Exploring Preservice Mathematics Teachers' Perception of the Mathematics Teacher through Communities of Practice[1]

Hatice Akkoç
Marmara University

Mehmet Ali Balkanlıoğlu
Marmara University

Sibel Yeşildere-İmre
Dokuz Eylul University

This research aimed to analyse the induction experiences of preservice mathematics teachers during their school placements through the lens of communities of practice. The main research question was concerned with how preservice mathematics teachers perceive what constitutes the practice of a professional community of mathematics teachers. A qualitative cross-sectional study was designed. Data collection tools consisted of face-to-face interviews and journals written by participants. Data was analysed using three modes of belonging in communities of practice framework: engagement, imagination and alignment. Findings indicated that participants had valuable observations with regard to professional relationships among mathematics teachers such as openness to exchange of ideas and collaboration. Data also revealed how preservice teachers align themselves with norms and values of university and school cultures. In most cases, preservice teachers endorsed norms of teacher education programs; e.g., they were critical about the traditional methods and the way technology was used in the partnership school. Their beliefs about the importance of confidence, strong subject knowledge and formative assessment were reinforced as a result of their observations in the partnership school.

Keywords · preservice mathematics teachers · initial teacher training · communities of practice · perceptions of the mathematics teacher · professional community of teachers

Introduction

Field experience is important for preservice teachers' development, since it is where they get a chance to put theory into practice. Various studies emphasise the problems due to theory-practice tension in the context of field experience (Darling-Hammond, 2006; Goos, 1999, 2005; Korthagen & Kessels, 1999; Nolan, 2006; Rhoads, Samkoff & Weber, 2013; Sutherland et al., 2005). Concerns with the effectiveness of field experience were reported in teacher education literature in general, and mathematics teacher education literature in particular (Ensor, 2001; Zeichner, 1981). For example, preservice teachers might not get a chance to observe or apply what they learn from university in the more conservative setting of schools (Zeichner & Tabachnick, 1981). Therefore, we should think more carefully about the problems with initial teacher training.

One of these problems is concerned with the traditional approach to teacher training which sees learning to teach as a de-contextualised activity (Lerman, 2001). In this approach, learning to teach is a cognitive process in which theoretical knowledge is "transferred" into practice. Preservice teachers are seen to resist advice if they are not successful in doing so (Singh & Richards, 2006). Ellis (2007) criticised this approach since it ignores contextual factors that surround teaching. Gale and Jackson (1997) mentioned that a limited amount of time is one of the problems of field experiences in teacher education programs. Another problem is concerned with school-based mentors. Frykholm (1988) stated that apprentice-master relationships between preservice teachers and school-based mentors might be ineffective if school-based mentors embrace a traditional approach to teaching. This might be the case since teacher education programs often chose the accessible mentors in schools (Zeichner, 1996).

With regard to the concerns described above, research studies suggested to take precautions during initial teacher training (Wasserman & Ham, 2013). First of all, building productive collaboration between faculties and schools has crucial importance (Carter, 2012; Sim, 2010). With respect to this collaboration, Postlethwaite and Haggarty (2012) reported findings regarding preservice mathematics teachers' views about ideas that were valued in university and the school contexts and how they dealt with differences between these ideas. They suggested that teacher educators should take these views into consideration. In parallel with this, some studies suggested redefining the role of cooperating teacher (mentor teacher) and university supervisor in learning to teach (Borko & Mayfield, 1995; Rodgers, & Keil, 2007; Slick, 1997). For example, Goos (1999) embraced an approach in which the role of the university-based mentor is to scaffold preservice teachers' post-lesson reflections. With this approach, it would be possible to help preservice teachers to analyse and resolve conflicts between school and university experiences.

Another suggestion is concerned with the timing of field experience in teacher education programs. Traditionally, school placement is in the last year. Sutherland et al. (2005) designed a different program in which a school practicum took place in the first year. They aimed to provide opportunities for preservice teachers participating in the daily work of teachers so that they get familiar with the professional knowledge and responsibilities. Therefore, this approach can help preservice teachers integrate what they learnt in school with the theoretical knowledge they learn from university. Tang (2003) found that an appropriate mix of challenge and support provided by university and school can encourage preservice teachers' professional development. School mentors' consciousness of their roles and recognition of these roles by university-based teacher educators in supporting preservice teachers' development is also an important issue (Graham, 2006).

