MENTORING PRACTICES IN PRE-SERVICE MATHEMATICS TEACHER EDUCATION WITHIN THE CONTEXT OF PEDAGOGICAL FORMATION PROGRAMS

by

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ABSTRACT

MENTORING PRACTICES IN PRE-SERVICE MATHEMATICS TEACHER EDUCATION WITHIN THE CONTEXT OF PEDAGOGICAL FORMATION PROGRAMS

The main purpose of this research is to examine mentoring practices within the context of pedagogical formation program in teaching mathematics in Turkey from the perspectives of three stakeholders of mentoring: supervisors, mentors, and mentees. The perceptions of all stakeholders about mentoring practices were analysed based on the factors of Five-Factor Mentoring Model: Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback. The sample of the study was comprised of 246 mentees from 6 universities, 54 mentors (each collaborating with one of these universities) and 6 supervisors from each university. The mentors' and mentees' perceptions on mentoring practices were investigated by MEMT-Mentor and MEMT-Mentee surveys, respectively; and Confirmatory Factor Analyses were conducted for each. Open-ended questionnaires which aimed to examine mentors' and mentees' typical examples of effective mentoring practices were also implemented. Supervisors' perceptions on mentoring practices and interactions with mentors and mentees were examined through a semi-structure interview. The findings showed that mentees and mentors gave high scores for each factor in the surveys. The practices about System Requirements were perceived by them as among the least performed practices. The findings also showed that in the pedagogical formation program of teaching mathematics, the practices carried out in the scope of the practicum course differ for many aspects from those identified in the regulations, and supervisor selection along with mentor selection are issues of debates. The results can be used in studies about planning the process of mentoring and mentor training.

ÖZET

PEDAGOJİK FORMASYON PROGRAMLARI BAĞLAMINDA HİZMET ÖNCESİ MATEMATİK ÖĞRETMENLİĞİ EĞİTİMİNDE MENTORLÜK UYGULAMALARI

Bu araştırmanın temel amacı, Türkiye'deki matematik öğretmenliği pedagojik formasyon programı kapsamında mentörlük uygulamalarını mentörlüğün üç paydaşının (süpervizör (danışman), mentör (uygulama öğretmeni), menti (öğretmen adayı)) bakış açısıyla incelemektir. Mentörlük uygulamalarına ilişkin tüm paydaşların algıları, Beş Faktörlü Mentörlük Modeli (Kişisel Özellikler, Sistem Gereksinimleri, Pedagojik Bilgi, Modelleme, Geri Bildirim) faktörlerine göre analiz edilmiştir. Araştırmanın örneklemini 6 üniversiteden 246 menti, her biri bu üniversitelerden biriyle iş birliği yapan 54 mentör ve her bir üniversiteden 6 süpervizör oluşturmuştur. Mentörlerin ve mentilerin mentörlük uygulamalarına ilişkin algıları sırasıyla MEMT-Mentor ve MEMT-Mentee anketleriyle araştırılmış; her biri için Doğrulayıcı Faktör Analizi yapılmıştır. Mentörlerin ve mentilerin etkili mentörlük uygulaması örneklerini incelemeyi amaçlayan açık uçlu anketler de uygulanmıştır. Süpervizörlerin mentörlük uygulamalarına ilişkin algıları ve mentörler ve mentiler ile etkileşimlerini incelemek için yarı yapılandırılmış görüşmeler yapılmıştır. Bulgular, mentilerin ve mentörlerin anketlerdeki her bir faktör için yüksek puanlar verdiğini göstermiştir. Sistem Gereklilikleri ile ilgili uygulamalar, en az gerçekleştirildiği düşünülen uygulamalar arasındadır. Bulgular ayrıca matematik öğretimi pedagojik formasyon programında, uygulama dersi kapsamında gerçekleştirilen uygulamaların birçok yönden yönetmelikte belirtilenlerden farklı olduğunu ve danışman seçimi ile mentör seçiminin tartışma konusu olduğunu göstermiştir. Çalışmanın sonuçları, mentörlük sürecinin planlaması ve mentör eğitimi ile ilgili çalışmalarda kullanılabilir.

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LIST OF ACRONYMS/ABBREVIATIONS

AVE	Average Variance-Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CoHE	Council of Higher Education
EFA	Exploratory Factor Analysis
MoNE	Ministry of National Education
MEMT	Mentoring for Effective Mathematics Teaching
MEPST	Mentoring for Effective Primary Science Teaching
MERID	MEntor (teacher) Roles in Dialogues
NCATE	National Council for Accreditation and Teacher Education
NCTM	National Council of Teachers of Mathematics
OECD	Organization for Economic Cooperation and Development
RMR	Root Mean Square Residual
RMSEA	Root Mean Square Error of Approximation
TLI	Tucker-Lewis Index
WRMR	Weighted Root Mean Residual

1. INTRODUCTION

Teaching is a complex task and learning how to teach is a complex process. This is why pre-service teacher education is crucial and teaching practice is an indispensable part of this education to teach pre-service teachers how to teach. There is a common idea that teachers' learning about practice is developed more effectively in practice (Ball and Cohen, 1999). Thus, pre-service teachers' experience of teaching in schools and classrooms plays a crucial role in their learning. In this experience, they need some support and effective guidance. The people who are responsible for providing such support and guidance are supervisors - instructors of pre-service teachers in the teacher education program and mentor teachers-collaborating teachers from practice schools.

However, compared to supervisors, mentors have more influence on pre-service teachers during their teaching practicum (Borko and Mayfield, 1995; Koerner, Rust and Baumgartner, 2002). Therefore, mentor teachers, their practices and roles of mentoring should be examined attentively.

When pre-service teacher mentoring is examined in Turkish education context, the partnership between schools and universities and accordingly mentoring started to be spoken about especially after the Council of Higher Education (CoHE) and World Bank introduced a framework called Faculty-Practice School Partnership Program in 1998. According to the partnership program, mentors should be selected by school coordinators, who are assigned by the practice school principals and supervisors (MEB). The features of a mentor teacher that should be considered in the selection of mentors are (Yükseköğretim Kurulu and Dünya Bankası):

- Being trained in their own field
- Having at least three years of professional experience
- To be successful in the application of teaching methods and techniques
- To set an example for students with their attitudes and behaviours

However, the study conducted by (Sağ, 2007) shows that more than 50% of 173 supervisors participated in the study did not select mentor teachers. The same study claims that mentor teachers are selected according to the conditions of the schools in which they work and/or the decision-making authority's priorities which are not relevant to the qualifications of the mentor as stated in the document of the Council of Higher Education and World Bank (1998).

On the other hand, the literature on pre-service teacher mentoring emphasize selection of mentors. Curran and Goldrick (2002) claim that clear standards determining mentors' roles are necessary for effective mentoring. Also, some studies (Jones and Straker, 2006; Robinson and Robinson, 1999) emphasize that mentor teachers need to recognize their roles as teacher educators. However, in Turkey, even though the mentor teachers are assigned to provide support, guidance and counselling to the pre-service teachers about the knowledge, attitudes and skills which are required for teaching profession (MEB, 1998, 2018; Yükseköğretim Kurulu and Dünya Bankası, 1998), Dağ and Sarı (2017) argue that "mentoring was not systemized throughout the country in Turkey, that it is not considered in a professional context and that it is not applied consistently and regularly in a procedural sense" (p. 126). Recently, in Turkey, the Ministry of National Education and the Council of Higher Education made some regulations on mentoring and the roles of mentor teachers, pre-service teachers and supervisors (MEB, 2018). There exists limited research about mentoring conducted after these regulations. Thus, the purpose of this study is to contribute to the literature on pre-service teacher mentoring in the current Turkish mentoring setting.

2. REVIEW OF LITERATURE

This chapter involves a brief review of literature about teacher education and mentoring. It includes the literature related to pre-service teacher education, teacher mentoring, mentoring for pre-service teachers, the components of effective mentoring for pre-service teachers, mentoring models, the Five-Factor Mentoring Model and effective mentoring particularly for pre-service mathematics teachers.

2.1. Teacher Education

In almost all fields, successive changes have taken place in the world. Education has become more important not only for individuals but also for nations in order to keep pace with and survive in the face of those changes (Darling-Hammond and Bransford, 2005). Educating new generations equipped with the knowledge, skills and attitudes to cope with the changes and endeavour for a better world has been crucial for nations. Especially teachers play a significant role in this process of educating future generations.

