although I observed that you generally use materials and hands-on activities in your classes, such activities seem to be more common in 5th and 6th grades when compared to 8th grades. Do you agree with my observation? [If yes, what might be the underlying reasons for this difference between grade levels? 8th graders will participate in TEOG, does this situation have an effect on the difference between 8th graders and other grade levels?]

17. I observed that you do not give long homework for the students. It was generally one-two pages long. What are your views about homework?

18. I observed that there are changes on the seat of students. Furthermore, you sometimes change the seat of a student during the class time. Do you talk with your colleagues about the behaviors of students and the seat plan? Or, is it something that each teacher decides individually?

19. In some of your classes, some students were misbehaving. At the beginning of the semester, I observed you tried to overcome these problems with some attempts. For instance, you individually talked with these students, you gave some responsibilities related to the class (such as controlling the homework of his/her classmates). Towards the end of the semester, I observed that you stopped such attempts and started to ignore these students and their behaviors. Do you agree with my observation? [If yes, what are the reasons for it?]

20. In your classes, there are some inclusive and immigrant students. During my observations, I observed that you had some problem related to these students. Is there anybody in your working community to seek help for such students and the problems you experienced related to these students? [How did you try to overcome the problems you faced? Do you think that you were ready for such students when you graduated from the teacher education program?]

21. During my stay in teachers' meeting room, I observed a friendly environment. Teachers make jokes and laugh together. However, I could not observe a professional sharing among teachers related to educational issues. My time in teachers' meeting room was limited. So, could you describe the general environment in teachers' meeting room? Is it similar with my observations or is it different?

22. During my stay in the teachers' meeting room, I felt like authoritarian teachers are appreciated more in the school. Do you agree with my observation? [If yes, do such views affect you as a teacher?]

23. I observed a conversation between one of the other mathematics teachers and you. You said that you will introduce rotation topic next week and said that student experience difficulty on this topic. The other mathematics teacher agreed with you and said, "I think just give the formula and go on. Say that, in this question type use this formula and procedures and in this question type use this formula and procedures. Otherwise, they do not understand". You responded like this: "When I was a student we also learned the topic in a way that you mentioned. However, I had problems to figure out the shapes when they are introduced in this way". Based on such conversations, I understand some other mathematics teachers support the use of teacher-centered approaches in their mathematics classes. What do you think about this issue? [Do their views on the ways/methods of mathematics teaching have an effect on your ways of teaching mathematics? On the contrary, do your views and practices related to mathematics teaching have an effect on other teachers' mathematics teaching practices?]

24. I know that you attended to many conferences and seminars related to mathematics education during the semester. Do these conferences and seminars have an effect on your mathematics teaching practices?

25. You were requested by the Ministry of National Education to be a trainer in an in-service training [related to the use of technology in the teaching of mathematics] for mathematics teachers. I observed that you had some concerns about your school administrators to get the permission to go for that training. Could you tell me about what you experienced in that process? [How do such things affect you as a teacher?]

26. Could you tell me more about the content of that training? [Do you benefit from your experiences in such trainings in your mathematics teaching?]

27. In one of our conversations, you told me that you like to interact with other teachers who have similar teaching views with you. Could you tell me more about that?

28. I know that you take master degree in mathematics teaching. Do you think that the master program help you in the profession as a mathematics teacher? [If yes, how? If no, why?]

29. How did you decide on the topic of your thesis?

30. You are not going to work in this school in the next year. You will work in a school that has better conditions. Why do you think that your new school wanted to work with you?

31. What are your expectations from your new working community?

Third Interview Questions for P11

1. I observed that you use warm addressing words for your students. I also observed a positive class environment in which both you and your students make jokes and laugh together. Is this a conscious decision to create a positive class environment? [Do you think that creating a positive class environment is important for teaching?]

2. I observed that students' participation to the topic is high in general. What do you think that the underlying reasons of this participation?

3. When you ask a question, many of the students in the class raise their hands to answer your question. You sometimes choose a student who raised his/her hand and sometimes a student who has not raised his/her hand to talk. How do you decide on who will answer your question?

4. Even if the student on board makes a mistake, you do not let other students cut in and want the student on board to explain his/her solution. What are the underlying reasons for such a practice? [How did you develop this practice?]

5. I observed that you often motivate students to share their solutions on the board. Do you think that such student participation is important? [What do you think about how you developed these views?]

6. I felt like you know your students well and give responsibilities based on this knowledge. For instance, you want relatively less successful students to solve relatively easier questions and vice versa. Do you agree with this observation? [If yes, how did you develop this practice and what did help you to know students better?]

7. After a student solves a question on board, you want him/her to explain his/her solution. Do you think that it is important? [What did help you to develop these views?]

8. After a student shares his/her solution on board, you ask for other solutions. Do you think that multiple solutions are important in the teaching of mathematics? [How did you develop these views?]

9. In checking the homework of students, you used different methods and one of them was peer review. Could you talk about this method and why did you choose this method?

10. In one of the Coaches' Meeting, you said that you place one successful student with relatively less successful students in the seat plan. You mentioned that you aimed to increase the collaboration among the students with such a seat plan. Could you tell me about this method and your views about it?

11. As far as I observed, when starting a new topic, you ask some questions to your students and want them to talk about the topic. Then, you summarize what they said and introduce and explain the topic. Afterward, you solve questions related to the topic in the classroom. Finally, you give them some homework. Do you agree with my observations? [If you do not agree, could you explain me the reasons for your disagreement? If you agree, what do you think about how do you develop such a teaching practice?]

12. In your classes, I observed that you sometimes use activities (e.g., time management activity, research question activity) related to the content. Could you share your experiences in such activities? What was good and bad about these activities? [Why do you think that you do not use such activities more in your mathematics classes?]

13. During my observations, I have not seen you much while using materials in math classes. Does this observation represent the general situation in your mathematics classes or specific to the time that I observed? (Could you share the underlying reasons of this choice?)

14. In your classes, I observed that you use 4 textbooks as resources. Could you tell me about your views about these textbooks?

15. Students have smart notebooks, but other than that, they do not have a notebook. Could you tell me about why you chose such a method in your classes?

16. Other than the resources I mentioned before, do you benefit from other resources?

17. I know that your working community requested you to do out-school activities, such as individual meetings and weekend activities with the students, in order to know your students better. Do you think that such activities are beneficial for you as a teacher? (If yes, how? If no, why?]

18. During the semester, it was seen that students were less successful in some topics and you decided to put extra hours after the regular class hours. Could you share the underlying reasons of this decision? [Did these extra hours help to the students?]

19. In your school, evaluation examinations are held monthly. What do you think about this practice? [Are there any effects of this practice on the students and you?]

20. In both your regular mathematics examinations and evaluations tests, you interact with educational measurement and assessment teacher. Do you think that this interaction helps you as a teacher? [If yes, how? If no, why?]

21. I observed the practice of "Reading Hour" in your school. What do you think about it? [Do you think that this practice helps you and your students in terms of

gaining reading habit? Do you think that reading hours have an effect on your students' success in mathematics?]

22. I felt that it is aimed to develop a close relationship between parents and teachers in your working community. For instance, you do parent meetings, there is a WhatsApp group to communicate, you do weekend activities with the parents. Do you think that it is important to have a close relationship with the parents of your students? [If yes, why? Does having a close relationship with the parents help you as a teacher?]

23. Another way of interacting with the parents was using an online system called "CBS". Could you tell me about this system?

24. I want to learn about your opinions about Coaches' Meeting that is conducted weekly. What do you think about these meetings? Do you think the discussion in these meetings contributes to you as a teacher? [If yes, how? If no, why?] Do you think that your opinions mentioned in these meetings contribute to the other teachers and to the development of school? [If yes, how? If no, why?]

25. In one of our conversations, you said that you do not have enough collaboration with the other mathematics teachers when you compared with the teachers in Coaches' Meeting. Could you tell me more about this? [What would happen if there were meeting(s) among the mathematics teachers similar to the Coaches' Meeting? Could you compare the collaboration among the mathematics teachers in your current school with your previous working community?]

26. In one of our conversations, you said that you could not find enough time to (individually) study in the school. Could you tell me more about this?

27. It is your first year in this school. In your adaptation process, who did help you in this process? [Could you compare your adaptation process in this school and in your previous school? Is there a difference between you as a mathematics teacher in this school and you as a mathematics teacher in your previous school?]

28. I know that counselor teacher meets with the teachers individually. Do you think that such meetings are beneficial for you as a teacher? [If yes, how? If no, why?]

29. You interact with the other teachers in teachers' meeting room and in Coaches' Meeting. Do you know about the teaching methods of other teachers? [Is there any method they used and you benefitted and integrated into your teaching?]

D. Approval of Applied Ethics Research Center

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

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25 KASIM 2015

Gönderilen: Doç.Dr. Çiğdem HASER
İlköğretim Bölümü

Gönderen: Prof. Dr. Canan SÜMER
İnsan Araştırmaları Komisyonu Başkanı

İlgi: Etik Onayı

Danışmanlığını yapmış olduğunuz doktora öğrencisi Okan ARSLAN "Kariyerinin Başlangıcındaki Ortaokul Matematik Öğretmenlerinin Matematik Öğretmen Kimliği Oluşturma Süreci ve Bu Süreçte İçinde Bulundukları Çalışma Topluluklarının Rolü (Mathematics Teacher Identity Development Process of Early Career Middle Grade Mathematics Teachers and The Role of Participated Communities)" isimli araştırması İnsan Araştırmaları Komisyonu tarafından uygun görülerek gerekli onay 01.12.2015-01.12.2016 tarihleri arasında geçerli olmak üzere verilmiştir.

Bilgilerinize saygılarımla sunarım.

Prof. Dr. Canan SÜMER
Uygulamalı Etik Araştırma Merkezi
İnsan Araştırmaları Komisyonu Başkanı

Prof. Dr. Meliha ALTUNIŞIK
Etik Komitesi Üyesi

Prof. Dr. Aydan BALAMİR
Etik Komitesi Üyesi

Prof. Dr. Mehmet UTKU
Etik Komitesi Üyesi

Prof. Dr. Ayhan SOL
Etik Komitesi Üyesi

E. Permission from Ankara Provincial Directorate for National Education

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

ÖĞRENCİ İŞLERİ
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Sayı : 14588481-605.99-E.758575 21.01.2016
Konu : Araştırma izni

ORTA DOĞU TEKNİK ÜNİVERSİTESİ REKTÖRLÜĞÜNE
(Öğrenci İşleri Daire Başkanlığı)

İlgi: a) MEB Yenilik ve Eğitim Teknolojileri Genel Müdürlüğünün 2012/13 nolu Genelgesi.
b) 25/12/2015 tarihli ve 13183 sayılı yazınız.

Üniversiteniz Eğitim Fakültesi Doktora Öğrencisi Okan ARSLAN' ın **"Kariyerinin başlangıcındaki ortaokul matematik öğretmenlerinin matematik öğretmen kimliği oluşturma süreci ve bu süreçte içinde bulundukları çalışma topluluklarının rolü"** başlıklı tezi kapsamında çalışma yapma talebi Müdürlüğümüzce uygun görülmüş ve araştırmanın yapılacağı İlçe Milli Eğitim Müdürlüğüne bilgi verilmiştir.