Above all, field experience provides opportunities for preservice teachers to interact with a community of teachers and to develop their teaching selves. In this regard, Tang (2001) investigated preservice teachers' professional learning during a field experience course. He particularly focused on how their interactions with teachers and their peers constructed their teaching selves and affected their perceptions which were categorised as isolation, detachment, engagement and affiliation. With regard to isolation, preservice teachers developed a poor relationship with school-based mentors. Similarly, they did not have much dialogue on professional matters (in case of detachment). In terms of engagement, preservice teachers were faced with challenges and support, and took initiative to interact with the school community. In a similar study, Samaras and Gismondi (1998) investigated the way in which preservice teachers' sense of what it means to teach is enhanced by using school partnership for cognitive and collegial support, and perspective-taking. Findings revealed that preservice teachers came to define for themselves what it means to be a teacher.

School culture and social relations might influence "other's perceptions of their potential as teachers" (Nguyen, 2009, p. 661). In Wang's (2001) study, mentor teachers reported learning to cooperate with teachers and adopting to department culture as one of the social skills preservice teachers should develop. Rozella and Wilson (2012) found that preservice teachers changed their beliefs and practices through collaboration with school-based mentors.

This paper particularly focuses on preservice mathematics teachers' initial interactions with a professional community during the first phase of a field experience course. We investigated

their perceptions of what constitutes the practice of the school community in general and mathematics teachers in particular.

Theoretical Framework

"Communities of practice" is embraced as a theoretical framework to investigate how preservice teachers make an induction into a school community. It is a framework that focuses on social aspects of learning (Lave & Wenger, 1991). Like teaching, every profession has a socio-historical context with its own practices, routines and conventions (Sutherland, Scanlon and Sperring, 2005). Embracing a socio-cultural view of learning, the central theme of the framework is learning by engaging and participating (Wenger, 1998). Learning is "an integral part of generative social practice in the lived-in world" (Lave & Wenger, 1991, p. 35). It does not take place in the minds of individuals. Members of a community learn from each other through the process of sharing experiences. Therefore, during this process, new members become familiar with the norms and values of the community and learn to perform basic tasks by gradually participating in the community (Lave & Wenger, 1991). When new comers enter into a community, different levels of participation occur. Lave & Wenger (1991) and Wenger (1998) define two kinds of participation: central and peripheral. They describe learning as the process of moving from peripheral participation to full participation through not only mastering knowledge and skills but also developing an identity.

Communities of practice framework has been used in many studies in teacher education literature to explain the way in which teachers or preservice teachers learn to teach. Most of it focused on professional development of teachers (Brodie, 2014; Graven, 2004; He An, 2009; Lambson, 2010; Vescio, Ross, & Adams, 2008).

One of the notions of the framework used in these studies is "legitimate peripheral participation". According to Lave and Wenger (1991) and Wenger (1998) people learn through participation in a community and members have different degrees of participation. New comers who enter the community participate at the periphery. Experts, on the other hand, have central participation. Johnston (2015) questions whether preservice teachers could be considered as having legitimate peripheral participation during field experience courses. On the one hand, he emphasises that they are not fully registered teachers who have full responsibility, but they are rather guests or visitors. On the other hand, he claims that they could have peripheral participation since they take on responsibilities and take part in the work of school by helping teachers and students. Furthermore, he emphasises that preservice teachers may start to build an identity as a teacher in field experience courses if they are allowed to voice opinions and join in on decisions. Therefore, Johnston (2015) extends communities of practice framework to include preservice teachers' participation. He used this framework to explore the problematic nature of their admission to the school community. Likewise, Sutherland et al. (2005) used the notion of legitimate peripheral participation to describe field experience activities designed for preservice science teachers during their first year. The authors found that legitimate peripheral participation activities were useful for preservice teachers in developing professional knowledge.

Considering the literature above, a distinction should be made between studies focusing on teacher preparation and professional development of teachers. This distinction is necessary with regard to the way in which communities of practice framework is used. When participants are teachers, communities of practice are pre-existing and teachers have full participation (Roos & Palmér, 2015). On the other hand, preservice teachers participate at the periphery. This study investigates the first phase of this kind of participation when preservice teachers are first introduced to the school community. Preservice teachers have experiences in different contexts such as teacher education programs in a university and school context. They also interact with the members of different communities such as university tutors, their peers and teachers in partnership schools. Therefore, they are faced with different norms and values of different communities. As they enter the school community, though as mere observers in the beginning, they interact with teachers and students. These interactions, along with their interactions with university tutors, inform the pedagogical practice of preservice teachers (Sutherland et al.,

2005). In that sense, this paper investigates the induction activities in a teacher education program during which preservice teachers are introduced to the school community. These induction activities require them to observe members of the community and interactions among them. The aim of this study is to analyse preservice teachers' perceptions of what constitutes the practice of the school community using "three modes of belonging" to a social learning system: engagement, imagination and alignment (Wenger, 1998; 2010). Wenger (2010, pp. 184-185) defined these modes as follows.