Many people believe that anyone can be a teacher if he/she has enough subject-matter knowledge (Darling-Hammond, 2000). The literature shows that even though both subject-matter courses and teaching methods courses that a teacher had taken have positive effects on student achievement, teaching methods courses are more strongly correlated to student performance than subject-matter courses (Monk, 1994). Darling-Hammond (2000) modelled the effect of subject knowledge with a curve. So that subject area knowledge may help student learning to some degree; but, at some point, its impact on student learning begins to diminish. Therefore, besides content knowledge, pedagogical knowledge of how to teach and manage the classroom is required. In other words, teachers should know teaching methods as much as the content.

Ball and Cohen (1999) asserted that general teaching methods courses are not sufficient for effective teaching and teachers need to learn content-specific teaching

methods in order to improve their teaching skills. In other words, teachers should have pedagogical content knowledge which refers to an understanding of how a particular content is taught to students with different needs. Moreover, teachers have to rapidly form critical judgement about many different situations occurring in the classroom (Darling-Hammond and Bransford, 2005). For example, they need to decide on the most effective way of teaching for student understanding in consideration with students' diverse needs which may stem from their cultures, languages, approaches to learning, interests and so on. Darling-Hammond and Bransford (2005) describe the complexity of teaching by drawing analogy between teaching and managing an orchestra:

To a music lover watching a concert from the audience, it would be easy to believe that a conductor has one of the easiest jobs in the world. There he stands, waving his arms in time with the music and the orchestra produces glorious sounds, to all appearances quite spontaneously. Hidden from the audience-especially from the musical novice-are the conductor's abilities to read and interpret all of the parts at once, to play several instruments and understand the capacities of many more, to organize and coordinate the disparate parts, to motivate and communicate with all of the orchestra members. In the same way that conducting looks like hand-waving to the uninitiated, teaching looks simple from the perspective of students who see a person talking and listening, handing out papers and giving assignments. Invisible in both of these performances are the many kinds of knowledge, unseen plans and backstage moves - the skunkworks, if you will - that allow a teacher to purposefully move a group of students from one set of understandings and skills to quite another over the space of many months. (p. 1).

With this respect, the complexity of teaching stems from the difficulty in managing the classroom and also in managing the ideas (Shulman, 1987). In order to deal with these difficulties, teachers should have, at least, seven types of knowledge (Shulman, 1987): (a) content knowledge, (b) general pedagogical knowledge, (c) curriculum knowledge, (d) pedagogical content knowledge, (e) knowledge of learners and their characteristics, (f) knowledge of educational contexts, (g) knowledge of educational foundations, purposes and values.

Furthermore, some people view teaching as an inherent ability. Yet, "Teaching is, essentially, a learned profession" (Shulman, 1987, p. 9). Just as some people might be more inclined to certain professions, there may also exist some with a greater tendency to teaching. Yet, people can develop themselves in teaching like as in many other professions because teaching can be learned. Also, some people claim that the best way of being a teacher is trial and error on teaching (Darling-Hammond, 2000). To some extent, trial and error can help people improve their teaching. It is a well-known fact that teachers learn from experience; however, they should construct their experience based on a knowledge foundation of teaching.

Teacher education can be viewed as a life-long education consisting of pre-service, induction and in-service stages. Pre-service teacher education is the formal stage of teacher preparation. In this stage, teacher candidates are expected to learn how to teach and provided with required knowledge and skills for teaching in universities before becoming a teacher. This research study will specifically focus on pre-service teacher education and teaching practicum practices which play an important role in education of teacher candidates.

2.1.1. Pre-service Teacher Education and Practicum

Expectations from teachers have increased day by day as many changes lead societies to evolve. Pre-service teacher education, which is the initial step towards the teaching profession, gains importance in educating quality teacher candidates who meet the expectations. During the last decades, many countries have discussed the expectations, standards and competences about teaching with the purpose of providing quality pre-service teacher education. To give an example, in the US, the National Council for Accreditation and Teacher Education (NCATE) established a framework of standards for quality teacher education adopted by almost all states of the US (Muniz-Rodriguez, Alonso, Rodriguez-Muniz and Valcke, 2017). NCATE (2008) argued that teachers should have content knowledge, pedagogical and professional knowledge and skills and also field experiences and practice in order to learn how to teach both independently and collaboratively.

As another example, one of the educational reports of the Organization for Economic Cooperation and Development (OECD), which is an association of several nations in order to promote their economic welfare, indicated that pre-service teacher education should include subject area courses, pedagogy courses and subject-specific pedagogy courses (OECD, 2011). The report highlights the importance of the partnership between teacher education institutions and schools in order for teacher candidates to gain experience in the schools. It also mentions mentor teachers who are responsible for providing guidance and support to student teachers in the practicum schools and necessity of their training for mentoring.

Moreover, Musset (2010) classified the main components of pre-service teacher education conducted in the OECD countries as subject-matter courses, teaching methods courses and practical school experience. These components are seen vital for pre-service teachers to learn how to teach. Along with these components, some countries also have other courses for cognitive, behavioural and social sciences, child development and improving research skills.

2.1.2. Pre-service Teacher Education in Turkey

In Turkey, the education system has always been the subject of debate. Since teachers' effect on the education system is higher than many other educational resources' effects (Safran *et al.*, 2014), teacher education has taken into consideration. Accordingly, a set of reforms in teacher education have been introduced in Turkey throughout the decades.

One of the main reforms was made in 1981 by assigning the responsibility of teacher training to universities and, the responsibility of controlling and regulating teacher education programs to the Council of Higher Education (Gursimsek *et al.*, 1997). Before this reform, the Ministry of National Education was responsible for teacher education. This major change was followed by several significant reforms.

Firstly, the length of the two-year elementary school teacher education was regulated as 4 years, in 1989 (Gursimsek, *et al.*, 1997). The second reform was made in 1997 by integrating non-thesis master programs in teacher education into the bachelor programs in secondary school teacher education (Yükseköğretim Kurulu, 1998). Also, the length of the integrated BS (Bachelor of Science) and MS (Master of Science) programs was determined as 5 years. The third radical movement was in 1998; the Council of Higher Education restructured the school-based pre-service teacher education and introduced the Practice School Partnership Program which aimed to regulate the teaching experience courses and the partnership between universities and schools (Yükseköğretim Kurulu and Dünya Bankası, 1998). Also, the roles and responsibilities of mentor teachers were stated and the features that a teacher should have to be selected as a mentor teacher were introduced. However, the decision on selecting mentor teachers according to the defined features was not applied properly (Sağ, 2007). The fourth reform was in 2010; graduates of the Faculty of Arts and Sciences were given the right of being a teacher by pedagogical formation certificate programs (Ertaş, 2014, p. 1-2). In 2014, 5-year integrated BS and MS teacher education programs were changed to 4-year undergraduate programs in teacher education.

Moreover, recently, the Ministry of National Education and the Council of Higher Education made regulations on pre-service teachers' practices, the partnership between universities and schools and revised the roles of pre-service teachers, mentors and supervisors (MEB, 2018).

Furthermore, removing pedagogical formation certificate programs have been discussed nowadays. However, considering the current framework of pre-service teacher education in Turkey, there exist two routes of becoming a teacher; completing an undergraduate program in the Faculty of Education and completing the pedagogical formation programs that are provided at the education faculties for the graduates of an undergraduate program in the Faculty of Arts and Science. In particular, in order to become a mathematics teacher, it is required to graduate from one of the primary school mathematics education or secondary school mathematics education programs, or to complete the pedagogical formation program after graduating from the under-

graduate mathematics program. In both ways, teacher candidates are expected to take subject-matter courses and teaching methods courses and to experience teaching in practicum schools. Universities are responsible for providing teacher candidates with the courses of subjects and teaching methods. In the field experience, both universities and partner schools have responsibilities for teaching practices of teacher candidates. Especially, mentoring provided by mentor teachers who are the supporters of teacher candidates at practicum schools plays a significant role in the development of teacher candidates' knowledge and skills on teaching.

2.2. Teacher Mentoring

Teacher education is a life-long education consisting of pre-service, induction and in-service stages. In these stages, particularly during the pre-service education and induction, teacher candidates and novice teachers need supervision, support and guidance from mentor teachers. In the literature, there exist many definitions of mentoring and mentors; but none of them is universally accepted. This might be because of that mentoring may change from context to context depending on the needs of mentees, personalities of mentors and mentees and the environment and so on. Anderson and Shannon (1988) describes broadly mentoring as

a nurturing process in which a more skilled or more experienced person, serving as a role model, teaches, sponsors, encourages, counsels and befriends a less skilled or less experienced person for the purpose of promoting the latter's professional and/or personal development. Mentoring functions are carried out within the context of an ongoing, caring relationship between the mentor and protege (p. 40).