Uygulama formunun (5 sayfa) araştırmacı tarafından uygulama yapılacak sayıda çoğaltılması ve çalışmanın bitiminde bir örneğinin (cd ortamında) Müdürlüğümüz Strateji Geliştirme (1) Şubesine gönderilmesini arz ederim.

Ali GÜNGÖR
Müdür a.
Şube Müdürü

Güvenli Elektronik İmzalı
Aslı İle Aynıdır.
27-01-2016-1493 21/01/2016

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F. Curriculum Vitae

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Educational Background

2010 – 2012	Middle East Technical University/ Ankara – TURKEY Master/ Elementary Science and Mathematics Education
2006 –2010	Hacettepe University/ Ankara – TURKEY Bachelor's degree- Elementary Mathematics Education

Work Experience

2018 -	Mehmet Akif Ersoy University / Faculty of Education Research Assistant
2016 – 2017	Western Michigan University (USA) / Department of Mathematics of the College of Arts and Sciences Visiting Scholar
2011 – 2018	Middle East Technical University / Faculty of Education Research Assistant
2010 - 2011	Mehmet Akif Ersoy University / Faculty of Education Research Assistant

Projects

METU Research Fund 05-06-2014-001. *A Comparative Study of Mathematics Teachers' Beliefs: NorBaTM Project.* (2014, Researcher)

METU Research Fund 05-06-2016-003. *Mathematics Teacher Candidates' Teacher Identity Development Process and the Role of Teacher Education Program on This Process.* (2016, Researcher)

Leveraging MOSTs Research Project (National Science Foundation/USA Grant No: WMU DRL-1220148). *Mathematical Opportunities in Student Thinking*. (2016-2017, Researcher)

Given & Assisted Courses

Middle East Technical University

Community Service, Instructional Technology and Material Development, Methods of Teaching Mathematics I, Methods of Teaching Mathematics II, Practice Teaching in Elementary Education, Research Methods, School Experience, Teaching Mathematics in Early Childhood

Academic Publishing

Articles Published in Journals Indexed by SCI, SSCI, and AHCI

Arslan, O., Işıksal-Bostan, M., & Şahin, E. (2013). The development of belief scale about using origami in mathematics education. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi* [Hacettepe University Journal of Education], 28(2), 44-57.

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Arslan, O., & Işıksal-Bostan, M. (2016). Origami in mathematics education: The development and validation of an origami-related self-efficacy scale. *Elementary Education Online, 15* (2), 548-559. doi: 10.17051/io.2016.06024

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Arslan, O., & Işıksal, M. (2013). The effect of the origami course on preservice teachers' beliefs and perceived self-efficacy beliefs towards using origami in mathematics education. In B. Ubuz, Ç. Haser, & M. A. Mariotti (Eds.), *Proceedings of the Eighth Congress of the European Society for Research in Mathematics Education* (pp. 1279-1289). Middle East Technical University, Turkey.

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Haser, Ç., **Arslan, O**., & Çelikdemir, K. (2015). Mathematic teachers in preservice teachers' metaphors. In K. Krainer & N. Vondrova (Eds.), *Proceedings of the Ninth Congress of the European Society for Research in Mathematics Education* (pp. 1188-1194). Charles University, Prague-Czech Republic.

Arslan, O., Van Zoest, L. R., & Ruk, J. M. (2017). *Learning to Become a Researcher in an Ongoing Research Project: A Communities of Practice Perspective*. In E. Galindo, & J. Newton (Eds.), *Proceedings of the 39th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1423–1426). Indianapolis, IN: Hoosier Association of Mathematics Teacher Educators.

Papers Presented at International Conferences and Published as Short Paper (Abstract)

Arslan, O., & Işıksal, M. (2012, September). *Development and validation of origami in mathematics education belief scale.* Paper presented at The European Conference on Educational Research, Cadiz, Spain.

Arslan, O. (2013, September). *The effects of the Bologna process on Turkish higher education system.* Paper presented at The European Conference on Educational Research, İstanbul, Turkey.

Arslan, O. (2014, September). *Negative numbers: From past to present.* Paper presented at The European Conference on Educational Research, Porto, Portugal.

Arslan, O., & Haser, Ç. (2016, July). *How did I become such a mathematics teacher?* Paper presented at 13th International Congress on Mathematical Education, Hamburg, Germany.

Ubuz, B., & **Arslan, O.** (2016, August). *Minus sign in algebraic equations: Strategies and difficulties.* In C. Csikos, A. Rausch, & J. Szitanyi (Eds.), *Proceedings of the 40th*

Conference of the International Group for the Psychology of Mathematics Education (v.1, pp. 253-254), Szeged, Hungary.

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Haser, Ç., Çelikdemir, K., & **Arslan, O.** (2017, May). Matematik öğretmen adaylarının gözünden matematik eğitiminde araştırılması gereken problemler. In A. Baki, B. Güven, Ü. Çakıroğlu, & ….. Z. Arslan (Eds), *3. Türk Bilgisayar ve Matematik Eğitimi Sempozyumu* (pp. 582-285). Kocatepe University, Afyon-Turkey.

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Bulut, A, & **Arslan, O.** (2016, September). *Öğretim teknolojileri ve materyal geliştirme dersinin öğretmen adayları üzerindeki etkileri.* In T. Özsevgeç, N. Sönmez, Z. Özer, S. Toros, M. Doğan, D. Taşkın, O. Güven, & A. Kılınç (Eds.), Proceedings of the 12. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi (pp.48), Trabzon, Turkey.

G. Turkish Summary / Türkçe Özet

KARİYERİNİN BAŞLANGICINDAKİ ORTAOKUL MATEMATİK ÖĞRETMENLERİNİN MATEMATİK ÖĞRETMEN KİMLİĞİ GELİŞİMİ VE İÇİNDE BULUNDUKLARI ÇALIŞMA TOPLULUKLARININ ROLÜ

Öğretmen kimliği eğitim alanyazınında araştırma konusu olarak ilk 1980'li yıllarda ortaya çıkmış olup (Beijaard, Meijer ve Verloop, 2004), bu konu üzerinde son yıllarda giderek artan bir ilgi bulunmaktadır (Darragh, 2016; Merseth, Sommer ve Dickstein, 2008). Bu ilginin temelinde kişinin kimliği ve davranışları arasında bir ilişki olduğu sayıltısı bulunmaktadır (Wenger, 1998). Bu nedenle, öğretmenin sınıf içi davranışlarının onun öğretmen kimliği tarafından şekillendirildiği alanyazında kabul görmüştür (Chong, Low ve Goh, 2011; van Putten, Stols ve Howie, 2014).

Bu çalışmada kariyerinin başlangıcındaki matematik öğretmenlerinin matematik öğretmen kimlikleri araştırılmıştır. Her ne kadar geliştirilen öğretmen kimliğinin bir öğretmen için ne kadar önemli olduğu hususunda ortak bir anlayış olsa da, alanyazındaki çalışmalarda ortak bir terminoloji bulunmamaktadır. Bu nedenle, bir sonraki bölüm bu çalışmada kullanılacak olan terimleri açıklamak için ayılmıştır.

1.1. Kimlik, Öğretmen Kimliği ve Matematik Öğretmen Kimliği

Wenger'in (1998) Sosyal Öğrenme Teorisi'nde kimlik "*sadece yetenek ve bilgilerin toplamı değil, aynı zamanda bir var olma süreci—belirli bir kişi olmak veya belirli bir kişi olmaktan kaçınmak*" şeklinde tanımlanmıştır (s. 215). Eğitim alanyazınında ise öğretmen kimliği farklı şekillerde tanımlanmıştır, hatta bazı çalışmalarda öğretmen kimliği tanımına yer verilmemiştir (Beijard, Meijer ve Verloop, 2004). Bu nedenle, Beijaard ve çalışma arkadaşları (2004) alanyazındaki öğretmen kimliği ile ilgili

çalışmaları inceleyip bu çalışmalarda ortaya çıkan öğretmen kimliğinin özelliklerini belirleme ihtiyacı duymuşlardır. Alanyazında öğretmen kimliği hakkındaki dört ortak özellik şu şekilde belirlenmiştir: (i) Kişinin tecrübelerini değerlendirdiği sürekli devam eden bir süreçtir, (ii) Hem kişisel hem de çevresel faktörlerden etkilenmektedir, (iii) Birbiri ile ilişkili pek çok alt kimlik içermektedir ve (iv) Gelişim sürecinde kişi aktif olarak rol almaktadır.

Tıpkı öğretmen kimliği gibi, matematik öğretmen kimliği için de alanyazında kullanılan genel geçer bir tanım bulunmamaktadır (bknz., Gresalfi ve Cobb, 2011; Hodges ve Cady, 2012; Kasten, Austin ve Jackson, 2014; van Putten, Stols ve Howie, 2014; Van Zoest & Bohl, 2005). Alanyazındaki tüm matematik öğretmen kimliği tanımlamaları dikkate alınarak, bu çalışmada matematik öğretmen kimliği öğretmenin matematik ve matematik öğretimine yönelik bilgi, istek, niyet, inanış ve duygularını içerisine alan, hem bireysel hem de çevresel etkenler yardımıyla geliştirilen bir kavram olarak kabul edilmiştir. Bu çalışmada kullanılan matematik öğretmen kimliği kavramı iki alt boyuta sahiptir: *Algılanan Matematik Öğretmen Kimliği* ve *Uygulanan Matematik Öğretmen Kimliği*. Algılanan Matematik Öğretmen Kimliği öğretmenin kendisini bir matematik öğretmeni olarak nasıl gördüğü, Uygulanan Matematik Öğretmen Kimliği ise matematik öğretmen kimliğinin sınıf içerisinde uygulamaya dökülmüş halidir (van Putten, Stols ve Howie, 2014).

1.2. Reform Odaklı Matematik Öğretmen Kimliği

Tüm öğretmenlerin geliştirdikleri bir öğretmen kimliği olmasına rağmen, bu öğretmen kimliği ulusal eğitim ve öğretmen yetiştirme politikalarına uyumlu olmayabilir. Bu nedenle, araştırmacılar istenilen yönde geliştirilen öğretmen kimliğini açıklamak için farklı terimler kullanmaktadırlar: Reform odaklı öğretmen kimliği (Hodges ve Cady, 2012; Van Zoest ve Bohl, 2005), iyi-yeterli öğretmen kimliği (Alsup, 2006; van Putten Stols ve Howie, 2014), güçlü öğretmen kimliği (Beltman vd., 2015; Ruohotie-Lyhty, 2013) ve başarılı öğretmen kimliği (Anspal, Eisenschmidt ve Löfström, 2012). Her ne

kadar terminoloji değişse de tüm bu terimler genel eğitim ve öğretmen yetiştirme politikaları ile uyumlu öğretmen kimliğini tanımlamak için kullanılmaktadır.