Engagement is defined as "engaging in activities, doing things, working alone or together, talking, using and producing artefacts" (p. 184).

Imagination is concerned with constructing an image of the world that helps us understand how we belong or not… images of the world to locate and orient ourselves, to see ourselves from a different perspective, to reflect on our situation, and to explore new possibilities. The world provides us with many tools of imagination (e.g., ..stories,…role models) (p. 184).

Alignment is going beyond engagement and is defined as follows:

> making sure that activities are coordinated, that laws are followed, or that intentions are communicated… it is not a one-way process of submitting to external authority or following a prescription. Rather it is a two-way process…enlisting a colleague's collaboration or convincing a manager to change a policy (p. 185).

Since preservice teachers have peripheral participation, three modes of belonging will be used to analyse their observations as well as their participation in the professional community. In the light of this framework, research questions are formulated as follows:

- How do preservice mathematics teachers interact with members of the school community?
- What do preservice mathematics teachers observe concerning professional interaction among colleagues in schools?
  - What kinds of engagement do they observe in the professional community?
  - What kinds of alignment do they observe in the professional community?
- How do experiences of preservice mathematic teachers in schools (interactions and observations) effect their perception of the mathematics teacher? (imagination)

Methodology

Background of the Study

This study was conducted in a teacher preparation program in a Faculty of Education of a state university in Istanbul, Turkey. The data was collected during autumn term in 2013, in a five-year diploma program which awards its participants with a certificate for teaching mathematics in high school for students aged between 15 and 19. In the program, there are four kinds of courses which make a total of 272 ECTS (European Credit Transfer System), comprising:

Subject matter courses: Twenty-two mathematics courses which are taken from mathematics department and two physics courses which are taken from physics department in the Faculty of Arts and Sciences.

Education courses: Introduction to Educational Sciences; Developmental Psychology; Learning and Teaching: Theories and Approaches; Assessment and Evaluation; Classroom Management; and Guidance and Program Development which are taken from Education Department.

Mathematics education courses: Mathematics Teaching Methods I and II; Instructional Technologies and Material Development; School Experience; Teaching Practice; Research Projects in Subject Matter; and three optional courses which are taken from Mathematics Education Department.

General knowledge courses: Fifteen courses such as Foreign Languages; Computer; Fine Arts; and History of Science, taken from Faculty of Education.

This study particularly focuses on field experience component of the program. There are two courses during which preservice teachers visit partnership schools. The first one is the "School Experience" course that mainly requires observations. Preservice teachers take this course in the autumn term in their fifth year and it has two components: University and school. In the university component, preservice teachers spend one hour every week at the university. Guided by their university mentor (the first author of this paper), they discuss their experiences in their school visits and plan for the next week's observations and activities. During the school component, preservice teachers spend four hours a week in the partnership school. During these visits, preservice teachers make observations on such issues like school resources, classroom management, staffroom observations, teaching methods, questioning, students' difficulties and the mathematics curriculum.

The second course that is related to field experience is called "Teaching Practice". The course, which is in the spring term in the fifth year, has two components. The university component lasts for two hours every week and is guided by the university mentor. During the school component, preservice teachers are expected to teach six hours per week in the school. They discuss and reflect on their teaching with the university mentor.

Participants and Setting

The mathematics teacher education program admits around forty preservice teachers every year. The mathematics education department is responsible for the allocation of preservice teachers. Participants of this study are eight preservice teachers who are allocated to a partnership school. Table 1, below, gives some background information about these participants.

Table 1.
Background information of participants

Name (Pseudonym)	Gender	Mathematics Teaching Department as a first choice
Çiğdem	Female	No
Emre	Male	No
Filiz	Female	Yes
Gamze	Female	Yes
Giray	Male	Yes
İhsan	Male	Yes
Rıza	Male	No
Zeliha	Female	Yes

All participants were twenty-two years old. As can be seen in Table 1, half of the participants were female and the other half were male. All preservice mathematics teachers were graduates from Teacher Schools, which admit graduates from secondary schools at the age of fifteen. Teacher Schools are state schools and follow the national curriculum in all subjects. In addition to that, there are courses on general pedagogy. A central examination board provides opportunities for the graduates of Teacher Schools if they decide to be a teacher. Graduates of Teacher Schools take university entrance examinations, then they get extra points if they choose a faculty of education. None of the participants had any previous teaching experiences such as private tutoring.

Generally, one school-based mentor is appointed to three preservice teachers. Each preservice teacher visits and observes his/her mentor's lessons as a part of the ''School Experience'' course. The mathematics education department arranges two different schools so that preservice teachers have an alternative experience each term.