Considering the definitions of mentoring in the educational literature, the mentor is seen as a more-experienced teacher (Hayes, 2001; Price and Chen, 2003). However, Smith (2015) argues "if all experienced teachers can be mentors or is mentoring a different experience than practicing the profession" (p. 238) and consider mentoring not the same as the teaching profession, but a different "profession within the teaching profession" (p. 238). Kiraz and Yıldırım (2007) supports that teaching experience

does not necessarily imply having competency in mentoring based on their findings such that less-experienced teachers had higher competency in mentoring than the more experienced ones according to pre-service teachers' perceptions.

Even though mentoring is in the context of teaching, a good teacher does not guarantee to be a good mentor since mentoring differs from teaching in terms of its (i) content, (ii) the stakeholders, (iii) theoretical foundations and (iv) the form (Smith, 2015). In teaching, the content is a subject such as mathematics, physics, literature and so on; however, mentoring is teaching about teaching such subjects. While teachers teach to students, mentors guide adults. Accordingly, the theoretical basis of teaching is pedagogy which refers broadly to the teaching actions and methods, whereas andragogy, which refers to the actions and methods used in adult education, is regarded as the theoretical basis of mentoring. In the form of teaching, there is an explicit and accepted hierarchy; but, in the form of mentoring, the hierarchy between mentors and mentees is implicit. Regarding these differences, we cannot claim that being a mentor reflects years of teaching experiences and that a good teacher is also a good mentor. Mentoring is a different practice from teaching even though it is within the teaching profession.

2.2.1. Pre-service Teacher Mentoring

In the literature there exist a growing body of research about mentoring; however, most of them are about mentoring novice teachers and the research studies about mentoring pre-service teachers are limited. Therefore, the current study will particularly focus on mentoring in pre-service teacher education.

In pre-service teacher education, the internship plays a significant role in developing teacher candidates' practice of teaching and gaining them the teacher identity. Also, research shows that many pre-service teachers view the internship as the most important component of their education (Smith and Lev-Ari, 2005). It might be because of that they gain an opportunity to transfer their theoretical knowledge to the practice in the process of practicum. In this practicum process, mentoring is pivotal for pre-service teachers' professional development. Teacher candidates also consider

the mentoring they receive at practice schools to be the key aspect of practicum (Hudson, 2004a). This aspect of practicum, mentoring, is beneficial not only for pre-service teachers, but also for mentor teachers.

According to the literature, mentoring might have psychological, social, personal and professional benefits for mentees (Hobson, Ashby, Malderez and Tomlinson, 2009). Pre-service teachers meet their mentors at the practicum schools and mentors support them to get accustomed to the schools that are new environments to pre-service teachers and require them to move from the student role to the teacher role. During this challenging process, mentors are expected to support pre-service teachers both psychologically and professionally. They might help mentees to be perceived as teachers; in other words, might help them to gain the teacher identity. Besides, pre-service teachers may get the opportunity to develop their pedagogical practices by observing specific instructions and classroom management strategies and by the help of the feedback they receive from mentors about their practices (Lai, 2005; Rajuan, Beijaard and Verloop, 2010). Moreover, student teachers might get the chance of networking with the teachers who may become references to them for job applications. On the other side, mentoring might help mentors' professional development (Hobson *et al.*, 2009). During the mentoring process, they may focus and reflect more on their own practices and can observe new strategies that mentees apply. Also, they may gain the opportunity for evaluating and developing their mentoring skills (Gilles and Wilson, 2004). Furthermore, they may refresh their knowledge about the education system and the curriculum in order to share them with the pre-service teachers. In short, mentoring has many positive effects on both mentees' and mentors' growth. However, mentoring cannot provide that many benefits for pre-service and mentor teachers if it is not performed effectively.

2.2.2. Effective Mentoring in Pre-service Teacher Education

There are some research studies about effective mentoring and its components. In the study of Hudson *et al.* (2013), the participating experienced mentors advocated that, first of all, mentors and mentees should respect each other. Also, in order to

mentor effectively, mentor teachers should try to use mentoring time efficiently, share knowledge and resources for teaching and learning and model pedagogical practices.

Moreover, Curran and Goldrick (2002) pointed out two main components of effective mentoring. Firstly, mentoring should be subject-specific. It means that if a pre-service teacher is a candidate for being a mathematics teacher, he/she should be mentored by a mathematics teacher specifically on teaching and learning mathematics. Secondly, mentoring should be based on clear standards. Some researchers argue that meeting pre-service teachers' needs is at the centre of mentoring. Their needs might differ; therefore, mentors should consider their needs and take actions accordingly. Yet, even though their needs may differ, all pre-service teachers deserve to be mentored effectively. Thus, mentoring should include clear standards in order to enhance effective mentoring for all pre-service teachers (Curran and Goldrick, 2002). Also, Jarvis and colleagues (2001) support that standards and specific objectives are required for effective mentoring in order to guide mentor teachers. Even though many studies support that mentoring should be a systematic manner built on clear standards, the status of mentoring in Turkish context does not look much systematized (Dağ and Sarı, 2017).

One of the main concerns in Turkey in terms of pre-service teacher mentoring is selection of mentor teachers. Ministry of Education does not have any regulation on determining teachers for mentorship status, except that they should have the Certificate of Teaching Practice Training (MEB, 2018). A common method of determining mentors, internationally used method is to choose 'good teachers' (Cox, 2005). However, Smith (2015) questions selection of mentors as "The claim that I make is that mentoring is not the same as teachers' first order professional practice, it is a profession within the profession in which mentoring takes place" (p. 238). So, mentoring as a profession within a profession needs to be examined in Turkish setting.

2.2.3. Mentoring Models

In the literature, there exist several mentoring models as framework for mentors' roles. Hennissen *et al.* (2008) derived a model representing diverse roles of mentors from

the literature on mentor teachers' behaviours in the dialogues with their mentees. This model is called the MEntor (teacher) Roles in Dialogues (MERID) model. It includes four different mentor teacher roles in mentoring dialogues: initiator, imperator, advisor and encourager. Initiator refers to the mentor teacher who initiates the discussion by determining a topic and then supports pre-service teachers by asking open-ended questions in order to make them consider on the topic. Imperator represents a mentor who introduces a topic and leads the dialogue by directly giving their own opinions or advising pre-service teachers on what to do. If a mentor has the role of advisor, in the mentoring process, the topic is mostly introduced by the pre-service teacher and then the mentor teacher guides the dialogue by giving advice to the pre-service teacher. If a mentor teacher is an encourager, then he/she reacts to the topic most of which is introduced by the pre-service teacher by using non-directive interventions in order to make the pre-service teacher explore his/her own behaviours.

Gardiner (2009) discussed a mentoring model with two frameworks. The first one is a product framework in which there exist an expert-apprentice relationship between mentors and mentees. Mentees are expected to learn by observing how mentors act in various situations. The second one is a process framework based on reflection and inquiry in which mentees are required to reflect on and assess their own practices. Darling-Hammond (2006) and Feiman-Nemser (2001) advocated that process framework was more effective for pre-service teachers to understand teaching and learning. However, Gardiner's (2009) four-year study conducted with eight participating mentors showed that the process framework was beneficial but not enough to meet some pre-service teachers' needs and to solve some problems they had encountered as a mentor.

In another study conducted by Ngara and Ngwarai (2012), data were collected via a questionnaire from ten mentees and their mentors and via the interview from five pairs of mentors and mentees. The purpose was to identify those fifteen pairs of mentors' and mentees' perception on mentors' roles and attributes. The results showed that the participants perceived a mentor's critical roles mainly as a guide, counsellor and advisor. Most of the participants viewed giving feedback, focusing on mentee

needs and being a role model, friend, networker and resource facilitator for mentees as some other important roles of mentors. Moreover, according to the study, some of the attributes that a mentor needs for effective mentoring were being approachable, open to learning, communicating effectively, a good listener, flexible, knowledgeable about the teaching profession, trusted, ethical and sensitive to mentee's needs, humble, honest and hard-working.

Mentors' roles and attributes might depend on how they position themselves in their relationship with the mentee. In order to understand how relationships between mentors and mentees are formed and how they understand their own roles and the others', positioning theory should be examined. Positioning theory is based on the fact that individuals construct their own and others' roles in their relationships as interacting with each other. These roles determine their positions. Harré and Moghaddam (2003) define positions as "rights and duties to think, act and speak in certain ways" (p. 8) and these rights and duties may change in relation to people, places and time. Therefore, relationships between mentors and mentees, accordingly mentor roles, might change from context to context and from person to person depending on how they position themselves.