Bu çalışmada istenilen yönde geliştirilen matematik öğretmen kimliğini tanımlamak için *reform odaklı matematik öğretmen kimliği* terimi kullanılmıştır. Bu yönde matematik öğretmen kimliği geliştirmiş olan öğretmenlerin Milli Eğitim Bakanlığı'nın politikaları (bknz., MONE, 2013; 2018) doğrultusunda, öğrencilerin aktif bir şekilde derse katıldığı, anlamlı öğrenmenin desteklendiği ve olumlu bir sınıf ortamının geliştirildiği matematik derslerini planlama ve uygulama konusunda gerekli bilgi, beceri ve inanışlara sahip ve kendilerini bu doğrultuda geliştiren öğretmenler olması beklenmektedir.

1.3. Öğretmen Kimliği Geliştirme Süreci

Kimlik geliştirme sürecinde pek çok topluluk içerisine girip bu topluluklar içerisinde tecrübeler ediniriz (Wenger, 1998). Bu tecrübeleri yorumlayarak yeni anlamlar çıkarıp yeni bilgiler edinir ve var olan kimliğimizi düzenleriz (Wenger, 1998). Öğretmen kimliği gelişimi açısından düşünüldüğünde, topluluklara katılım genel olarak 3 başlık altında değerlendirilmiştir: Öğrencilik süresince içerisinde bulunulan topluluklar, öğretmen eğitimi süresince içerisinde bulunulan topluluklar ve meslek hayatı içerisinde içinde bulunulan topluluklar (Beauchamp ve Thomas, 2009; Chong vd., 2011; Flores ve Day, 2006; Trent, 2011; Yuan ve Lee, 2014).

Kişiler öğrencilik hayatları süresince kendi öğretmenlerini gözlemleyerek istendik ve istenmedik yönde öğretmen davranışları konusunda fikirler geliştirirler (Alsup, 2006; Chong vd., 2010; Flores ve Day, 2006). Öğretmenlik hakkındaki fikirleri öğretmen eğitim programları esnasında daha profesyonel bir şekilde gelişmeye devam eder. Bu süreçte öğretmen adayları öğretimin nasıl yapılması gerektiğine yönelik bilgi, inanış ve niyetler geliştirirler (Van Zoest ve Bohl, 2005). Öğretmen eğitim programlarından mezun olup göreve başlayan öğretmenler, farklı topluluklara katılmaya devam ederler. Bu topluluklar görev yaptıkları okullar, görev yaptıkları okul bölgesindeki öğretmen toplulukları ve

mesleki gelişim toplulukları olabilir (Flores ve Day, 2006; Hodges ve Cady, 2012; Van Zoest ve Bohl, 2005). Öğretmenlerin tüm bu topluluklar içerisindeki tecrübeleri onların reform odaklı bir öğretmen kimliği geliştirmesine yardımcı olabileceği gibi (Chen ve Wang, 2014; Hodges ve Cady, 2012) bazı durumlarda öğretmenlerin reform odaklı öğretmen kimliğini gelişimine olumsuz etki de edebilir (Flores ve Day, 2006).

Öğretmen kimliği gelişimi sürecinde meslekteki ilk yıllar önem arz etmektedir. Bu süreç içerisinde öğretmenler pek çok sorun ile karşılaşır ve sorunların üstesinden gelebilmek için çeşitli yöntemler geliştirirler (Alsup, 2006; Pillen vd., 2013; Ruohotie-Lyhty, 2013). Her ne kadar meslekteki ilk yıllar öğretmen kimliği açısından büyük bir öneme sahip olsa da alanyazında kariyerinin başlangıcındaki öğretmenlerin öğretmen kimliğini araştırmaya yönelik yeterince çalışma bulunmamaktadır (Chong vd., 2011). Bu nedenle bu çalışmada kariyerinin başlangıcındaki öğretmenlerin matematik öğretmen kimliği gelişimi üzerine odaklanılmıştır.

1.4. Amaç ve Araştırma Soruları

Öğretmen kimliği oluşturma sürecinde meslekteki ilk yılların önemi alanyazında sıklıkla belirtilmektedir. Bu nedenle meslek hayatlarının başlarındaki matematik öğretmenlerinin matematik öğretmen kimliklerini araştırmak ve öğretmen kimliği gelişimi sürecinde etkili olan faktörleri belirleyebilmek reform odaklı matematik öğretmen kimliği gelişimini destekleyebilmek adına önem arz etmektedir. Bu doğrultuda aşağıdaki araştırma sorularına bu çalışmada cevap aranmaktadır:

1. Kariyerinin başlangıcındaki ortaokul matematik öğretmenlerinin algılanan matematik öğretmen kimliği nelerdir?
2. Kariyerinin başlangıcındaki ortaokul matematik öğretmenlerinin algılanan matematik öğretmen kimliklerini oluşturma sürecinde etkili olan faktörler nelerdir?

Yukarıdaki iki araştırma sorusunu cevaplamak için katılımcıların görüşmelerde verdikleri cevaplar kullanılmaktadır ve bu nedenle de "*Algılanan*" öğretmen kimliği terimi ile ifade edilmektedir. Fakat, öğretmenlerin kendileri hakkındaki algıları her zaman sınıftaki gerçek uygulamalarını yansıtmayabilir (van Putten, Stols ve Howie, 2014). Öğretmenlerin kendilerini nasıl algıladıkları ile gerçekte nasıl oldukları arasında farklılıklar olabilir. Bu nedenle, bu çalışmada iki ortaokul matematik öğretmeni çalışma topluluklarında ve kendi sınıflarında gözlenerek onların "*Uygulanan*" matematik öğretmen kimliğinin belirlenmesi amaçlanmıştır. Böylelikle, bu iki öğretmen için algılanan ve uygulanan matematik öğretmen kimliklerinin ne derece tutarlı olduğu araştırılmıştır:

3. Kariyerinin başlangıcındaki iki ortaokul matematik öğretmeninin algılanan ve uygulanan matematik öğretmen kimlikleri arasında ne derece tutarlılık bulunmaktadır?

Farklı çalışma topluluklarının öğretmenlerden farklı beklentileri olabilir ve bu beklentiler öğretmen kimliği oluşturma sürecinde oldukça etkilidir (Hodges ve Cady, 2012). Destekleyici çalışma toplulukları öğretmen kimliği gelişimi süresini olumlu yönde etkilerken, destekleyici olmayan çalışma toplulukları bu süreci olumsuz yönde etkilemektedir (Beauchamp ve Thomas, 2009; Flores ve Day, 2006). Bu nedenle, bu çalışmada gözlenecek iki matematik öğretmeni belirlenirken öğretmenlerin çalışma toplulukları dikkate alınmıştır. Öğretmenlerden biri destekleyici olmayan bir okulda görev yapmakta iken, diğer öğretmen göreceli olarak destekleyici bir okulda görev yapmaktaydı. Böylelikle, çalışma topluluklarının öğretmen kimliği gelişimi sürecindeki etkilerinin araştırılması amaçlanmıştır:

4. Farklı nitelikteki çalışma toplulukları, kariyerinin başlangıcındaki ortaokul matematik öğretmenlerinin matematik öğretmen kimliği oluşturma sürecini nasıl etkilemektedir?

1.5. Tanımlar

Çalışma amacı ve araştırma sorularını daha iyi anlayabilmek adına çalışmada kullanılan önemli terimlerin tanımlanmasına ihtiyaç bulunmaktadır. Bu çalışmada "Matematik Öğretmen Kimliği" terimi, Van Zoest ve Bohl'un (2005) çalışmasından adapte edilmiş ve matematik öğretmeninin matematik ve matematik öğretimine yönelik bilgi, inanış, amaç ve isteklerini kapsayan bir terim olarak kullanılmaktadır. Bu tanım ile uyumlu olarak, "*Reform Odaklı Matematik Öğretmen Kimliği*" de ülkemizdeki öğretmen eğitim politikaları ile uyumlu bir kimlik geliştirmiş/geliştirmekte olan öğretmenleri tanımlamak için kullanılmıştır. Yani, reform odaklı matematik öğretmen kimliği geliştirmiş/geliştirmekte olan öğretmenler, öğrencilerin derse aktif olarak katıldıkları ve matematiği anlamlı bir şekilde öğrenmelerine imkan verecek şekilde derslerini planlama ve uygulama üzerine bilgi, beceri, inanış ve istekleri olan öğretmenlerdir.

Bu çalışmada matematik öğretmen kimliğinin iki alt kategorisi bulunmaktadır: Algılanan ve Uygulanan matematik öğretmen kimliği. Alanyazındaki diğer çalışmalara paralel olarak (bknz., Beijaard, Meijer ve Verloop, 2004; van Putten, Stols ve Howie, 2014), algılanan öğretmen kimliği hem öğretmenlerin kendileri hakkındaki hem de araştırmacının öğretmenin görüşmede anlattıkları doğrultusunda öğretmen hakkında oluşan algılarını içerisine alan bir kavram olarak kullanılmıştır. Uygulanan öğretmen kimliği ise öğretmenin sınıf içi davranışlarının gözlenmesi sonucu araştırmacının öğretmen hakkındaki yaptığı çıkarımlar ile ilgilidir.

1.6. Çalışmanın Önemi

Öğretmenin davranışlarını yönlendirmede geliştirdiği öğretmen kimliğinin önemli bir etkiye sahiptir (Beauchamp ve Thomas, 2009) ve etkili bir öğretmen olmanın yolu bu yönde bir öğretmen kimliği geliştirmekten geçmektedir (Beltman vd., 2015; Flores ve Day, 2006). Bu sebeple, görev yapmakta olan öğretmenlerin geliştirdikleri öğretmen kimliklerinin belirlenmesi, öğretmen kimliği gelişimini olumlu ve olumsuz yönde

etkileyen faktörlerin belirlenmesi önem arz etmektedir. İlgili alanyazında öğretmen kimliği gelişiminde çalışma topluluklarının rolü sıklıkla vurgulanmıştır ve kariyerinin başlangıcındaki öğretmenlerin çalışma topluluklarından daha çok etkilendiği belirtilmiştir (Beltman vd., 2015; Chong vd., 2011). Kariyerinin başlangıcındaki öğretmenler çalışma toplulukları tarafından desteklenmeye ihtiyaç duymakta ve onların nasıl bir desteğe ihtiyacı olduğunu anlamak için öncelikle çalışma toplulukların bu öğretmenler üzerinde ne gibi etkilerinin olduğunun anlaşılması gerekmektedir (Alsup, 2006; Hodges ve Cady, 2013). Dolayısıyla bu çalışmadan elde edilecek bulgular hem alanyazına hem de Milli Eğitim Bakanlığı'na, kariyerinin başlangıcındaki öğretmenlerin reform odaklı matematik öğretmen kimliği geliştirme süresince ne gibi desteğe ihtiyaç duyduklarını belirleme noktasında katkı sağlayacaktır. Dahası, öğretmen eğitim programları bulgular ışığında öğretmen adaylarına daha etkin bir hazırlık süreci geliştirebileceklerdir (Beauchamp ve Thomas, 2009). Böylelikle, meslekteki ilk yıllar öğretmenler için olumsuz tecrübeler yaşanılan değil, aksine meslekteki bazı zorluklara hazırlıklı oldukları verimli bir dönem olarak yaşanabilir (Chong vd., 2011).