This study focuses only on the "School Experience" course during the first term. Participants of this study were allocated to a very prestigious private school in Istanbul, Turkey.

This school's success rate (which is based on the number of students who enter university) is very high (100% in 2014, 100% in 2013, and 99% in 2012). The school allocates extra study time before and after school hours for revision by organising study groups. Teachers are appointed by the school administration.

Data Collection

The data was collected during the autumn term in 2013. A qualitative cross-sectional study was conducted to investigate the preservice teachers' induction. A convenience sample of eight preservice mathematics teachers was selected for the study. Data collection consisted of face-to-face interviews and journal writing. At the end of the ''School Experience'' course in the 2013 autumn term, face-to-face interviews were conducted in the mathematics education department by the university mentor. Both researchers and participants signed informed consent forms at the beginning of the study. Interviews were tape-recorded. On average, interviews took about thirty to forty-five minutes. In the interviews, participants were asked the following questions:

1. What kind of dialogues did you have with (a) the school head? (b) the head teacher of mathematics? (c) other mathematics teachers?
2. What did you observe in the staff room?
3. What kind of dialogues did you witness among the head of school and mathematics teachers?
4. What kind of dialogues did you witness among head of mathematics and other mathematics teachers?
5. What kind of dialogues did you witness among mathematics teachers?
6. Did these observations change your perception of a mathematics teacher? If so, how?
7. Did these observations change your perception of being a mathematics teacher in a private school? If so, how?
8. Would you like to be a mathematics teacher in a private school? Why?
9. Did the ''School Experience'' course change your perception of a mathematics teacher? If so, how?
10. Could you please evaluate the ''School Experience'' course?

Additional data was collected through journal writing. Preservice teachers were asked to write journals every week. These journals included remarkable incidents they had experienced during their school visits. They submitted these journals electronically using a word processor. There were a total of 58 pages of journals.

Data Analysis

Content analysis was used to analyse the data. First, interviews were transcribed verbatim. Second, transcriptions of interviews and journals were analysed based on the research questions and theoretical framework of the study. Various codes emerged as a result of analysis: "engagement", "observing engagement", "alignment", "observing alignment" and "imagination". Each of the codes are explained below:

Engagement refers to instances where participants themselves engage in activities in school e.g. joining a discussion in the staff room.

Observing engagement refers to instances where participants observe the way in which members of the school community engage in activities of daily practice e.g. observing how teachers organise a study group after school or observing collaboration among mathematics teachers.

Alignment represents cases where participants adapt to the school culture or challenge it e.g. enlisting mentor teachers' advice or trying to convince a teacher to change his/her teaching method.

Observing alignment refers to instances where participants observe the way in which members of a school community adapt to school culture or challenge it.

Imagination is concerned with how participants reflect on their observations to build their perception of the mathematics teacher and their selves as mathematics teachers e.g. taking a teacher as a role model.

Using the data from interviews and journals, themes were specified considering the above codes. The themes are presented in the findings section below.

Findings

This section presents themes that emerged from participants' interactions with each member of the professional community (school head, head of mathematics, school-based mentor, and other mathematics teachers) and how their interactions and observations affect their perceptions of the mathematics teacher.

Engagement

Participants rarely engaged in activities in school since the first phase of field experience course required mostly observations. One kind of engagement is collaboration with teachers as in Riza's case. He suggested to the head of mathematics and other teachers around him the Pick Theorem (which provides a formula for calculating the area a polygon on a geoboard) when they were examining a geoboard:

> They were trying to show how to calculate area with it (geoboard). I showed them the Pick Theorem, they didn't know it at all. He (head of mathematics) told the other teacher to investigate this and show this to students and he said okay. He didn't take any offence that he learnt something new considering he is quite old and experienced. I just appreciated him … they are so open-minded. They said let's teach this. One of the teachers said that "Anything (an interesting problem) could make a difference for students. They don't have to learn it properly but when you show them, students would like it and feel like they make a new discovery" he said. (Riza)

As can be inferred from the excerpt above, Riza engaged in a discussion among mathematics teachers and he was welcomed to such a collaboration since mathematics teachers were open-minded about suggestions.

Observing Engagement

Preservice teachers observed various kinds of activities in school. As they mentioned in their journals and interviews, they put an emphasis on collaboration among teachers especially in the staff room.