Even though mentors' roles and attributes may vary according to contexts and people, a standardized mentoring procedure and specific mentor roles should be determined for effective mentoring. The studies of Hennissen *et al.*, (2008), Gardiner (2009) and Ngara and Ngwarai (2012) identified some important mentor roles; but, they did not clearly and specifically explain mentors' roles, attributes and actions that are required for all mentors to serve effective mentoring. The literature points out the Five-Factor Mentoring Model, developed by Hudson and Skamp (2001, 2003), which defines five factors for effective mentoring: *Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback*. Each of these factors includes the indicators of specific roles, attributes and practices of mentors. The Five-Factor Mentoring Model will constitute the main framework of this study and it will be explained in detail in the next part.

2.2.3.1. Five-Factor Mentoring Model. Hudson and Skamp (2001, 2003) identified a five- factor mentoring model which includes mentoring attributes, roles and practices for developing mentees' knowledge and skills in teaching science. The factors in the model are Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback (Figure 2.1). In this model, each factor has some items which are determined as indicators of attributes and practices that a mentor need to have for effective mentoring. Based on the findings of Hudson and Skamp (2001, 2003), the five factors, Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback, are defined below along with their indicators (Hudson and Skamp, 2005):

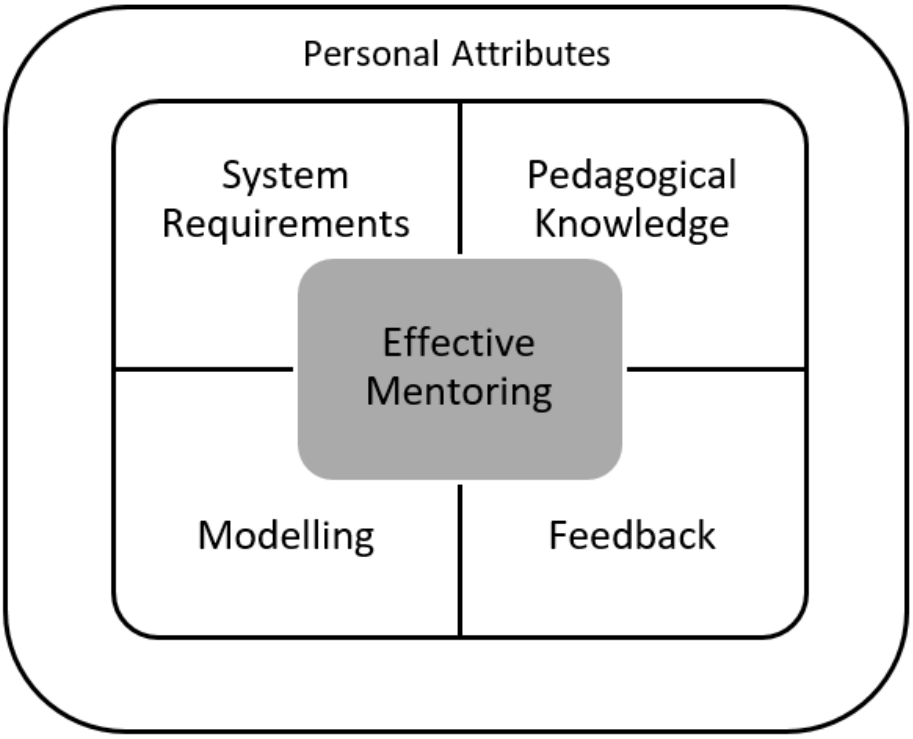

Figure 2.1. The Five-Factor Mentoring Model.

- *Factor 1 - Personal Attributes* The main personal attributes that a mentor needs to have are being supportive, listening attentively, instilling confidence and positive attitudes for teaching and encouraging pre-service teachers to offer reflection on teaching practices.
- *Factor 2 - System Requirements* Most of the education systems have requirements that give a direction for what to teach and how to teach. For an effective men-

toring, mentors need to explain to their mentees the curricula, their goals and school policies.

- *Factor 3 - Pedagogical Knowledge* Articulating pedagogical knowledge and pedagogical content knowledge is essential for effective mentoring of pre-service teachers. Mentors help mentees in the process of preparation and planning for teaching and schedule lessons for mentees. They provide the pedagogical knowledge for the implementation of the lesson plans, classroom management techniques and teaching and assessment strategies. Mentors also need to discuss knowledge about teaching a specific subject, help mentees to improve their questioning skills and provide problem solving strategies for mentees' teaching. Moreover, mentors should provide pedagogical viewpoints on teaching in order to develop pre-service teachers' teaching practices.
- *Factor 4 - Modelling* Pre-service teachers obtain the skills and practices for teaching more efficiently as observing someone who model teaching practices (Carlson and Gooden, 1999). Therefore, mentors should model the teaching process including planning, preparation, implementation and assessment stages. Mentors are required to show enthusiasm towards the subject and teaching and to model a rapport with their students, language appropriate for student learning, effective teaching practices, classroom management techniques, hands-on materials and well-designed lessons.
- *Factor 5 - Feedback* Mentors should articulate their expectations, review pre-service teachers' lesson plans and observe their teaching practices. Then, they should provide mentees with oral and written feedback. Also, mentors should help pre-service teachers learn how to evaluate their own teaching, which help them to reflect on their teaching more effectively.

This model has been an interest of educational research on effective mentoring. Some of the research have investigated pre-service teachers' perceptions of their mentors (Duah, 2010; Hudson, 2007; Hudson and Peard, 2006; Hudson, Uşak and Savran-Gencer, 2010) and some have explored mentors' perceptions of their own mentorship (Hudson, 2010). In Australia, Hudson and Peard (2006) investigated 147 pre-service primary mathematics teachers' perceptions on their mentors' practices within five fac-

tors: personal attributes, system requirements, pedagogical knowledge, modelling and feedback. The result of this study indicated that the majority of mentees' perceptions on their mentors' practices were considerably high within the four factors: personal attributes, pedagogical knowledge, modelling and feedback. However, they perceived that their mentors' practices on system requirements were below 50 per cent.

Another study (Hudson, 2007) conducted in Australia compared 331 pre-service primary science teachers' and 115 pre-service primary mathematics teachers' perceptions of their mentors' practices in regard to the five factors of mentoring. According to the study, pre-service mathematics teachers' perceptions were higher than the perceptions of pre-service science teachers about the mentoring they received. For example, under the factor of personal attributes, 89% of pre-service mathematics teachers perceived their mentors as supportive and 86% viewed them as comfortable in talking about mathematics teaching; but, the percentages of pre-service science teachers considering their mentors as supportive and comfortable in talking about science education are 64% and 56%, respectively. While approximately 64% of mathematics teacher candidates thought that they received adequate pedagogical knowledge from their mentors, the approximate percentage of science teacher candidates who perceived they were provided with pedagogical knowledge for science teaching was only 37%. In addition, above 70% of primary mathematics teachers' mentors modelled a well-designed mathematics lesson, teaching, classroom management, effective mathematics teaching, hands-on activities and the syllabus language; however, above 50% of pre-service science teachers claimed that they were not provided with such modelling practices. The picture for the factor of feedback was similar to the previous factors. It was inferred that more mathematics mentors provided feedback than science mentors. Similar to the study of Hudson and Peard (2006), most of the primary science and mathematics teacher candidates perceived that their mentors did not discuss the system requirements with them. The results indicated that percentages and mean scores of pre-service mathematics teachers' perceptions on mentoring practices were considerably higher by comparison with pre-service science teachers' perceptions. This might have implied that for this sample of pre-service teachers, the mentoring practices provided for pre-service science teachers were not equitable to mentoring pre-service mathematics teachers. Since

all teacher candidates deserve equal opportunities, it was concluded that obtainable mentoring objectives for each subject should be specified clearly.

Similarly, in UK, Duah (2011) compared the perceptions of pre-service mathematics teachers and pre-service science teachers about their mentors' practices. As opposed to Hudson's (2007) study, in this study, mathematics and science teacher candidates' perceptions of mentoring were not considerably diverge. Yet, for pre-service mathematics teachers, the commonly perceived mentoring practice was displaying personal attributes whereas the pre-service science teachers commonly viewed their mentors to provide effective feedback in teaching science. Similar to the previous studies, the percentage of mentee who perceived their mentors to discuss the system requirements was the least in comparison to other factors. In addition, this study concluded that even though the majority of mentees' perceptions were higher on their mentors' personal attributes and practices within modelling, they perceived that their mentors need to develop their practices in outlining curriculum, discussing content knowledge with their mentees, helping mentees in assessing and reviewing mentees' lesson plans.