Öğretmen kimliği üzerine olan çalışmalar sadece öğretmen adaylarının eğitimi ve görev yapmakta olan öğretmenlerin mesleki gelişimlerini destekleyici nitelikte değil, aynı zamanda çalışmaya katılan öğretmenlerin mesleki gelişimlerine de katkı sağlamaktadır. Kariyerinin başlangıcındaki öğretmenler yaşadıkları tecrübeler hakkında konuşma ihtiyacı duymaktadırlar (Alsup, 2006). Böylelikle kendi öğretmen kimlikleri hakkında bir değerlendirme yaparlar ve bu durum da öğretmen kimliği gelişimini olumlu yönde etkiler (Anspal vd., 2012). Yani, bu gibi çalışmalara katılan öğretmenler kendilerinin nasıl bir öğretmen oldukları ve nasıl bir öğretmen olmak istedikleri üzerinde değerlendirmeler yapıp kendi öğretmen kimliklerinin farkına daha iyi varmaktadırlar.

2. ALANYAZIN TARAMASI

2.1. Matematik Öğretmen Kimliği Kavramsal Çerçevesi

Bu çalışmadaki matematik öğretmen kimliği kavramsal çerçevesi belirleyebilmek adına alanyazındaki matematik öğretmen kimliği üzerine 2000 yılından sonra yayınlanan tüm çalışmalar incelenmiştir. Bu doğrultuda elde edilen çalışmalardan %28'inde öğretmen kimliği teorik ve/veya kavramsal çerçevesinden bahsedilmediği görülmüştür. Diğer çalışmalarda kullanılan teorik ve/veya kavramsal çerçeveler şu şekilde belirlenmiştir: Wenger'in (1998) *Sosyal Öğrenme Teorisi* (%21), Holland, Lachiotte, Skinner ve Cain (1998) tarafından geliştirilen *Kurgulanmış Dünyalar* (%10), Sfard ve Prusak (2005) tarafından geliştirilen *Öyküsel Kimlik Teorisi* (%8) ve Gee'nin (2001) *Kimliği Anlamak için Dört Yol* (%2). Ayrıca, alanyazın taramasındaki çalışmaların %13'ünün yukarıdaki bahsedilen teorik ve/veya kavramsal çerçevelerden en az ikisini aynı anda kullandığı (bknz., Gresalfi ve Cobb, 2011) ve %19'unun da yukarıda bahsedilen çerçeveler harici teorik ve/veya kavramsal çerçeveleri kullandığı belirlenmiştir (bknz., Walshaw, 2010). Çalışmanın kavramsal çerçevesini belirleyebilmek adına yukarıda verilen teorik ve/veya kavramsal çerçevelere ek olarak Matematik Öğretmen Kimliği üzerine olan çerçeveler de incelenmiştir. Bu doğrultuda van Putten, Stols ve Howie (2014) tarafından geliştirilen "*Profesyonel Matematik Öğretmen Kimliği Çerçevesi*" ve Van Zoest ve Bohl (2005) tarafından geliştirilen "*Matematik Öğretmen Kimliği Çerçevesi*" incelenmiştir.

Kimlik, öğretmen kimliği ve matematik öğretmen kimliği üzerine alanyazında sıklıkla kullanılan teorik ve kavramsal çerçeveler incelendiğinde bu çerçevelerin bazı ortak ve farklı noktalara sahip olduğu görülmüştür. Örneğin hem Wenger (1998) hem de Holland ve arkadaşları (1998) kimlik gelişim süresince sosyal ve çevresel faktörlerin önemine vurgu yapmıştır. Öte yandan, Sfard ve Prusak (2005) öğretmen kimliği gelişiminde kişisel tecrübelerin önemine vurgu yapıp, öğretmen kimliğinin kişisel hikâyelerin analiz edilmesi ile keşfedilebileceğini ileri sürmüştür. Matematik öğretmen kimliğine yönelik kavramsal çerçeveler dikkate alındığında ise matematiğe ve öğretimine yönelik alan bilgisinin

önemine vurgu yapmakla birlikte, matematik ve öğretimine yönelik inanışlar ve duygular gibi duyuşsal faktörlerin de matematik öğretmen kimliğinin önemli bir parçası olduğu görülmüştür (bknz., Van Putten, Stols ve Howie, 2014; Van Zoest ve Bohl, 2005).

Tüm bu teorik ve kavramsal çerçevelerden faydalanmakla birlikte bu çalışmadaki kavramsal çerçevenin temel olarak Wenger'in (1998) Sosyal Öğrenme Teorisi'nden ve Van Zoest ve Bohl'un (2005) Matematik Öğretmen Kimliği Çerçevesi'nden etkilendiğini söylemek mümkündür. Dolayısıyla, bu çalışmada kişinin içerisinde bulunduğu topluluklardan sosyal ve çevresel anlamda etkilendiğini ama aynı zamanda bireysel bilişsel becerilerinin de öğretmen kimliği gelişimi sürecinde önemli bir yere sahip olduğu kabul edilmektedir. Yani, matematik öğretmen kimliği kavramı kişinin matematik öğretiminin değişik bileşenlerine—alan, pedagoji ve yöntem gibi—sahip olduğu bilişsel, duyuşsal ve duygusal bilgi ve becerilerini kapsayan bir kavram olarak kabul edilmiştir.

2.2. Matematik Öğretmen Kimliği Üzerine Alanyazındaki Bulgular

Alanyazın taraması sonucunda çalışmaların bulguları bu çalışmada 3 temel başlık altında değerlendirilmiştir: (i) Öğretmen kimliği değişimi üzerine olan çalışmalar, (ii) Geliştirilen öğretmen kimliğini ve öğretmen kimliği gelişimi sürecini araştıran çalışmalar ve (iii) kariyerinin başlarındaki matematik öğretmenlerinin matematik öğretmen kimliği ve gelişimi üzerine olan çalışmalar.

Öğretmen kimliği değişimi üzerine olan çalışmalar genellikle bir amaç doğrultusunda düzenlenmiş topluluklarda (araştırma projeleri, meslek içi eğitimler gibi) bulunan öğretmenlerin öğretmen kimliklerinin bu topluluklardaki tecrübeler doğrultusunda nasıl bir değişim gösterdiğini incelemiştir. Bu çalışmalarda öğretmenlerin katıldıkları toplulukların amaçları değişiklik göstermiştir: Matematik öğretmenlerinin orantısal akıl yürütme becerileri ile ilgili öğretimlerini geliştirme (Cyrino, 2016), matematik öğretmenlerinin kültürel değerlere duyarlı pedagojik yaklaşım geliştirmesi (Hunter, 2010), öğretmenlerin matematik eğitiminde eşitlikçi pedagojik yaklaşım geliştirmesi

(Wager ve Foote, 2013), öğretmenlerin matematik öğretiminde işbirlikçi grup yöntemini kullanmalarına yönelik uygulamalar geliştirmesi (Oslund, 2016), öğretmenlerin matematik derslerinde öğrencilerin matematiksel kavramları kendilerinin keşfetmesine yardımcı olacak uygulamalar geliştirmesi (Bjuland vd., 2012), matematik öğretmenlerinin cebir (Battey ve Franke, 2008), sayılar (Kumar ve Subramaniam, 2015) ve kesirler (Hanley ve Darby, 2006) konularını anlama ve öğretme becerilerinin geliştirilmesi. Her ne kadar öğretmenlerin katıldıkları çalışma topluluklarının amaçları değişiklik gösterse de, bu çalışmalara katılan öğretmenlerin içinde bulundukları çalışma topluluklarından etkilenerek öğretmen kimliklerinde—genellikle—istendik yönde değişimler gözlenmiştir.

Alanyazında geliştirilen matematik öğretmen kimliği tipini araştıran çalışmalarda ortak bir terminoloji kullanılmadığı görülmüştür. Bu çalışmalardan bazılarında geliştirilen matematik öğretmen kimliği tiplerini belirlemek yerine, matematik öğretmen kimliğini betimleyen açıklamalara yer verilmiştir (bknz., Brown ve Redmond, 2015; Lloyd, 2006; Mosvold ve Bjuland, 2016). Öte yandan bazı çalışmalarda ise spesifik olarak matematik öğretmen kimliği tipleri belirlenmiştir. Mesela, Williams'ın (2011) araştırmasına katılan iki matematik öğretmenin "Geleneksel" ve "Bağlantıcı" olmak üzere iki farklı matematik öğretmen kimliği geliştirdiği görülmüştür. Friedrichsen ve arkadaşları (2008) ise öğretmenlik sertifika programına katılan öğretmenlerin matematik öğretmen kimliklerini araştırmış ve 3 öğretmen kimliği tipi belirlemişler: (1) Her zaman öğretmen olmak isteyenler, (2) Sonradan öğretmen olmaya karar verenler ve (3) Meslek arayışı içinde olanlar. Bir başka çalışmada ise Lutovac ve Kaasila (2014) matematik öğretmen adayları için iki matematik öğretmen kimliği tipi belirlemişlerdir: (1) Kararlı öğretmen kimliği ve (2) Belirsiz öğretmen kimliği.

Alanyazında matematik öğretmen kimliği gelişimi sürecinde etkili olan faktörler pek çok çalışmanın konusu olmuştur. Matematik öğretmen adayları ile yapılan çalışmalarda öğretmenlik uygulamaları dersinin öğretmen adaylarının matematik öğretmen kimliğine olumlu yönde katkı yaptığı görülmüştür (bknz., Mosvold ve Bjuland, 2016; Neumayer ve DePiper, 2013; Ponte ve Brunheira, 2001). Bir başka çalışmada, öğretmen adaylarının

matematik öğretmen kimliği gelişimine daha geniş bir çerçeveden bakılmış ve öğretmen adaylarının üniversiteye gelmeden önceki öğrencilik tecrübeleri, öğretmen eğitim programında ve staj okullarında elde ettikleri tecrübelerin onların matematik öğretmenlik kimliğini şekillendirdiği ortaya çıkmıştır (Smith, 2006). Öğretmen adayları ile yapılan bir başka çalışmada ise, Ma ve Singer-Gabella (2011) üniversitede reform odaklı matematik öğretmen kimliği geliştirmeye yönelik eğitim verilen matematik öğretmen adaylarının bazılarının bu yönde bir matematik öğretmen kimliği geliştirdiği, ama bazı öğretmen adaylarının ise istenilen ölçüde reform odaklı matematik öğretmen kimliği geliştiremediği görülmüştür. Yani öğretmen eğitim programı her ne kadar matematik öğretmen kimliği gelişimi sürecinde önemli bir faktör olsa da, verilen eğitimin tüm öğretmen adayları için aynı etkiyi gösterdiğini söylemek mümkün değildir. Alanyazında, matematik öğretmenlerinin matematik öğretmen kimliklerini belirlemeye yönelik çalışmalar matematik öğretmen adayları ile yapılan çalışmalara kıyasla daha az bulunmaktadır. Bu çalışmalarda, öğretmenlerin görev yaptıkları okulların öğretmenlerde beklentileri, öğretmenlere sundukları imkânlar ve çalışma arkadaşları ile olan etkileşimlerinin onların matematik öğretmen kimliği gelişimi sürecinde etkili olduğu görülmüştür (Gresalfi ve Cobb, 2011; Hodges ve Cady, 2013). Bu çalışmalar, çalışma topluluklarının matematik öğretmen kimliği gelişimi sürecindeki önemini göstermekle birlikte, çalışma topluluklarının matematik öğretmen kimliği gelişimindeki olumlu ve olumsuz etkilerini derinlemesine inceleyen araştırmalar ulaşılabilir alanyazında bulunamamıştır.