During the interviews, preservice teachers were asked what they observed in the staff room and how these observations changed their perceptions of being a mathematics teacher. All of them said that mathematics teachers discussed exams, homework and tasks. For example, Gaye said:

> They advise strategies to each other. They solve the questions in the tests together, then compare to each other's. Then they decide to exclude some questions since they thought it would be difficult for students. (Gaye)

Filiz talked about how mathematics teachers discussed the solutions of problems:

> They discuss about how to find simpler solutions to the questions. They compare their solutions and try to find the most practical one … They continually talk about the changes in the exams, when to do it, checking them together … They always talk about questions in the tests … Math teachers study all the time in the staff room! (Filiz)

Another issue raised by four participants (Emre, Filiz, Gaye and Giray) was collaboration among mathematics teachers in the staffroom. For example, Giray said: "Math teachers I see in the staffroom exchange ideas in a very good way. It's like teamwork. After I see that I thought this is something I should do when I become a math teacher." He also added that the way

mathematics teachers exchange ideas was very useful and they looked for advice from other teachers, even from those who had less experience.

Some of the participants reported various professional conversations. Three participants mentioned that the head of mathematics talked about issues related to organising exams and study groups. Riza emphasized the collaboration between the head of mathematics and other teachers and also mentioned that he liked the way they collaborated:

> They were trying to support each other … for example the head of mathematics was asking mathematics teachers to find something new for students, something that would engage their attention and interest … all young teachers were around him … they were discussing the teaching material, it was something like a board, there were nails on it (trying to describe a geoboard), they were trying to show how to calculate the area with it … that was good. (Riza)

Another category of the school community we focused on is the school-based mentors. With regard to their mentors, some of the preservice teachers talked about the dialogues they witnessed between their mentors and other mathematics teachers. Çiğdem said that the other mathematics teachers asked her mentor for advice. Zeliha mentioned that her mentor talked about her students in the classroom and jealousy among her students. Giray pointed out the exchange of ideas among mathematics teachers:

> They (math teachers) prepare a common exam together. He (his mentor) was discussing about what to include in lessons. For example, when he was teaching vectors, one can find the area of a triangle using matrices and determinants. The other math teacher suggested not to include this method in lessons and let students solve the question without using it. Otherwise, students would solve using the determinant and we will not be able to assess whether they know the other method, she said. My mentor suggested to give the determinant method since what's important is to reach the correct answer. It's ok to use the short cuts, he said. (Giray)

Another theme emerged from participants' observations is concerned with teaching methods used by teachers. For example, Zeliha made positive comments about the teaching methods of her mentor although she described his approach as being traditional. She especially liked the way he used the theorems and their proofs:

> His teaching was so traditional. I think like the other mathematics teachers as I know from my classmates … I was very influenced by [how] he was trying to use the theorems … he was trying to teach simple theorems. I liked that so much. He didn't do this much in mathematics but in geometry, he tried to prove the theorems in his own way, well in a simpler way, although not like we learnt them in university (Zeliha)

Classroom management was also an issue raised by some of the participants. Zeliha added that she learnt a lot about classroom management by observing her mentor: "What I liked most is his classroom management rather than his teaching. It was so good, his communication with his students … he got his students to do what he wanted ... I learnt a lot about classroom management".

Another theme emerged from the analysis of data is subject knowledge. Some of the mentors gave advice to preservice teachers to develop their subject knowledge. For example, Gaye's mentor encouraged her to strengthen her subject knowledge and added that she had to love her profession to become successful. Filiz also observed strong subject knowledge in practice:

> You can see that he (her mentor teacher) loves teaching, he is teaching math with such confidence. He told me that if you can have a good command of most of the things then you can't be happier. "You have to make an effort to achieve this. You should do this. Try to have a good command of your subject" he said. (Filiz)

Participants also observed some characteristics of private schools. Preservice teachers mentioned that they did not expect traditional teaching methods in a private school. Some of them described the school's approach as "exam-oriented". They said they expected to see technology-enhanced lessons. However, as they emphasized, technology-integration was only limited to the use of smart boards. Participants also mentioned that teachers had a very busy schedule in this private school.

Assessment practice in the school was also noticed by one of the participants. Giray mentioned the importance of assessment as follows:

> I observed how teachers were concerned about giving feedback to students. In fact, making exams or any other kind of assessment is for learning. Not for marking. This was something we learnt in the university but it was very good to see it in practice. (Giray)

As can be seen from the excerpt above, Giray's belief about the importance of assessment was reinforced with his observations of how mathematics teachers used formative assessment in a useful way.

Finally, participants also observed what kinds of activities the assistant head teacher engaged in the daily practice of school. Preservice teachers mentioned that they talked to the assistant head teacher, mostly about discipline issues, such as how he intervened with the classroom when it was noisy or how he organized the central exams. For example, Gaye wrote in her journals that the assistant head teacher inspected whether students completed their homework and informed their parents if they did not. Similarly, Giray said that the assistant teacher was responsible for managing the exams and study groups before and after school. Zeliha said she witnessed how the assistant head teacher entered the classroom and interrupted the lesson as she was observing the lesson.