Another study exploring mentees' perceptions of their mentors' practices in primary science teaching within five factors conducted in Turkey by Hudson, Uşak and Savran-Gencer (2010). In this study, the majority of 304 pre-service science teachers perceived that mentoring practices within all five factors were provided in their internship. Under each factor, above 50% of mentees perceived their mentors to provide with the mentoring practices.

The abovementioned studies (Hudson and Peard, 2006; Hudson, 2007; Duah, 2011; Hudson, Uşak and Savran-Gencer, 2010) reflect the perceptions of pre-service teachers, due to this nature, these studies have a limitation. If pre-service teachers have reported that their mentors not providing certain mentoring practices, then it may imply either that mentors have not fulfilled that particular mentoring practices or that pre-service teachers have not recognised the mentoring practices performed by mentors. In order to examine mentoring practices, thus, there needs to be studies focusing both on mentors and mentees.

In some respect, Hudson (2010) approached this issue by examining mentors' perceptions on their own mentoring practices and the factors affecting mentees' success. In the mixed-design study, participants were primary mathematics mentor teachers and primary science mentor teachers in Australia. Quantitative data collected from mentors indicated that the perceptions of mathematics teachers on their mentoring practices were higher than science teachers' perceptions. This result was connected to the fact that science teachers could not have time to fulfil their mentoring practices since science courses were less than mathematics courses in Australia. Qualitative data collected from primary mathematics mentors showed that the aspects making the mentee feel unsuccessful were their poor behaviour management, lack of preparedness, lack of content knowledge and poor mentor-mentee discussion. For a mentor teacher, the factors making pre-service teachers feel successful in teaching depended on satisfying the mentoring roles determined by the five factors including Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback.

When the literature is reviewed, it has been suggested to investigate both pre-service teachers' and mentors' perceptions on mentoring practices and evaluate mentors' practices accordingly.

2.2.4. Pre-service Teacher Mentoring in Turkey

In Turkey, mentoring in pre-service teacher education has been a controversial issue for many years. One of the important movements about pre-service teacher mentoring was the Faculty-Practice School Partnership Program introduced in 1998. The aim of the program was to develop partnership between education faculties and schools. Mentor teachers were expected to provide support, guidance and counselling to the pre-service teachers (MEB, 1998, Yükseköğretim Kurulu and Dünya Bankası, 1998). General mentoring roles were also stated in the report of Faculty-Practice School Partnership Program and a three-day mentor training program was introduced; but it could not be implemented consistently and effectively (Yılmaz and Bıkmaz, 2020).

Reviewing the Turkish literature, most of the studies examined pre-service teacher mentoring from the perspectives of pre-service teachers (Akyar, 2020; Aydın and Ok, 2020; Aydın, Selçuk and Yeşilyurt, 2007; Ekiz, 2006; Hudson, Uşak and Savran-Gencer, 2010; Kiraz, 2003; Kiraz and Yıldırım, 2007; Koç and Yıldız, 2012; Sağ, 2008; Yılmaz, 2011); but Ekiz (2006) also examined the views of mentors and Yılmaz and Bıkmaz (2020) investigated mentoring needs from the perspectives of supervisors, mentors and pre-service teachers. The studies were conducted about mentoring in different contexts, such as in Primary School Science Teaching Program (Hudson, Uşak and Savran-Gencer, 2010), Classroom Teacher Education Programs (Koç and Yıldız, 2012; Yılmaz, 2011; Yılmaz and Bıkmaz, 2020), Early Childhood Education (Akyar, 2020), English Language Teaching Department (Aydın and Ok, 2020) and The Faculty of Education including several teaching programs (Aydın, Selçuk and Yeşilyurt, 2007; Kiraz, 2003; Kiraz and Yıldırım, 2007; Sağ, 2008).

Ekiz (2006) investigated primary school mentoring from the perspectives of teacher candidates and mentors. This study indicated that mentors' practices were not based on the mentoring roles stated in the report of Faculty-Practice School Partnership Program. For example, teacher candidates claimed that mentors did not observe their teaching practices and were not willing to provide oral or written feedback, which leaded to limited mentoring support and mentor-mentee communication. Also, according to the case study conducted by Hudson, Uşak, Savran-Gencer (2010), some mentoring practices such as planning, assessment, classroom management and explaining curriculum were not performed effectively. Akyar (2020) supported that mentors' guiding was perceived as ineffective and there were different types of mentors such as giving supportive feedback, giving not supportive feedback and even not giving feedback. Similarly, Koç and Yıldız (2012) pointed out that there were both supportive and non-supportive mentors. Aydın and Ok (2020) also discussed the existence of different types of mentors although each pre-service teacher was desired to be equally mentored.

As another example, Kiraz (2003) examined pre-service teachers' perceptions on their mentors' competencies under three factors: preparation for mentoring, instructional planning and reflection and collegial supervision and effective mentoring. The

researcher explored that pre-service teachers perceived mentors' competencies, particularly on collegial supervision and effective mentoring practices, as unsatisfying. That study was followed by the comparison of novice and experience teachers' mentoring practices from the perspectives of pre-service teachers (Kiraz and Yıldırım, 2007). In that study, the researchers found that novice teachers were perceived as providing more effective mentoring in comparison with more-experienced teachers. They highlighted that the years of teaching experience was significant for mentoring, but not the only criterion for mentor selection.

Moreover, the study conducted by Sağ (2008) investigated the expectations of pre-service teachers from supervisors, mentors and practicum schools. The results showed that pre-service teachers needed some support to learn the school-specific rules and routines. In addition, the studies of Sağ (2008) and Yılmaz (2011) indicated that pre-service teachers needed their mentors to behave them as a teacher instead of a student.

Furthermore, most of the studies revealed the weakness of the interaction between practicum schools and the Faculties of Education (e.g. Akyar, 2020; Aydın and Ok, 2020; Aydın, Selçuk and Yeşilyurt, 2007; Ekiz, 2006; Sağ, 2008). That limited interaction leaded to inconsistency between the practices of mentors and supervisors in the scope of the practicum course and accordingly affected pre-service teachers' professional development during the practicum process in a negative way (Akyar, 2020; Ekiz, 2006).

In the recent year, the Ministry of National Education, in collaboration with Higher Education Council, regulated the process of teaching practices of pre-service teachers in schools, the interactions between faculties and schools and the roles of pre-service teachers, mentors and supervisors (MEB, 2018). According to the regulations, it is compulsory for a mentor to attend the mentor training program and a mentor is defined as a teacher who has the Certificate of Teaching Practice Training given by Ministry of National Education and who will guide pre-service teachers within the scope of the teaching practices required by the teaching profession. The mentor

training program for the certificate involves introducing an online system (MEBBIS) for the assessment of mentees' teaching practices and explaining Clinical Supervision Model. This model was developed by Morris Cogan and colleagues in 1950s at Harvard University (Reilkoff, 1981). It is visualized basically by a cycle of planning, observation and evaluation stages and focuses on providing feedback mentees' practices and lesson plans. Also, the need for collaboration among the stakeholders of mentoring (supervisor, mentor and mentee) is emphasized in assessing mentees' performances.

The study of Yılmaz and Bıkmaz (2020) aims to examine the mentors' needs within the context of Classroom Teacher Education from the perspectives of supervisors, mentors and mentees. They classified the mentors needs under three categories: professional knowledge and skills, core mentoring skills and social qualifications. According to the findings, mentors needed to develop in many aspects of the teaching and mentoring professions such as curriculum implementation, teaching methods, using technology, observing mentees' teaching practices, providing feedback and instructional guidance and providing empathy, love and tolerance. Also, each stakeholder stated that mentors had a need for their roles and responsibilities to be clearly stated, which confirms Curran's and Goldrick's (2002) argument that mentoring should be based on clearly stated objectives. Moreover, Yılmaz and Bıkmaz (2020) emphasized that even though the mentor training program was built on a collaborative approach, in practice, mentoring diverges from being a collaborative effort.

2.2.5. Effective Mentoring for Pre-service Mathematics Teachers

Until this point, studies examined in the literature review highlight the importance of clear standards for an effective mentoring such as standards drawn by the Five-Factor Mentoring Model is described. However, since theoretical knowledge of teaching and learning might vary from subject to subject, its implications in practice might be different. Therefore, a specific subject focus is required for effective mentoring, along with clear standards (Curran and Goldrick, 2002). An effective mentor in mathematics education is defined as one who has the knowledge, skills and personal attributes to make effective mathematics lessons for all students and to help colleagues

and "one who is knowledgeable about research in mathematics teaching and learning and best practices" (Lemons-Smith, 2009, p. 6). Given this definition, being an experienced mathematics teacher is not enough to be an effective mentor in teaching mathematics. A teacher should follow research studies and best practices in teaching and learning mathematics in order to be an effective mentor.