Matematik öğretmen kimliği alanyazında özellikle son yıllarda sıklıkla araştırılan bir kavram olmasına rağmen, kariyerinin başlarındaki matematik öğretmen adayı ile yapılan çok az sayıda çalışmaya ulaşılabilmiştir. Matematik öğretmenleri meslek hayatlarının başlangıcında çok sayıda zorlukla karşılaşmaktadır ve bu zorluklar üstesinden gelinemediği takdirde onların matematik öğretmen kimliği gelişimini olumsuz yönde etkilemektedir (Alsup, 2006; Beauchamp ve Thomas, 2009; Pillen, Beijaard ve den Drok, 2013). Bu yıllarda öğretmenlere destek verilmesi önem arz etmektedir (Haggarty ve Postlethwaite, 2012). Her ne kadar, meslek hayatlarının ilk yılları öğretmenler için zorlu bir süreç olarak belirtilse de, bu yıllardan itibaren reform odaklı matematik öğretmen

kimliği geliştirmeyi başarabilmiş öğretmenlere de alanyazındaki çalışmalarda rastlanmıştır. Bu çalışmalarda, reform odaklı matematik öğretmen kimliği geliştirilmesinde öğretmenlerin çalışma topluluklarından aldıkları desteklerin ve bu desteklere ek olarak katıldıkları başka reform odaklı toplulukların (bölge çalışma toplulukları, mesleki gelişim toplulukları gibi) etkisi gözlenmiştir (bknz., Hodges ve Cady, 2012; Jong, 2016). Bu gibi çalışmalar, kariyerinin başlangıcındaki matematik öğretmenlerinin reform odaklı matematik öğretmen kimliği gelişim süreçlerine yönelik bir ışık tutsa da, alanyazında bu konuda yeterli çalışma olmadığı da görülmüştür.

Ulusal alanyazında öğretmen kimliği üzerine sadece 7 çalışmaya ulaşılabilmiştir ve bu çalışmalardan sadece bir tanesi matematik öğretmen kimliği üzerinedir. Bu çalışmada, Gülbağcı-Dede ve Akkoç (2016) öğretmenlik eğitim programındaki matematik öğretmen adayları ile öğretmenlik pedagojik sertifika programındaki matematik öğretmen adaylarını sahip oldukları matematik öğretmen kimlikleri üzerinden karşılaştırmıştır. Çalışma sonucunda öğretmenlik eğitim programındaki matematik öğretmen adaylarının öğretmenliğe yönelik kararlılıkları açısından öğretmen eğitim programındaki matematik öğretmen adaylarının daha ileride olduğu sonucuna varılmıştır. Matematik öğretmen kimliği gelişiminde sosyal faktörlerin göz önünde bulundurulması gerektiği alanyazında sıklıkla vurgulanmaktadır. Bu doğrultuda, ulusal alanyazında matematik öğretmen kimliği üzerine yalnızca bir çalışmaya ulaşılabilmesi ülkemizdeki matematik öğretmen kimliği kavramını anlayabilmek adına bir eksiklik olarak değerlendirilebilir.

2.3. Çalışmanın Alanyazına Olası Katkıları

Alanyazında matematik öğretmen kimliği üzerine özellikle son yıllarda giderek artan bir ilgi olduğu görülmektedir. Fakat pek çok çalışmada öğretmen kimliğini anlamak için açık bir şekilde ifade edilmiş bir teorik ve/veya kavramsal çerçeveye yer verilmediği görülmüştür. Bu durum, matematik öğretmen kimliği ve gelişimini anlamak için alanyazındaki önemli bir eksiklik olarak değerlendirilmiş ve bu çalışma ile bu eksikliğin giderilmesi yönünde bir adım atılması amaçlanmıştır.

Matematik öğretmen kimliği gelişimi ve değişimini inceleyen pek çok çalışmanın bir amaç doğrultusunda kurulmuş toplulukların etkilerini—araştırma projeleri, mesleki eğitim programları gibi—konu aldığı görülmüştür. Bu çalışmalarda, bu topluluklara ek olarak öğretmenlerin görev yaptığı okulların etkilerinden de bahsedilmiştir. Fakat spesifik olarak öğretmenlerin görev yaptıkları okulların onlar üzerindeki etkilerini anlayabilmek için yapılan bir araştırmaya ulaşılamamıştır. Bu çalışmada hem destekleyici hem de destekleyici olmayan nitelikteki çalışma topluluğunda görev yapan öğretmenlerin bulunması çalışma topluluklarının matematik öğretmen kimliği gelişimindeki rolünü anlayabilmek adına önemli olarak yorumlanabilir. Ayrıca hem kariyerinin başlangıcındaki matematik öğretmenleri hem de Türkiye'deki matematik öğretmenleri ile yapılan sınırlı sayıda çalışma olması, bu çalışmanın bulgularını alanyazın için önemli hale getirmektedir.

3. YÖNTEM

3.1. Araştırma Deseni

Araştırma sorularına yanıt verebilmek için bu çalışmada nitel araştırma yöntemlerine yer verilmiştir. Çalışmanın ilk iki araştırma sorusuna cevap verebilmek için araştırma deseni olarak "*Olgu Bilim* kullanılmıştır. Olgu bilim çalışmaları katılımcıların yaşadığı tecrübeleri anlamlandırmayı amaçlar (Creswell, 2007; Moustakas, 1994). Başka bir deyişle, katılımcıları neler yaşadıkları ne bu yaşadıklarının nasıl anlamlandırdıkları olgu bilim çalışmalarının araştırma konusudur (Moustakas, 1994). Bu çalışmadaki ilk iki araştırma sorusu doğrultusunda, kariyerin başlangıcındaki matematik öğretmenlerinin matematik öğretmen kimliği geliştirme sürecinde neler yaşadıkları, bu yaşadıklarının etkisiyle nasıl bir matematik öğretmen kimliği geliştirdikleri ve bu süreçte etkili olan faktörlerin belirlenebilmesi amaçlanmaktadır. Matematik öğretmen kimliği ve onun gelişimi olgusunu daha derinlemesine anlayabilmek adına üçüncü ve dördüncü araştırma sorularında kariyerinin başlangıcındaki iki matematik öğretmenine odaklanılmasına karar verilmiştir. Böylelikle, bu olgunun geliştirilmesi sürecinde çalışma topluluklarının etkisi, algılanan ve uygulanan matematik öğretmen kimlikleri arasındaki farklılık ve/veya

tutarlılıkların belirlenmesi mümkün olacaktır. Bu doğrultuda çalışmanın üçüncü ve dördüncü araştırma sorularını araştırabilmek için "*Çoklu Örnek Olay*" araştırma deseninden faydalanılmıştır. Özetle, çalışma araştırma deseni çoklu örnek olay deseni ile desteklenmiş olgu bilim çalışması olarak tanımlanabilir.

3.2. Katılımcılar

Hem olgu bilim hem de çoklu örnek olay araştırma desenlerinde katılımcıların çalışmanın amaçları doğrultusunda seçilmesi önemlidir (Creswell, 2007). Bu doğrultuda kariyerinin başlangıcındaki 11 matematik öğretmeni 1. ve 2. araştırma sorularını, bu 11 matematik öğretmeninden 2'si de 3. ve 4. araştırma sorularını araştırabilmek adına katılımcı olarak belirlenmiştir. Katılımcı 11 matematik öğretmeni belirlenirken meslek hayatlarının ilk 3 senesi içerisinde olmasına, aynı öğretmen eğitim programından mezun olmasına ve hali hazırda ortaokul matematik öğretmeni olarak görev yapıyor olmasına dikkat edildi. Üçüncü ve dördüncü araştırma sorularına cevap verebilmek adına seçilen 2 matematik öğretmeni belirlenirken de görev yaptıkları çalışma toplulukları dikkate alındı. Yapılan görüşmeler sonucunda örnek olay olarak seçilen matematik öğretmenlerinden biri destekleyici bir çalışma topluluğunda görev yaparken (P11, Erkek), diğer öğretmen de destekleyici olmayan bir çalışma topluluğunda görev yapmaktaydı (P5, Kadın). Hem P5 hem de P11 çalışma sırasında meslek hayatlarındaki ikinci yılın içerisindeydiler.

3.3. Veri Toplama ve Analiz Süreci

Çalışmanın ilk iki araştırma sorusunu cevaplayabilmek adına 11 katılımcı ile ikişer defa olmak üzere yarı-yapılandırılmış görüşmeler yapıldı. İlk görüşmede, katılımcıların kişisel özelliklerinin, aileleri ile ilgili bilgilerin, üniversite öncesi dönemde öğrenci olarak yaşadıkları tecrübelerin ve üniversitede öğretmen adayı olarak yaşadıkları tecrübelerin belirlenmesi amaçlanmıştır. İkinci görüşme ise ilk görüşmeden bir hafta sonra yapılmış olup katılımcıların matematik öğretmeni olarak yaşadığı tecrübeleri, matematik öğretimine yönelik uygulamalarını, görev yaptıkları çalışma toplulukları hakkındaki

değerlendirmelerini ve kendilerini bir matematik öğretmeni olarak nasıl gördüklerini belirleyebilmek adına yapılmıştır.

Görüşme yapılan öğretmenlerden ikisi (P5 ve P11) on hafta, haftada iki gün ve günde 6-8 saat olmak üzere çalışma topluluklarında ve sınıflarında gözlendi. Sınıf ortamı, öğretmenlik uygulamaları, çalışma toplulukları hakkında ve öğretmenin diğer öğretmen ve okul yöneticileri ile olan ilişkileri üzerine gözlem notları tutuldu. Sonrasında, yapılan gözlemleri tartışabilmek adına öğretmenlerle son bir görüşme daha gerçekleştirildi.

Katılımcı öğretmenler ile yapılan görüşmeler analize başlanmadan kontrol edilmek üzere katılımcılara gönderildi ve sonrasında nitel veri analiz programlarından Atlas.ti programına aktarıldı. İlk aşamada 11 katılımcı ile yapılan görüşmeler analiz edildi. Bu süreçte öncelikle açık kodlama yöntemi ile beş katılımcıdan elde edilen görüşme verileri kodlandı ve her kod çalışmanın kavramsal çerçevesi doğrultusunda geliştirilen kod kitapçığında tanımlandı. Sonraki aşamada kodlanılan veriler kod kitapçığı ile birlikte matematik eğitimi alanından iki uzman ile tartışıldı. Veri analizinin ve kullanılan kodların çalışmanın kavramsal çerçevesi ile uyumlu olduğu sonucuna varıldı. Sonrasında kalan görüşmeler hazırlanan kod kitapçığından faydalanılarak analiz edildi. Kodlanılan bu veriler içerisinden 2 öğretmene ait toplam 4 görüşme ikinci kodlayıcı tarafından kodlandı. İki kodlayıcının kodlamaları arasında %88 tutarlılık görüldü ve anlaşmazlıklar tamamen çözülene kadar tartışıldı. Benzer süreç P5 ve P11'den elde edilen görüşme ve gözlem verileri için de tekrarlanarak veri analizine son verildi.