Other kinds of engagement observed were teachers' discussions around students' mistakes in mathematical language, evaluation of students anonymously, warm professional relationships among teachers and teachers' own work space in the staff room.

Alignment

During their field experience, preservice teachers received some advice from their school mentors. For example, four participants mentioned that the head of mathematics had some suggestions for them. He suggested Çiğdem and Filiz to improve their English since the language of instruction in some of the private schools is English and they might want to work in a private school in the future. He suggested Riza to observe teachers in the school very carefully and make critical notes since they were experienced and good teachers. Participants mentioned that they acknowledged experienced teachers' advice. In other words, this advice was aligned with their perception of the mathematics teacher. On the other hand, Giray's alignment with some issues in the school context was in the opposite way. He complained about the content of collaboration in the staff room and said: "They do not talk about teaching activities or tasks in the classroom … but just about exam questions".

Observing Alignment

Analysis of data indicated that preservice teachers made more observations on the way in which alignment occurred in the school culture. One of the aspects was related to teaching methods. Five preservice teachers talked about their observations about the teaching methods of their mentors. One of them was Emre, and he had positive comments about the teaching approach of his mentor. He was surprised about her approach, since the school was exam-oriented and his mentor challenged the expectations of the school:

> My observations were fruitful in terms of classroom interactions, with regard to student to teacher interaction. Although she was a bit more tolerant, I didn't see any disrespect from students. There were exceptions, [but] rarely. In terms of her teaching approach, it was very fruitful, especially in terms of seeing different solution methods. It was last grade and there was exam pressure and it was a private school, but it was very good to see that she taught without using testing techniques … my expectation from the school was an exam-oriented approach … for most of the time she said that she would not give the formula, and it came from here, etc. "It is better for you to know where it comes from" she said. (Emre)

As can be inferred from the excerpts above, the preservice teacher noticed the way in which his mentor challenged the expectation of the school which is an indication of alignment.

Another example of alignment is concerned with professional relationships between mathematics teachers and head of mathematics. Participants were asked how the head of

mathematics and other mathematics teachers interact with each other. Three preservice teachers described the professional relationships as "warm and serious at the same time", while two of them said that mathematics teachers were wary of the head of mathematics since he can influence the renewal of their contracts and he can be unapproachable sometimes. Zeliha said that mathematics teachers were trying to prove themselves to the head of mathematics.

Preservice teachers also observed alignment concerning the school administration and how its expectations were communicated with teachers. As mentioned above, the private school they visited was a very prestigious one and has a very high success rate. In general, private schools in Turkey receive students with a high socio-economic background. However, teacher authority in the classroom is weak compared to public schools and teachers are under pressure because of that. The analysis of interview transcripts indicated preservice teachers' astonishment about the high level of discipline in the school. They were surprised to see how school administration does not interfere with teachers and does not threaten teacher authority.

Imagination

As preservice teachers made observations and interacted with teachers, they constructed images of the professional community which affected the way they see themselves as mathematics teachers. With regard to this, various themes emerged from the analysis of data.

The first theme is concerned with role models. During the interviews, preservice teachers were asked how they changed their point of view of a mathematics teacher after interactions with their mentors. Five of them talked about how they were influenced by their mentors and changed their point of view. For example, Emre observed that his mentor was always trying to improve himself and he would take this as an example when he becomes a teacher. İhsan, who did not want to be a teacher as he mentioned during in an interview, has been influenced by his mentor:

> I do not want to be a teacher, but if I become a teacher I want to be like my mentor … first of all, his subject knowledge is strong. Also, the way he approaches his students. It was so good. He was not strict with them … When I said I did not want to be a teacher he gave me advice. He said teaching was the best profession … I saw the way students loved him so much. (İhsan)

Riza was also influenced by his mentor who gave him the following advice:

> He advised me to do my own job and not to care about anyone else. "Sometimes they talk about something else, do unnecessary things … you should focus on your own job. If you do so you will not waste your energy"… These kinds of things influenced me. (Riza)

Riza said that he was surprised to see how the head of mathematics and other mathematics teachers were open to improve themselves and did investigations. He said that he took the head of mathematics as a teacher model for himself.

Another preservice teacher Zeliha was impressed by how the head of mathematics was writing so neatly on the board, and how he could communicate with students so well. Similarly, Gamze mentioned that she liked the way her mentor was so confident about himself and his subject knowledge; therefore she took him as a good example of a mathematics teacher. She said the following: "I saw myself as a teacher in him. My image of a teacher has been consolidated."