As Curran and Goldrick (2002) pointed out, besides a specific subject, clear standards are also required for an effective mentoring. Hudson and Peard (2006) demonstrated the transferability of the set of standards drawn by the Five-Factor Model to mentoring in mathematics teaching. Accordingly, for an effective mathematics-specific mentoring, mentor teachers should have certain personal attributes, provide information on system requirements, pedagogical knowledge and feedback and model the teaching process in mathematics. In addition, in order to model mathematics lessons satisfactorily; mentors' mathematical knowledge must be adequate, mentor teachers must feel confident in mathematics and they must have positive attitudes towards mathematics. The results of Hudson and Peard's (2006) study showed that adequate mathematical content knowledge is needed to satisfy other standards such as Modelling, Pedagogical Knowledge and Personal Attributes.

This study will particularly examine pre-service mathematics teachers', their mentor teachers' and supervisors' insights on mentoring practices in relation to five factors: Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback.

3. SIGNIFICANCE OF THE STUDY

In the fast-changing world, education takes an important place in order to raise generations who can deal with the challenges and create a better world. Teachers, among many other educational resources, are the foremost contributors of educating such generations. Therefore, their education, especially pre-service teacher education which is the entry point of the teaching profession is critical. Teachers are expected to have mainly content knowledge, pedagogical knowledge and pedagogical content knowledge (Darling-Hammond, 2000; Shulman, 1987). Accordingly, there are three major components of pre-service teacher education; subject-matter courses, teaching methods courses and experience in professional practice (Musset, 2010; NCATE, 2008; OECD, 2011). Professional practice is developed more effectively when it occurs in the workplace (Jones and Straker, 2006). Thus, teaching practicum in schools is one of the most important part of pre-service teacher education programs. It provides pre-service teachers the opportunity of transferring their theoretical knowledge into practice. In this process of teaching practice, the mentor teachers with the role of providing effective guidance and support are pivotal for pre-service teachers' learning to teach (Cochran-Smith, 1991). For effective mentoring, literature suggests that mentoring should be subject-specific and based on obtainable clear objectives for mentoring practices (Curran and Goldrick, 2002). Even though there exist a number of research studies (e.g. Gardiner, 2009; Hennissen *et al.*, 2008; Ngara and Ngwarai, 2012) which pointed out some important mentoring roles, these studies had limited discussion on the practices required for effective mentoring.

On the other hand, the Five-Factor Mentoring Model, developed by Hudson and Skamp (2001, 2003), presented a set of standards for effective mentoring with considerations on subject-specific practices. Those standards were grouped under five factors: *Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback.* Therefore, the Five-Factor Mentoring Model is the main framework of the current study in order to describe the insights of pre-service mathematics teachers, their mentors and supervisors about effective mentoring practices.

In regard to mentoring in Turkey, in 1998, the Higher Education Council stated the decision that mentor teachers would be selected by school coordinators and supervisors (MEB, 1998). However, the literature indicated that the decision was not implemented as stated (Sağ, 2007). Moreover, a mentor training program was introduced on the 1998 regulation. It also was not carried out as stated. Yet, in the recent years, the Ministry of National Education and the Council of Higher Education regulated the process of teaching practices of pre-service teachers in practicum schools, the partnership between universities and schools and the roles of pre-service teachers, mentor teachers and supervisors (MEB, 2018). It was declared that a teacher must gain the Certificate of Teaching Practice Training given by Ministry of National Education in order to become a mentor teacher, which means a mentor training became compulsory. These regulations indicated that the importance given to mentor teachers and their practices has been increasing in Turkey.

In the recent study of Yılmaz and Bıkmaz (2020), mentors' professional learning needs were examined from the perspectives of the three stakeholders (supervisors, mentors and mentees) within the context of Classroom Teacher Education. The researchers presented those needs under three categories: professional knowledge and skills, core mentoring skills and social qualifications; also stated the need for mentoring roles and responsibilities to be clearly stated. On the other side, there exist limited research study about mentoring practices particularly in mathematics education in Turkey. Also, pedagogical formation programs that are the subject of debate for many years in Turkey, have recently come to the fore with the regulations announced by the Ministry of National Education. According to the regulations, pedagogical formation programs were declared to be closed and master programs are decided to be opened for the graduates of several programs who want to gain the pedagogical formation. Within this respect, this study aims to investigate the mentoring aspect of the pedagogical formation programs in teaching mathematics; particularly the current mentoring practices based on the perceptions of three stakeholders; supervisors, mentors and mentees (pre-service mathematics teachers), in relation to the Five-Factor Mentoring Model. The findings might provide a basis for the planning of mentoring process in future programs of pedagogical formations by outlining the current mentoring practices.

4. STATEMENT OF THE PROBLEM

This study aims to examine mentoring practices within the context of pedagogical formation program in teaching mathematics from the viewpoints of mentees (pre-service teachers), their mentors and supervisors. In this section, the variables were defined operationally and research questions were stated.

4.1. Variables

The current study explored mentees', their mentors' and supervisors' perceptions of mentoring practices, based on the five dimensions of the Five-Factor Mentoring Model. These dimensions are Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback. In order to explore mentees' and their mentors' perceptions, Mentoring for Effective Mathematics Teaching (MEMT) instrument was used. In the instrument, indicators for each of dimensions are determined as follow (Hudson, Skamp and Brooks, 2005):

- *Indicators of personal attributes* Being supportive, comfortable in talking, listening attentively, instilling confidence, instilling positive attitudes and assisting in reflecting.
- *Indicators of system requirements* Discussing aims, curriculum and policies.
- *Indicators of pedagogical knowledge* Guiding preparation; assisting classroom management, teaching strategies and planning; discussing implementation, content knowledge, questioning techniques and assessment; providing viewpoints; and solving problems.
- *Indicators of modelling* Modelling rapport with students, well-designed lessons, teaching, classroom management, hands-on activities and effective teaching; displaying enthusiasm; and using syllabus language.
- *Indicators of feedback* Observing teaching for feedback, providing oral and written feedback, reviewing lesson plans, providing evaluation on teaching and articulating expectations.

4.1.1. Mentees' (Pre-service Mathematics Teachers') Perceptions on Mentoring

Mentees' perceptions on their mentors' mentoring practices were operationalized under five dimensions of effective mentoring via Mentoring for Effective Mathematics Teaching (MEMT-Mentee) survey and an open-ended questionnaire.

4.1.2. Mathematics Mentor Teachers' Perceptions on Mentoring

Mathematics mentor teachers' perceptions on their own mentoring practices were operationalized under five dimensions of effective mentoring via Mentoring for Effective Mathematics Teaching (MEMT-Mentor) survey and an open-ended questionnaire.

4.1.3. Supervisors' Views on Mentoring

Supervisors' views on the mentors' practices in regard of teaching practicum course were examined by a semi-structured interview in relation to the five dimensions of the Five-Factor Mentoring Model.

4.2. Research Questions

The aforementioned variables were studied with four research questions. Figure 4.1 shows how research questions were designed to examine the variables.