4. BULGULAR

4.1. Algılanan Matematik Öğretmen Kimlikleri

Çalışmanın birinci araştırma sorusuna cevap verebilmek için kariyerinin başlangıcındaki 11 matematik öğretmeni ile yapılan görüşmeler analiz edildi. Analiz sonuçlarına göre, katılımcı öğretmenlerin algılanan matematik öğretmen kimlikleri iki kategori altında

değerlendirildi: *Geleneksel Yöntem Sahip Matematik Öğretmen Kimliği* ve *Karma Yönteme Sahip Matematik Öğretmen Kimliği*.

4.1.1. Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği

Bu çalışmada, "*Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği*" kavramı matematik derslerinde çoğunlukla öğretmen merkezli ders işleyen matematik öğretmenlerini tasvir etmek için kullanılmıştır. Çalışmaya katılan 11 öğretmenden 7'sinin algılanan matematik öğretmen kimliği bu kategoride değerlendirildi: P1, P2, P4, P6, P9, P10 ve P11.

Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği geliştiren öğretmenlerden bazıları matematik derslerinde reform odaklı uygulamaları denediklerini ama başarısız olmaları nedeniyle zamanla daha öğretmen merkezli olan geleneksel yöntemleri uygulamaya başladıklarını belirttiler.

> *Üniversitede geliştirdiğimiz aktiviteleri kullanmaya çalıştım. Bunları düzenleyip kendi sınıflarımda uyguladım. Fakat benim sınıf mevcudum 43 ile 45 arasında. Bu yüzden, birkaç defa uygulasam da başarılı olamadım. Şimdi aktivite kullanmıyorum artık.* (P10_G1)[5]

> *Aktivite hazırlayıp uygulamıyorum […] Geçtiğimiz yıllarda denedim ama bu sene hiç denemedim, artık vazgeçtim.* (P4_G2*)*

Öte yandan bu gruptaki bazı öğretmenlerin ise uygulamalarında reform odaklı yöntemlere hiç yer vermediği anlaşıldı. Bu öğretmenler kendilerinin matematik öğretimine yönelik uygulamalarını "geleneksel" olarak değerlendirmektedir.

> *Geleneksel yöntemleri kullanıyorum. Çoğunlukla soru-cevap ile ilerliyorum, aktivite kullanmıyorum. Onun yerine, mantığını anlatıyorum—neden böyle oldu, [formül] nereden geldi gibi.* (P6_G2)

Bu kategoride değerlendirilen öğretmenlerin matematik öğretimine yönelik inanış ve istekleri reform odaklı matematik öğretimi ile paralellik gösterse bile, uygulamalarında bu

[5] P10 ifadesi görüşme yapılan kişiyi belirtirken (10 numaralı katılımcı), G1 ifadesi verinin elde edildiği görüşmeyi (1. Görüşme) belirtmektedir.

yöntemlerden faydalanmadıkları anlaşılmıştır. Bunun sebebi olarak öğretmenler genellikle görev yaptıkları çalışma topluluklarının reform odaklı matematik öğretimi için gerekli şartlara sahip olmadığını ifade ettiler.

> *Daha çok öğrenci merkezli yöntemler kullanmak istiyorum ama müfredatın yoğunluğu ve şartlar… 36-38 kişilik sınıflarda ders veriyorum […] Bu şartlar beni çok etkiliyor.* (P9_G2)

Özetle, algılanan matematik öğretmen kimliği "Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği" olarak tanımlanan öğretmenlerin derslerinde öğrenci merkezli ve reform odaklı yaklaşımlardan ziyade öğretmen merkezli ve geleneksel yaklaşımları kullandığı anlaşılmıştır. Öğretmenlerin çalışma toplulukları hakkında verdikleri bilgiler doğrultusunda bu öğretmenlerin genellikle reform odaklı öğretimi destekleyici olmayan nitelikte çalışma topluluklarında çalıştıkları ve bu durumun da matematik öğretmen kimlikleri üzerinde etkileri olduğu sonucuna varılmıştır.

4.1.2. Karma Yönteme Sahip Matematik Öğretmen Kimliği

Bu çalışmada, "*Karma Yönteme Sahip Matematik Öğretmen Kimliği*" matematik derslerinde hem öğrenci merkezli reform odaklı uygulamalardan hem de öğretmen merkezli geleneksel uygulamalardan faydalanan öğretmenleri tasvir etme amaçlı kullanılmıştır. Çalışmada algılanan matematik öğretmenliği bu kategoride değerlendirilen 4 matematik öğretmeni bulunmaktadır: P3, P5, P7 ve P8.

Bu çalışmaya katılan öğretmenlerin matematik öğretimine yönelik uygulamaları arasındaki temel fark sınıf düzeyi olarak göze çarpmaktadır. Bu öğretmenler, 5., 6., ve 7. sınıf derslerinde reform odaklı yöntemlere uygun olarak öğrencilerin aktif olduğu ve anlamlı öğrenmenin hedeflendiği dersler işlenirken, 8. sınıf derslerinde ise geleneksel yöntemler ile uyumlu olarak dersin öğretmen tarafından anlatıldığı çok sayıda soru çözümünün gerçekleştiği dersler işlenmektedir. Öğretmenler tarafından, matematik öğretimine yönelik uygulamalarındaki değişikliğin temel sebebi olarak 8. sınıflar için uygulanan TEOG sınavı gösterilmiştir.

7. sınıflarda ve 8. sınıflarda işlediğim ders birbirinden farklı. 7. sınıfta, öğrencilerin kendilerinin keşfetmelerini sağlayacak aktiviteler kullanıyorum […] 7. sınıfta aktivite temelli ilerlemeyi seviyorum […] 8. sınıfta, aktivite kullanmıyorum […] Olabildiğince çok pratik yaptırtmaya çalışıyorum TEOG öncesinde. O yüzden, bol bol soru çözüyoruz. […] 8. sınıfta böyle bir yöntem kullanmak beni mutlu mu ediyor, hiç de değil. Benim asıl uygulamak istediğim yöntem 7. sınıfta kullandığım yöntem. (P3_G2)

8. sınıflarda TEOG beni çok etkiliyor. Öğrenciler olabildiğince çok soru çözmek istiyor [sınava hazırlanmak için]. Bu yüzden biz de genellikle soru çözüyoruz. 6. ve 7. sınıflarda birçok aktivite uyguluyorum ama 8. sınıflarda belki de 6 ve 7'lerde [sınıflarda] uyguladığımın ancak yarısını uygulayabiliyorumdur. (P7_G2)

Karma Yönteme Sahip Matematik Öğretmen Kimliği geliştirmiş öğretmenlerin reform odaklı uygulamalarında öğretmen eğitim programında geliştirdikleri zengin etkinliklerin ve meslek hayatlarında katıldıkları reform odaklı mesleki gelişim programlarının ve konferansların etkili olduğu görülmüştür.

4.2. Matematik Öğretmen Kimliği Gelişiminde Etkili Olan Faktörler

Çalışmanın ikinci araştırma sorusu kapsamında kariyerinin başlangıcındaki ortaokul matematik öğretmenlerinin algılanan matematik öğretmen kimliklerinin gelişiminde etkili olan 6 faktör belirlenmiştir: *Kişisel özellikler*, *Başkalarının öğretmenlerin kimlikleri*, *Öğretmen eğitim topluluğu*, *Çalışma topluluğu*, *Branş* ve *Eğitim Politikaları*.

4.2.1. Kişisel Özellikler

Çalışmaya katılan öğretmenlerin kendilerini bir birey olarak nasıl gördükleri kendilerini bir matematik öğretmeni olarak nasıl gördükleri ile paralellik göstermektedir. Katılımcı öğretmenlerin kişisel özelliklerinin kendi matematik öğretmen kimlikleri üzerinde hem olumlu hem de olumsuz anlamda bir etkisi bulunabilmektedir. Mesela, P1 kendisini sürekli aktif olan ve çalışkan biri olarak tanımlamaktadır. Benzer şekilde bir matematik öğretmeni olarak kendisinde güçlü bulduğu özellikleri sorulduğunda da çalışkan bir öğretmen olduğunu ve kendisinin matematik öğretimini geliştirmek için sürekli yeni

yöntemler aradığını ifade etmiştir: "*Yeni şeyleri keşfetmeyi ve kendimi geliştirmeyi seviyorum. O yüzden onlara [öğrencilere] yeni şeyler göstermek hoşuma gidiyor. Ben yeni bir şeyler yapmadan duramam zaten*" (P1_G2). Öte yandan P8 ise kendisini çabuk stres altına giren bir kişi olarak tanımlamaktadır. Bu durum onun matematik öğretmen kimliği gelişiminde de olumsuz yönde etkisini göstermektedir: "*Evet, onların [okul yöneticilerinin] beklentileri yüzünden strese giriyorum ve performansımı etkiliyor. Konsantre olamıyorum. Zaten stresli birisiyim […] Böyle şeyler beni daha da stresli yapıyor*" (P8_G2).

4.2.2. Başkalarının Öğretmen Kimlikleri

Öğretmenler katıldıkları topluluklar içerisinde sürekli "*başkaları*" ile iletişim halindedirler. Bu toplukların içerisindeki tüm kişiler etkili olmasa da, bazıları öğretmen kimliği gelişiminde önemli etkilere sahip olabilmektedirler. Rol model öğretmenler de bu bazılarının içerisindedir. Çalışmaya katılan öğretmenlerin pek çoğunun kendilerine rol model olarak belirledikleri öğretmenlerin olduğu görülmüştür. Rol model öğretmenlerin çalışmaya katılan öğretmenlerin meslek tercihlerinde, öğretmen olarak izledikleri yöntemlerde ve öğrencilere davranış şekillerinde etkilerinin olduğu anlaşılmıştır.

> *Matematik öğretmenimiz diğerlerinden farklıydı. Her şeyi sebepleri ile birlikte anlatıyordu. O zamana kadar hiç öyle ders anlatılmamıştı bize. Yani bize eksi ile eksinin çarpımı artı dendi, o kadar. Fakat o hocamız her şeyin neden öyle olduğunu anlatırdı ve benim gerçekten anlamamı ve matematiği sevmemi sağladı. Onun sayesinde öğretmenliği seçtim, onun gibi bir öğretmen olmak istiyordum.* (P3_G1)

4.2.3. Öğretmen Eğitim Topluluğu

Öğretmen eğitim programı matematik öğretmen kimliği gelişimi süresince öğretmenlerin içerisinde bulundukları topluluklardan biridir. Bu topluluk içerisinde yaşadıkları tecrübelerin çalışmaya katılan tüm öğretmenlerin üzerinde etkileri—az ya da çok—olduğu görülmüştür. Katılımcı öğretmenler özellikle alan, müfredat ve matematik öğretim

yöntemleri konularında öğretmen eğitim programında aldıkları derslerin kendileri için çok faydalı olduğunu ifade etmişlerdir.