During an interview, Zeliha recounted how she was influenced by the way her mentor used classroom management effectively. Filiz, on the other hand, described her mentor as the hardworking version of herself:

> I saw my hardworking version of my self in her … if you add the practical side and communication skills of her to me, and if you add my mathematics education knowledge then this will be me (Filiz)

Filiz was impressed by "practical mathematics" (or so-called "relational mathematics" in Skemp's (1976) terms) although it is not encouraged by university courses:

> In the staffroom, they were talking about practical mathematics all the time. Math teachers were very good at practical math. I want to be like them. You know, practical math is like making a show in the classroom. It will make me feel so good! (Filiz)

In some occasions, preservice teachers were faced with "bad examples" in their own terms. Three participants mentioned that their experience with their mentors did not change their points of view. For example, Çiğdem said she would not take her mentor as a good example. On the contrary, she wanted to be the opposite since he was so strict and had a traditional approach to teaching mathematics. Giray also did not take his mentor as a model since he was not good at motivating his students, communicating with them and providing guidance for them.

Three preservice teachers also criticised the teaching methods of their mentors as being too traditional. Zeliha used the word "traditional" while Giray used the term "lecturing" to describe their teaching approaches. Çiğdem also criticised her mentor's approach and added that "it was traditional except everything is on the smart board but nothing changes, projecting on the smart board, reading from there, and then there comes the next question". All these three participants emphasised that they did not want to be like their mentors in the future.

Another theme concerned with imagination is collaboration among mathematics teachers. For example, Giray emphasised that he liked the way mathematics teachers exchanged ideas. He added that he would establish such cooperation in the future when he becomes a teacher. Filiz also mentioned that she would take this collaboration as a good example for her future teaching.

The last theme of imagination emerged from the analysis is concerned with "being a mathematics teacher in a private school". Preservice teachers mentioned that their images of a private school have been challenged with respect to disciplinary issues. They reported that they expected a lower level of discipline in a private school. They were also surprised to see that students and school administration did not threaten teacher authority. Despite a positive change of perspective, some of the preservice teachers mentioned that they used to prefer working in a private school as a second option but changed their minds after their school placements:

> I used to think of private school as a second option if I cannot be appointed to a job in a public school. But this private school does not give what I want. I'd like to use technology or other teaching materials. (Gaye)

> My first preference is a public school. I used to think that if I won't be able to be happy in my school, I would work in a private school. I was willing to do that until I came to this school. Here they work so hard ... they only aim to prepare students for the university entrance exam, and I don't want this. (Zeliha)

As can be inferred from the excerpt above, preservice teachers would not choose to be a mathematics teacher in a private school mainly because of its traditional approach to teaching and a busy schedule.

Discussion and Conclusion

This study investigated eight preservice mathematics teachers' perceptions of mathematics teachers during their initial interactions with a professional community. Participants interacted with the assistant head teacher, head of mathematics, school-based mentor, and other mathematics teachers. Three notions of communities of practice (engagement, imagination and alignment) were used to analyse preservice teachers' experiences.

Participants observed the school community as they engaged in various professional activities. It is no surprise that preservice teachers did not interact with the school head at all and had distant relationships with the assistant head teacher. They observed mostly discipline issues with regard to the assistant head teacher. Participants mostly interacted with their school-based mentors. They spent four hours a week and made observations in their mentors' lessons. They observed how their mentors exchanged ideas with other mathematics teachers, learning about the importance of subject knowledge and confidence. They also observed their

teaching methods. As the interview data indicated, they commented on these methods. Some of them criticised their mentors' teaching methods since they were traditional. On the other hand, some of them liked the way their mentors taught mathematics since it was reformed-based as encouraged by the teacher preparation program.

The preservice mathematics teachers also learnt a lot by observing the staff room, especially professional relationships and the daily work of teachers. Collaboration was again an issue raised by participants in the staff room. Participants reported that this collaboration constituted a good model for them. Another issue was assessment. One of the preservice teachers (Giray) said that he realised the importance of assessment and had a chance to see the usefulness of what he learnt about assessment in practice.

Preservice teachers themselves rarely engaged in activities in school since the first phase of their field experience course required mostly observations. A remarkable example was the collaboration between mathematics teachers and one of the preservice teachers (Riza). In this case, school-based mentors learnt from the preservice teacher and drew parallels to the findings reported by Abell, Dillan, Hopkins, McInerney and O'Brien (1995). They found that preservice teachers started to see their mentors as colleagues when mentors acknowledged that they can also learn from them.