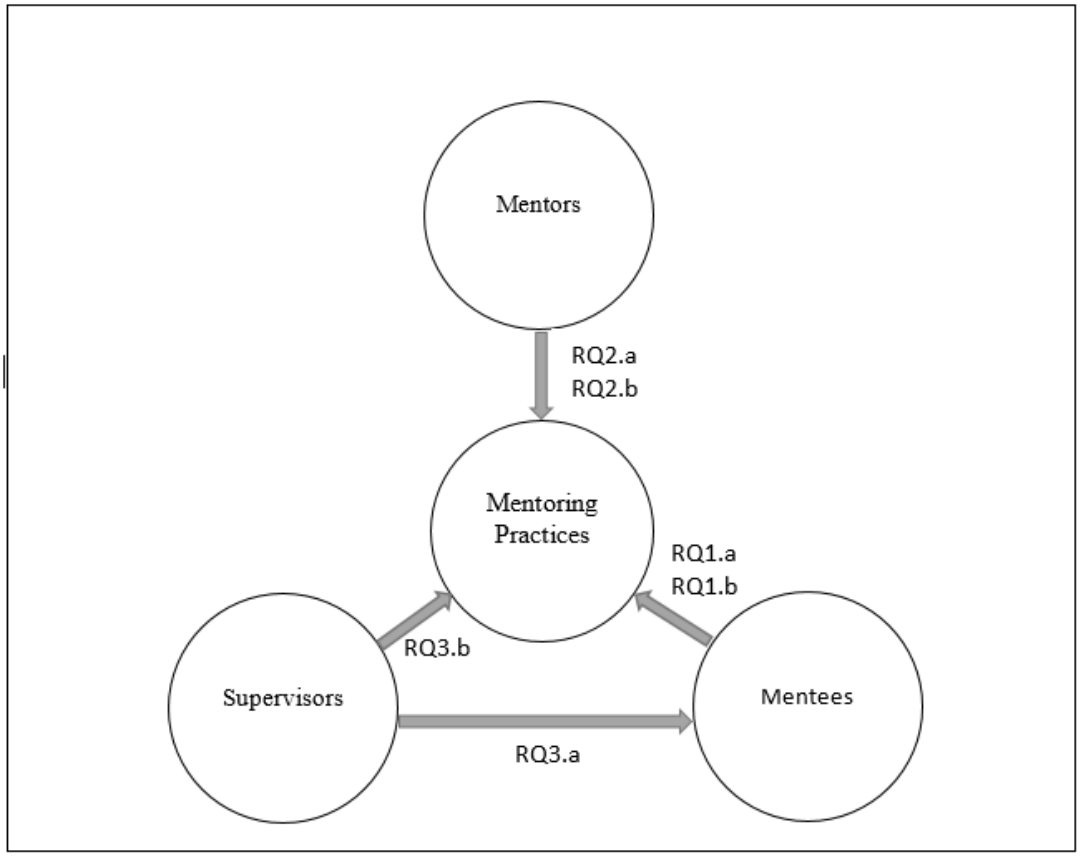

Figure 4.1. Variables with research questions to examine mentoring practices based on the Five-Factor Mentoring Model.

- RQ-1. What are the mentees' perceptions of their mentors' practices?
  - (i) What are the mentees' perceptions of their mentors' practices in relation to the five factors (personal attributes, system requirements, pedagogical knowledge, modelling and feedback) as measured by MEMT-Mentee scale?
  - (ii) What factors of the Five-Factor Mentoring Model are emerged from the mentees' answers to the open-ended questions on exemplary mentoring?

- RQ-2. What are the mentors' perceptions of their own practices?
  - (i) What are the mentors' perceptions of their own practices in relation to the five factors (personal attributes, system requirements, pedagogical knowledge, modelling and feedback) as measured by MEMT-Mentor scale?
  - (ii) What factors of the Five-Factor Mentoring Model are emerged from the mentors' answers to the open-ended questions on exemplary mentoring?

- RQ-3. What are the supervisors' views on mentoring practices in regard of teaching practicum course?
  (i) What are teaching practicum course requirements as reported by supervisors?
  (ii) What are the supervisors' views on mentors' mentoring practices during teaching practicum?

5. METHODS

The aim of this research is to describe mentees' (pre-service mathematics teachers') perceptions on their mentors' practices, their mentors' perceptions on their own mentoring practices and their supervisors' perceptions on mentor teachers' mentoring practices. Pre-service mathematics teachers, who enrolled the teaching practicum course, from different universities, their mentor teachers from different schools and their supervisors at the universities are the participants of this study. The data from pre-service teachers and mentors were collected in 2019 fall term through the survey instruments *Mentoring for Effective Mathematics Teaching - for mentee and -for mentor* (Hudson, 2009) and open-ended questionnaires. Both survey instruments were adapted to Turkish for this study. Mentor teachers' practices were examined from the viewpoints of mentees' supervisors through a semi-structured interview.

5.1. Sampling and Participants

In Turkey, there exist two routes of becoming a mathematics teacher. The first one is to be graduated from an undergraduate program in secondary mathematics education or in primary mathematics education. The second is to complete a pedagogical formation program in mathematics education for the certification of teaching at secondary school. Both the undergraduate programs and the pedagogical formation programs require teacher candidates to complete teaching practices in schools.

The target population of the present study is Turkish mathematics teacher candidates who were enrolled to the teaching practicum course in the fall semester of 2019, their mentor teachers at internship schools and their supervisors at universities. In the current research, eligible mentees (pre-service teachers) are the teacher candidates who were:

(i) enrolled a pedagogical formation program,
(ii) taking the teaching practicum course,

(iii) attending to a practicum school.

Therefore, the target population of this study is eligible pre-service teachers (mentees) defined above, their mentor teachers at the practicum schools and supervisors at the universities.

5.1.1. Mentees (Pre-service Mathematics Teachers)

There were approximately 20 universities providing pedagogical formation education in Turkey over the 2019 fall term. Seven with higher quotas were purposively chosen to collect data. All of them were public universities named Marmara University, Gazi University, Ege University, Akdeniz University, Gaziantep University, Atatürk University and OnDokuz Mayıs University. Request to conduct research was sent to all these universities, but data were collected from 6 whose instructors agreed to collaborate in the research. Instruments were implemented to volunteered pre-service teachers by instructors or the researcher. The names, cities and regions of the universities where the data were collected, as well as the quotas of teacher candidates and mathematics teacher candidates and the number of participant mentees are illustrated in Table 5.1. Since some universities did not accepted to share the quota information, approximate quotas, which were obtained from the universities' web sites, were given.

Table 5.1. Universities whose pedagogical formation students participated in the study.

University	**City**	**Region**	**Approximate Quotas**	**Approximate Quotas for Teaching Mathematics**	**Participant Mentees**
Marmara University	Istanbul	Marmara	2350	300	56
Gazi University	Ankara	Central Anatolia	1250	115	60
Ege University	Izmir	Aegean	800	55	30
Akdeniz University	Antalya	Mediterranean	750	55	46
Gaziantep University	Gaziantep	South-eastern Anatolia	1270	100	42
Ataturk University	Erzurum	Eastern Anatolia	875	65	12

Table 5.1 indicates that although the total quotas of universities in mathematics teaching were 690, only 246 pre-service mathematics teachers participated in the re-

search. This might be because some of them were not eligible for this study and/or some did not attend to the course on the week the data were collected. The detailed information of the participant mentees according to their universities are demonstrated in Table 5.2.

Table 5.2. Demographic information of mentees.

University	**Mentee Participants**	**Gender**		**Teaching Experience**	
		Female	Male	Exist	Not Exist
Marmara University	56	45	11	31	25
Gazi University	60	53	7	32	28
Ege University	30	21	9	18	12
Akdeniz University	46	31	15	15	30
Gaziantep University	42	32	9	26	16
Ataturk University	12	10	2	5	7
TOTAL	246	192	53	127	118

Table 5.2 clearly illustrates that female teacher candidates outnumbered males in all six universities by diverse ratios. In total, the sample consisted of 192 female and 53 male mentees aged between 19 and 46 (M = 23.27, SD = 3.53). Moreover, all participant mentees were asked to indicate whether they had a teaching experience like tutoring, teaching in a study centre, teaching as a contract teacher, being a research assistant and so on. Table 5.2 includes the number of mentees with/without teaching experience by the universities. In comparison with the mentees who do not have teaching experience, there were more mentees having experience at Marmara, Gazi, Ege and Gaziantep Universities while less at Akdeniz and Ataturk Universities. However, the numbers of mentees with and without experiences in almost all eight universities were close to each other. In total, the sample was comprised of 127 experienced and 118 inexperienced mentees.

5.1.2. Mathematics Mentor Teachers

After collecting data from teacher candidates, each of the mentor teachers of the mentees was asked to participate in the study. Instruments were administered to 54 mentors who volunteered. The detailed information of the participating mentors are shown in Table 5.3.

Table 5.3. Demographic information of mentors.

Participant Mentors	**Gender**		**Program they graduated**		
	Female	Male	Mathematics	Teaching Mathematics	Others
54	28	26	28	23	3

Examining participating mentors, there were 28 females and 26 males aged between 28 and 63 (M = 46.67, SD = 8.24). In addition, Table 5.3 shows that the number of mentors graduating from the mathematics department (28) was higher than the number of graduates from the mathematics teaching department (23). There were also 3 mentors graduating from a different department than mathematics and mathematics teaching such as public administration. Moreover, all participant mentors were asked to point out their year of experience in teaching and mentoring. Whereas their teaching experience ranged from 5 to 37 years (M = 22.70, SD = 7.86), their year of experience in mentoring varied from 1 to 26 (M = 6.07, SD = 7.13).