> *Bizi üniversitede çok iyi hazırladılar. Müfredattaki her kazanım için tek tek konuştuğumuzu hatırlıyorum. Bazen müfredattaki kazanım çok iyi açıklanmamış oluyor, o zaman üniversitede konuştuklarımızı düşünüyorum. Sorun yaşamıyorum böylece.* (P1_G1)

> *Metot [Özel Öğretim Yöntemleri] dersinde hocamız hem materyaller ile hem de materyaller olmadan konuların nasıl öğretilebileceğini çok güzel göstermişti bize. O zaman yapılandırmacılıktan nasıl faydalanırım öğrenmiştim […] Şimdi o tecrübelerimden faydalanıp ben de öyle ders işliyorum.* (P7_G1)

Öte yandan bazı katılımcı öğretmenler, öğretmen eğitim topluluğunda sınıf yönetimine yönelik aldıkları pedagojik eğitimin ve görev yapacakları çalışma topluluklarının şartları hakkındaki bilgilerin yeterli olmadığını belirtmişlerdir.

4.2.4. Çalışma Topluluğu

Çalışmaya katılan tüm öğretmenler, kendi çalışma topluluklarında yaşadıkları tecrübelerin onlar üzerinde bir hayli etkili olduğunu ifade ettiler. Katılımcı öğretmenler bu yaşadıkları tecrübelerden öğrendiklerini ve bu doğrultuda da matematik öğretimine yönelik uygulamalarını düzenlediklerini belirttiler.

> *[Görev yaptığım okulda yaşadıklarım] en etkili şeylerden biri. Çünkü sürekli yeni şeyler öğreniyorum. Öğrencilerden öğreniyorum, diğer öğretmenlerden öğreniyorum […] Yapa yapa öğreniyoruz.* (P2_G2)

Özellikle algılanan matematik öğretmen kimliği "Geleneksel Yönteme Sahip Matematik öğretmen Kimliği" olarak belirlenen öğretmenlerin, çalışma topluluklarındaki şartlardan olumsuz yönde etkilendikleri görülmüştür. Bu etkiler onları uygulamak istedikleri matematik öğretimi yönteminden uzaklaştırıyor gibi durmaktadır.

> *Yüksel lisans tezimde aktivite temelli yaklaşımı kullandım. Her derste aktivite kağıdı vardı, [öğrencilerin] keşfedecekleri adımlar ve açık uçlu sorular vardı. Daha keyifliydi ama sadece 8-9 öğrenci içindi. Benim sınıfımda böyle bir yöntem kullanmak çok zor çünkü benim sınıflarımda çok daha fazla öğrenci var. O yüzden kullanmıyorum.* (P4_G2)

Daha öğrenci merkezli dersler işleyeyim, her öğrencimi ayrı bir birey olarak değerlendireyim isterdim. Fakat müfredatın yoğunluğu ve öğrencilerin fazlalığı beni etkiliyor. Sınıflarımda 36-38 öğrenci var ve bu durum beni çok etkiliyor. (P9_G2)

4.2.5. Branş

Katılımcı öğretmenler sıklıkla matematik dersini öğretmenin diğer dersleri öğretmekten daha zor olduğunu ifade ettiler. Bu düşüncelerinin altında öğrencilerin matematik dersine karşı olan önyargıları ve matematik öğrenmenin diğer derslere oranla daha fazla çalışma gerektiriyor olduğunu düşünmeleri yatmaktaydı. Matematik öğrenimine ve öğretimine yönelik bu görüşleri onları bir öğretmen olarak kendilerini nasıl gördüğünü de etkilemiş gözükmektedir. Genellikle, katılımcı öğretmenler öğretmenlik yaptıkları branşın etkisiyle kendilerini daha "*değerli*" hissetmektedirler.

Ukalalık yapmak istemiyorum ama matematik öğretmeni olmak ile başka branşta öğretmen olmak arasında büyük fark var […] Biz detayları daha iyi düşünebiliyoruz, daha pratik zekalıyız ve öğretmek için çok daha fazla çaba gösteriyoruz […]. (P3_G2)

Matematik öğretmeni olmak daha iyi […] Yani normal bir öğretmen olmaktan daha farklı bence. Daha üstün, daha prestijli bir şey. (P11_G2)

Her ne kadar farklı branşlardan öğretmenlerden katılımcılar arasında olmasa da, bu çalışmadaki öğretmenler öğretim yapılan branşın da öğretmen kimliği gelişimi sürecinde etkili olabileceğini göstermiştir.

4.2.6. Eğitim Politikaları

Öğretmenlerin çalışma şartları ve/veya çalışma toplulukları öğretim yapılan ülkenin eğitim politikalarından bağımsız düşünülemez. Bu çalışma kapsamında, eğitim politikalarının en büyük etkisi ilköğretimden ortaöğretime geçişe yönelik uygulamalarda görülmüştür. Çalışmanın yapıldığı zamanda ilköğretimden ortaöğretime geçiş TEOG sınavı ile yapılmaktaydı. Bu sınavın öğretmenler üzerindeki etkisi katılımcı öğretmenler tarafından sıklıkla vurgulandı.

TEOG hem öğrencileri hem de öğretmenleri strese sokuyor […]. (P10_G1)

Küçük sınıflarda çoğunlukla aktivite temelli bir öğretim yapıyorum. Fakat 8. sınıfta öğretimim öğrencileri TEOG'a hazırlamaya yönelik. Farklı soru tipleri çözmek, farklı soru tiplerinde nasıl düşünüleceğini öğretmek… Çünkü girecekleri bir sınav var sonuçta. O yüzden benim yöntemim de onları bu sınava hazırlamaya yönelik. (P8_G2)

4.3. Algılanan ve Uygulanan Matematik Öğretmen Kimliği Arasındaki Tutarlılık

Algılanan ve uygulanan matematik öğretmen kimlikleri arasındaki tutarlılığı belirleyebilmek adına katılımcı öğretmenlerden ikisi (P5 ve P11) birer eğitim öğretim dönemi boyunca görev yaptıkları çalışma topluluklarında gözlendi.

4.3.1. Örnek Olay Olarak P5

Çalışmanın ilk aşamasında yapılan görüşmeler neticesinde matematik öğretmenliğinin P5'in öğrencilik yıllarından itibaren istediği bir meslek olduğu görülmüştür. Bu doğrultuda ilköğretim matematik öğretmeni olmayı tercih eden P5, öğretmen eğitim programında kendisini reform odaklı matematik öğretimi ilkeleri doğrultusunda geliştirdiğini düşünmektedir. Aldığı eğitime paralel olarak, matematik öğretmeni olarak göreve başladıktan sonra kendi sınıflarında bu yönde öğretim yapmaya çalıştığını ifade etmiştir. Her ne kadar 5. ve 6. sınıf derslerinde bu yönde bir öğretim yapabildiğini ifade etse de, 8. sınıf derslerinde bu yönde bir öğretim yapmakta başarılı olamadığını ve bu nedenle daha çok öğretmen merkezli yöntemlerden faydalandığını belirtmiştir. P5'in görüşmelerde kendisi ve matematik öğretimine yönelik uygulamaları hakkında söyledikleri dikkate alındığında, algılanan matematik öğretmen kimliğinin "*Karma Yönteme Sahip Matematik Öğretmen Kimliği*" olduğu sonucuna varılmıştır.

Çalışmanın ikinci aşamasında, P5'in uygulanan matematik öğretmen kimliğini keşfedebilmek adına görüşme ve gözlemler yapılmıştır. P5'in matematik öğretimine yönelik uygulamalarının sınıf seviyelerine göre farklılıklar gösterdiği görülmüştür. P5, 5.

ve 6. sınıf derslerinde günlük hayat durumlarından faydalanarak, materyaller ve öğrencilerin aktif oldukları ve keşfedebildikleri dersler işlemekteydi. Yani, bu sınıf seviyelerindeki matematik öğretimine yönelik uygulamalarının reform odaklı matematik öğretimi ilkelerine uyum gösterdiğini söylemek mümkündür. Öte yandan 8. sınıflara yönelik derslerinde ise daha çok öğretmenin merkezde olduğu görülmüştür. Bu derslerde konu genellikle P5 tarafından anlatıldıktan sonra anlatılan konu üzerine soruların çözülmekteydi. Her ne kadar matematik öğretimine yönelik kullandığı yöntemlerde sınıf seviyesine göre farklılıklar olsa da, P5 girdiği tüm sınıflarda öğrencilerin kavramsal yanılgıya düşmemesi için özel bir çaba göstermekte ve olumlu sınıf ortamını sağlamaktaydı. P5'in matematik öğretimine yönelik uygulamaları dikkate alındığında uygulanan matematik öğretmen kimliğinin "*Karma Yönteme Sahip Matematik Öğretmen Kimliği*" olduğu sonucuna varılmıştır.

Özetle, P5'in algılanan ve uygulanan matematik öğretmen kimliği arasında tutarlılık olduğu ve her iki öğretmen kimliğinin de "*Karma Yönteme Sahip Matematik Öğretmen Kimliği*" olduğunu söylemek mümkündür.

4.3.2. Örnek Olay Olarak P11

Çalışmanın ilk aşamasında P11 ile yapılan görüşmeler matematik öğretmenliğinin P11 tarafından öğrencilik yıllarından itibaren istenilen bir meslek olduğunu ortaya koymuştur. P11, öğretmen eğitim programlarındaki tecrübeleri doğrultusunda matematik öğretiminde öğrenci merkezli yaklaşımları benimsemek istediğini belirtmiştir. Fakat, o zamana kadar mesleki hayatında bu yöntemlerden faydalanamadığını da ifade etmiş ve daha çok öğretmen merkezli yöntemler kullandığını belirtmiştir. Bu nedenlerden dolayı da P11'in algılanan öğretmen kimliği "*Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği*" olarak belirlenmiştir.

Çalışmanın ikinci aşamasında, P11'in uygulanan matematik öğretmen kimliğini belirleyebilmek adına çalışma topluluğunda görüşme ve gözlemler yapılmıştır. Bu

gözlemler neticesinde, P11'in matematik derslerinde öğrencilerin matematiksel kavramları keşfettikleri değil, öğretmenin konuyu anlattığı ve sonrasında da yoğun bir şekilde soru çözümünün yapıldığı görülmüştür. P11 öğrencilerin kavramsal olarak öğrenebilmeleri için konuları mümkün olduğunca çok tekrar edip ilgili konu hakkında çok soru çözmeleri gerektiğini ifade etmiştir. Yapılan görüşmede her ne kadar reform odaklı yöntemleri uygulamak istediğine yönelik görüşlerini ifade etse de matematik öğretimine yönelik inanışlarının reform odaklı matematik eğitiminden ziyade geleneksel yöntemlere daha yakın olduğu ortaya çıkmıştır. P11'in matematik dersleri göz önüne bulundurulduğunda kendisinin uygulanan matematik öğretmen kimliğinin "*Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği*" olduğunu söylemek mümkündür.

Özetle, P11'in algılanan ve uygulanan matematik öğretmen kimliği arasında tutarlılık olduğu ve her iki öğretmen kimliğinin de "*Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği*" olduğu sonucuna varılmıştır.

4.4. Çalışma Topluluklarının Matematik Öğretmen Kimliği Gelişim Sürecindeki Etkileri

Çalışma amaçları doğrultusunda örnek olaylar seçilirken öğretmenlerden birinin destekleyici (P11), diğer öğretmenin ise destekleyici nitelikte olmayan bir çalışma topluluğunda (P5) görev yapıyor olmasına dikkat edilmiştir. Çalışma topluluklarının P5 ve P11 üzerindeki etkileri örnek olaylar olarak değerlendirilmiştir.