Data also revealed how preservice teachers aligned themselves with norms and values of university and school cultures. In most cases, they endorsed norms of the teacher education program. Data exemplified this situation such as criticism of traditional teaching methods and ineffective integration of technology. Furthermore, in some cases, experiences in schools reinforced beliefs about what was promoted in the teacher education program; e.g., the importance of formative assessment. Rhoads, Samkoff and Weber (2005) found various causes of tension between preservice teachers and school-based mentors. One of them was their different perceptions about freedom in teaching methods. This finding is not in parallel with research studies such as Frykholm (1998) who found inconsistencies between reform-based teacher education programs and traditional approaches of school-based mentors. On the other hand, this finding should be interpreted carefully since participants mostly had an observer role in the school. Fuller participation in school, such as teaching, might challenge their reform-oriented beliefs.

As opposed to the alignment of norms of different communities, findings revealed a tension in some cases. One of the preservice teachers was in favour of "practical mathematics", as she called it, or so-called "instrumental mathematics" in Skemp's (1976) terms or "procedural knowledge" in Hiebert and Lefevre's (1986) terms. Observations indicated that this teaching approach was privileged by the school culture, due to pressures on schools with regard to academic success in university entrance examinations with multiple-choice questions. In contrary to this school culture, the teacher education program privileges "relational understanding of mathematics" where necessary. The influence of traditional school culture on preservice teachers was also reported by Zeichner and Tabachnick (1981) who emphasised that what preservice teachers learn from university is inclined to be washed out in the more conservative setting of the school.

As preservice teachers made observations and interacted with teachers, they constructed images of the professional community which affected the way they see themselves as mathematics teachers. This was coded as "imagination". The analysis of data revealed a change of perception for five preservice teachers. As they reported during the interviews, they understood the importance of getting to know students and classroom management, and "practical mathematics". Some of the participants were impressed by the willingness and openness of their mentors for professional development. They said they took them as a good example and wanted to be like them in the future. On the other hand, three preservice teachers criticised their mentors and did not want to be like them when they become teachers.

The head of mathematics also had an influence on preservice teachers. They especially witnessed his professional relationship with other mathematics teachers. Participants liked the way the other mathematics teachers collaborated with the head of mathematics and looked for advice. One of the preservice teachers (Riza) explained a mathematical theorem to the head of mathematics and Riza was impressed by his openness to his suggestion. Another influence of

the head of mathematics on preservice teachers, is his level of confidence in terms of subject knowledge.

Another finding is concerned with perceptions of being a mathematics teacher in a private school. Preservice teachers became familiar with the norms of the particular private school they visited. They were surprised, and at the same time glad, to see the high level of discipline and teacher authority in a private school. On the other hand, most of them said they decided not to work in a private school since the teachers had a very tight schedule.

This study has implications both on theoretical and practical levels. On a theoretical level, the notions of *engagement, imagination and alignment* of communities of practice framework provided a theoretical lens to analyse preservice teachers' field experiences which was mainly based on observation. Communities of practice is a framework which is mostly used to investigate communities in which members have full (central) participation e.g. fully registered teachers. However, the way the framework was used in this study helped us to make sense of preservice teachers' peripheral participation which was limited to observations. With this regard, codes (observing engagement and observing alignment) which were not part of the framework emerged as a result of this study.

At a practical level, this study has some implications for teacher education. First of all, teacher educators should monitor carefully how preservice teachers align themselves with the norms and values of theory and practice that emerges from different cultures. Second, opportunities should be provided for preservice teachers for full participation in professional communities. Third, preservice teachers should be encouraged to be critical observers. Participants of this study critically observed not only professional activities in school (engagement) but also how the members of the school community aligned themselves in the school culture (alignment). Fourth, teacher educators should also be careful about their roles with regard to how preservice teachers align themselves between theory and practice. As Goos (1999) suggests, they should have a scaffolding role since preservice teachers have experiences both in university and school communities.

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Authors

Hatice Akkoç
Marmara University, Atatürk Eğitim Fakültesi, Matematik Öğretmenliği, Kadıköy, Istanbul, Turkey
email: hakkoc@marmara.edu.tr

Mehmet Ali Balkanlioglu
Marmara University, Fen-Edebiyat Fakültesi, Sosyoloji Bölümü, Kadıköy, Istanbul, Turkey
email: mehmet.balkanlioglu@marmara.edu.tr

Sibel Yeşildere-İmre
Dokuz Eylul University, Buca Eğitim Fakültesi, İlköğretim Matematik Öğretmenliği, İzmir, Turkey
email: sibel.yesildere@deu.edu.tr