4.4.1. Örnek Olay Olarak P5

P5, Ankara il merkezinde bir devlet ortaokulunda görev yapmaktadır. Görev yapmakta olduğu okulun sahip olduğu kalabalık sınıflar (42-50 öğrenci), matematik öğretimine yönelik materyal eksikliği ve öğretmenler odasının yetersizliği gibi olumsuz fiziksel şartların P5'i de olumsuz yönde etkilediği gözlenmiştir. Ayrıca, öğretmenler arasında ve öğretmenler ile okul yöneticileri arasında iş birliği olmaması da P5'i olumsuz yönde

etkilemektedir. Gözlemler sırasında P5'in sahip olduğu reform odaklı matematik öğretimine yönelik görüşlerinin diğer öğretmen ve okul yöneticileri tarafından desteklenmediğini sıklıkla gözlendi. P5 de bu durumun kendisi üzerindeki olumsuz etkilerini görüşmede ifade etti.

> *[…] İnsanlar yaptığınız işi takdir etmeyince, belirli bir süre sonra siz de motivasyonunuzu kaybetmeye başlıyorsunuz. Öğretmen için önemli bir şey bu. Yani demek istediğim siz azınlıktasınız ve diğerleri sizin doğru olduğuna inandığınız şeylerden farklı şekilde ders işliyor. Ne kadar kendi görüşlerinizin doğru olduğunu bilseniz de, moraliniz bozuluyor.* (P5_G3)

Her ne kadar P5'in çalışma topluluğu reform odaklı matematik öğretimi için destekleyici nitelikte olmasa da, P5 bazı olumsuz şartları olumluya çevirebilmeyi başarmıştır. Mesela, okulda reform odaklı matematik öğretiminde kullanılacak materyallerin olmaması nedeniyle sayma pulları, kesir kartları gibi materyalleri P5, öğrencileri ile birlikte kendisi oluşturdu. Benzer şekilde, okulda reform odaklı matematik öğretimi için diğer öğretmenler ve okul yöneticileri ile işbirliği yapamama durumunu, çalışma topluluğu haricindeki reform odaklı topluluklara (konferanslar, lisansüstü eğitim, mesleki gelişim programları) katılarak kendini reform odaklı matematik öğretimi konusunda geliştirerek olumluya çevirebilmiştir.

4.4.2. Örnek Olay Olarak P11

P11, Ankara il merkezinde bir özel okulda görev yapmaktadır. Görev yapmakta olduğu okulda olumlu fiziki koşullar (20 kişilik sınıf mevcutları, sınıflardaki teknolojik olanaklar, öğretmenler için ayrılmış çalışma alanları) ve profesyonel koşullar (öğretmenler arasındaki işbirliği, mesleki gelişim adına eğitim ve seminerler) gözlenmiştir. P11'in çalışma topluluğunda "Koçlar Toplantısı" ismi ile haftalık toplantılar yapılmakta ve bu toplantılara o sınıf seviyesinin sınıf öğretmenleri, ortaokuldan sorumlu okul yöneticisi ve okulun rehberlik öğretmeni katılmaktaydı. P11 de 5. sınıflardan birinin sınıf öğretmeni olması nedeniyle haftalık olarak bu toplantılara katıldı. Bu toplantılarda öğretmenler arasında öğrencileri hakkında bilgi alışverişi olmaktaydı ve bu durumun da P11'in öğrencilerini daha iyi tanımasına katkı sağladığı anlaşıldı.

Öğrencilerimi iyi tanıyorum. Sınıftaki davranışlarından dolayı tanıyorum artık onları […] Öğretmenler olarak Koçlar Toplantısı'nda da öğrenciler hakkında konuşuyoruz […] Bu da öğrencileri daha iyi tanımamı sağlıyor. (P11_G3)

[Koçlar Toplantısı] çok faydalı bir aktivite. Öğrenciler hakkında bilgi alışverişi yapıyoruz, bazı kararları ortak bir şekilde alıyoruz […]. (P11_G3)

Ayrıca, P11'in çalışma topluluğunda olumlu bir profesyonel ortam gözlenmiş, P11 de kendisini çalışma topluluğunun bir parçası olarak gördüğünü ve bu durumun kendisini duygusal anlamda olumlu yönde etkilediğini belirtmiştir.

Öte yandan, çalışma topluluğunun P11 üzerinde bazı olumsuz etkileri de bulunmaktadır. P11, çalışma saatlerinin yoğunluğu nedeniyle reform odaklı aktivitelere hazırlanmak için yeterli zamanı bulamadığını sıklıkla ifade etmiştir. Her ne kadar Koçlar Toplantısı aracılığıyla farklı branşlardaki öğretmenler arasında işbirliği olsa da matematik öğretmenleri arasındaki işbirliğinin zayıf olduğu görülmüştür. Bu durum P11 tarafından da ifade edilmiş olup kendisinin de bu eksikliği hissettiği belirtilmiştir.

Çalışma topluluklarının P11 üzerindeki bazı olumlu ve olumsuz etkilerinin yanı sıra çalışma topluluğundaki reform odaklı öğretim adına olumlu olarak değerlendirilebilecek bazı şartların P11 üzerinde bir etkisinin olmadığı gözlenmiştir. Çalışma topluluğunda geçirilen süre boyunca diğer branşlardaki bazı öğretmenlerin (Fen Bilgisi, İngilizce gibi) reform odaklı öğretim uygulamaları görülmüştür. Fakat, P11 gerek Koçlar Toplantısı sırasında gerekse ders aralarında reform odaklı öğretim yöntemleri uygulayan öğretmenler ile iletişim kurup onların tecrübelerinden faydalanma yolunu tercih etmemiştir.

5. TARTIŞMA

5.1. Algılanan Matematik Öğretmen Kimlikleri

Çalışmaya katılan matematik öğretmenlerinden 7'sinin "*Geleneksel Yönteme Sahip Matematik Öğretmen Kimliği*", 4'ünün ise "*Karma Yönteme Sahip Matematik Öğretmen*

Kimliği" geliştirdiği görülmüştür. Milli Eğitim Bakanlığı'nın ve buna paralel olarak öğretmen eğitim programlarının matematik öğretiminde reform odaklı yöntemler kullanan öğretmenler hedeflemesine rağmen, katılımcı öğretmenler arasında "*Reform Odaklı Matematik Öğretmen Kimliği*" geliştiren bir öğretmen olmaması olumsuz bir durum olarak değerlendirebilir. Bu durumun çeşitli sebepleri olabilir: (i) Öğretmen eğitim programında reform odaklı matematik öğretimine yönelik bilgi ve becerileri yeterince geliştirememiş olmak, (ii) Reform odaklı matematik öğretim yöntemlerini kullanmaya yönelik olumlu inanış ve isteklere sahip olmamak ve (iii) Reform odaklı matematik öğretiminde sorun yaşanıldığında destek alacak kimsenin olmaması.

Tüm bu olası sebepler göz önünde bulundurulduğunda, matematik öğretmenlerinin öğretmen eğitim programlarında reform odaklı matematik öğretimine yönelik daha çok uygulama yapması ve çalışma topluluklarında matematik öğretimine yönelik reform odaklı uygulamalarında sorun yaşadıklarında yardım alabilecekleri kişilerin bulunmasının gerekli olduğu görülmektedir.

5.2. Matematik Öğretmen Kimliği Gelişiminde Etkili Olan Faktörler

Bu çalışmanın bulguları doğrultusunda, matematik öğretmen kimliğinin uzun ve karmaşık bir süreç ardından geliştirildiğini söylemek mümkündür. Bu süreç matematik öğretmeninin kendi öğrencilik yıllarından başlayıp öğretmen eğitim programında ve görev yaptıkları çalışma topluluklarında devam etmektedir. Alanyazındaki bulguları destekler nitelikte (bknz., Beijaard, Meijeer ve Verloop, 2004; Van Zoest & Bohl, 2005), bu süreç içerisinde hem kişisel (örneğin, kişisel özellikler) hem de çevresel (örneğin, diğerlerinin öğretmen kimliği) faktörlerin etkili olduğu görülmüştür. Bu nedenle, matematik öğretmen kimliğinin sadece kişisel veya sadece çevresel faktörlerden değil, kişisel ve çevresel faktörlerin etkileşimi sonucunda geliştirildiğini iddia etmek mümkündür.

5.3. Algılanan ve Uygulanan Matematik Öğretmen Kimliği Arasındaki Tutarlılık

Öğretmenlerin kendileri ve matematik öğretimine yönelik uygulamaları hakkındaki algıları ile gerçekte olanlar arasında farklılıklar olabilir (van Putten, Stols ve Howie, 2014). Fakat bu çalışmada algılanan ve uygulanan matematik öğretmen kimlikleri araştırılan P5 ve P11 için farklılıktan ziyade tutarlılık olduğu görülmüştür. Çalışma kapsamında sadece iki öğretmenin algılanan ve uygulanan matematik öğretmen kimliği belirlendiği için, bu iki öğretmenden elde edilen tutarlılığı çalışmaya katılan diğer dokuz öğretmene genellemek yanlış olacaktır. Yine de P5 ve P11'in algılanan ve uygulanan matematik öğretmen kimliği arasındaki yüksek tutarlılık, çalışmada kullanılan veri toplama araç ve yöntemlerinin uygunluğu, P5 ve P11'in matematik öğretmeni olarak kendileri ve öğretim uygulamaları hakkındaki öz değerlendirme becerilerinin yüksek olduğu şeklinde yorumlanabilir.

5.4. Çalışma Topluluklarının Matematik Öğretmen Kimliği Gelişimindeki Etkileri

Alanyazındaki çalışmalarda, çalışma topluluklarının matematik öğretmen kimliği üzerindeki olumlu veya olumsuz yönde etkileri olabileceği sıklıkla vurgulanmıştır (bknz., Beauchamp ve Thomas, 2009; Van Zoest ve Bohl, 2005). Bu çalışma kapsamında da hem P5'in hem de P11'in çalışma topluluklarındaki bazı olumsuz koşullardan etkilendikleri görülmüştür. Bu durum çalışma topluluklarının matematik öğretmen kimliği gelişimindeki önemli etkisini göstermektedir. Bu doğrultuda çalışma topluluklarının özellikle kariyerinin başlangıcındaki öğretmenleri destekler nitelikte olmasının önemi görülmektedir. Öte yandan, P5'in çalışma topluluğundaki bazı olumsuz durumları olumluya çevirmesi ve P11'in çalışma topluluğundaki bazı olumlu durumlardan faydalan(a)madığının görülmesi çalışma topluluklarını etkilerinin öğretmenlerin var olan öğretmen kimliklerinden etkilendiği gerçeğini de göz önüne sermiştir. Bu nedenle, matematik öğretmenlerinin öğretmen eğitim programlarında güçlü bir şekilde reform odaklı matematik öğretmen kimlikleri geliştirmelerinin onların çalışma topluluklarında yaşayacakları tecrübeleri de etkileyebileceğini söylemek mümkündür.

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