5.1.3. Supervisors

After collecting data from mathematics mentor teachers, one supervisor from each participating university was invited to be interviewed. First, practicum course instructors (if only one supervisor drove the course) were attempted to invite to the research. If not reached, supervisors from the Department of Mathematics Education were invited to the research. If not reached, supervisors from the Faculty of Education were attempted to be interviewed. As a last option, supervisors from the Depart-

ment of Mathematics were asked to be interviewed. Finally, four supervisors from the Department of Mathematics Education, one supervisor from the Department of Computer Education and one supervisor from the Department of Mathematics (a total of 6 participants, one from each university) agreed to participate in the study.

In total, 246 mentees (192 females, 53 males, 1 not stated), 54 mentors (28 females and 26 males) and 6 supervisors (2 females and 4 males) formed the sample of the current study.

5.2. Instruments

The data collection instruments of this study consists of Mentoring for Effective Mathematics Teaching (MEMT) -Mentee and -Mentor instruments, open-ended questionnaires and a semi-structured interview. MEMT instruments and the questionnaires were implemented to mentee and mentor participants and one supervisor from each of 6 universities was interviewed.

Demographic information was collected from mentees and mentors in order to obtain their personal, educational and professional backgrounds. The demographic information gathered from mentees includes the following items; age, gender, graduation status, university and program they study/graduated from, university and field they receive pedagogical formation education, practice school, name of mentor, name of supervisor, whether they have teaching experience and type(s) of teaching experience if any. The demographic information collected from mentors contains the following items; age, gender, university and program they graduated from, city they work in, school they work in, school type (public or private), years of experience in teaching, years of experience in mentoring and number of pre-service teachers assigned in the fall semester of 2019.

5.2.1. Mentoring for Effective Mathematics Teaching-Mentee and -Mentor

In this part, the original instrument, adaptation procedures, reliability and validity issues of MEMT-Mentee and MEMT-Mentor are discussed.

5.2.1.1. Development of the Instrument. Hudson *et al.* (2005) developed the Mentoring for Effective Primary Science Teaching (MEPST) survey instrument to investigate pre-service science teachers' perceptions of their mentors' attributes and practices within 5-Factor Mentoring Model. The factors and their indicators were identified based on the literature of mentoring in teacher education (Hudson and Skamp, 2003). The MEPST instrument was implemented to 331 pre-service teachers and the 5-Factor Mentoring Model was supported by Confirmatory Factory Analysis. According to the reliability analysis of each factor, namely, Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback, Cronbach's alpha coefficients were .93, .76, .94, .95 and .92, respectively. CFA indicated fit indices that the Normed Chi-Square (X^2/df)=2.60, Confirmatory Fit Index (CFI)=.921, Root Mean Square Residual (RMR)=.066, Root Mean Square of Approximation (RMSEA) =.070 ($p<0.001$).

Then, Hudson and Peard (2006) demonstrated the transferability of the MEPST instrument to the instrument of Mentoring for Effective Mathematics Teaching (MEMT) for the purpose of collecting data about pre-service mathematics teachers' perceptions of their mentors' attributes and practices. MEMT consists of 34 five-point likert type items ranged from 1 (strongly disagree) to 5 (strongly agree). In the MEMT instrument, Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback have 6 (α=.91), 3 ((α=.74), 11 ((α=.94), 8 ((α=.89) and 6 ((α=.91) items, respectively (Hudson and Peard, 2006).

Hudson (2010) redesigned the MEMT instrument in order to measure mentor teachers' perceptions on what mentoring practices they facilitated. In this process, as an example, the item "During my final professional school experience in mathematics teaching my mentor: was supportive of me for teaching mathematics" was changed to

the sentence "During the pre-service teachers' final professional school experience in mathematics teaching, I believe I: was supportive of my mentee for teaching mathematics". All the factors along with their items that were restated for mentors remained the same.

In the current research, to avoid any confusion, the Mentoring for Effective Mathematics Teaching (MEMT) instrument designed to investigate pre-service teachers' perceptions on mentoring practices will be named as "Mentoring for Effective Mathematics Teaching-Mentee (MEMT-Mentee)" and the MEMT created to explore mentors' perceptions on their own mentoring practices will be called as "Mentoring for Effective Mathematics Teaching-Mentor (MEMT-Mentor)". Table 5.4 shows each of five factors along with the item numbers and item codes used for MEMT-Mentee and MEMT-Mentors separately.

Table 5.4. Five factors with item numbers and item codes.

Factors	**Item Numbers**	**MEMT-Mentee Item Codes**	**MEMT-Mentor Item Codes**
1. Personal Attributes	Item 1	ePA1	rPA1
	Item 17	ePA2	rPA2
	Item 22	ePA3	rPA3
	Item 23	ePA4	rPA4
	Item 26	ePA5	rPA5
	Item 31	ePA6	rPA6
2. System Requirements	Item 4	eSR1	rSR1
	Item 11	eSR2	rSR2
	Item 25	eSR3	rSR3
3. Pedagogical Knowledge	Item 3	ePK1	rPK1
	Item 6	ePK2	rPK2
	Item 8	ePK3	rPK3
	Item 10	ePK4	rPK4
	Item 14	ePK5	rPK5
	Item 18	ePK6	rPK6
	Item 21	ePK7	rPK7
	Item 24	ePK8	rPK8
	Item 27	ePK9	rPK9
	Item 30	ePK10	rPK10
	Item 32	ePK11	rPK11

Table 5.4. Five factors with item numbers and item codes (cont.).

Factors	Item Numbers	MEMT-Mentee Item Codes	MEMT-Mentor Item Codes
4. Modelling	Item 2	eM1	rM1
	Item 5	eM2	rM2
	Item 7	eM3	rM3
	Item 9	eM4	rM4
	Item 12	eM5	rM5
	Item 15	eM6	rM6
	Item 19	eM7	rM7
	Item 29	eM8	rM8
5. Feedback	Item 13	eFB1	rFB1
	Item 16	eFB2	rFB2
	Item 20	eFB3	rFB3
	Item 28	eFB4	rFB4
	Item 33	eFB5	rFB5
	Item 34	eFB6	rFB6

5.2.1.2. Adaptation of the Instrument. In the current study, the term "adaptation of the instrument" is preferred to "translation of the instrument" since adaptation is a broader term that covers all the steps from getting permission from the test developers to documenting the validity of the instrument and includes translation as a step as well (ICT, 2018). Moreover, simply translating an instrument from the source language to the target language may bring out some problems; therefore, in the adaptation process, the importance of considering cultural and linguistic differences is highlighted (Hambleton, Merenda and Spielberger, 2005).

For the test adaptation, the first step is to obtain permission from the test developers (ICT, 2018). For this study, permission was granted for the use of MEMT instrument in the Turkish context (P. Hudson, personal communication, November 26, 2019). Proceeding with the adaptation design, there are two popular translation approaches: forward translation and backward translation (ICT, 2018). Both have some advantages and disadvantages. In the forward translation approach, a test is translated into the target language; then, a different translator or small group of translators judge the equivalence of the source and translated tests and decide on the best version of the translated form. Forward translation is frequently used since it is simple and cost-effective. However, it is highly depended on the translator's experience,

which decreases the quality of translation (Geisinger, 1994). On the other hand, in the backward translation approach, a test is firstly translated into the target language; secondly, translated back to the source language by a different translator or group of translators; finally the original and the back-translated versions were compared to judge their equivalence (ICT, 2018). Even though this approach results in more objective judgement, its main disadvantage is that the translator might miss out some important linguistic and cultural differences while focusing on the grammatical issues to maximize the equivalence of the original and back-translated versions (Erkut *et al.*,1999; Hambleton, 1993). That may result in low reliability and validity of the translated test.

The instrument MEMT-Mentee was adapted to Turkish (Translation1 - T1) by Hacıömeroğlu and Şahin-Taşkın (2010) by using backward translation approach. In the current study, firstly, the items of MEMT-Mentee test were translated from the source language English to Turkish (Translation2 - T2) by the researcher who is fluent in English. In the forward translation process, mathematics teaching context, cultural issues and interpretation of items in Turkish were considered in depth. Then, the Translation2 (T2) was compared with the Translation1 (T1) and their equivalence was judged by the researcher and an expert in mathematics teacher education. Even though most items were almost the same, there were some important differences in 10 items (item numbers 2, 5, 7, 10, 12, 13, 19, 24, 26 and 27). Along with the original forms in English, some test statements which were significantly different in T1 and T2 were listed below as exemplars (Table 5.5).

Table 5.5. Exemplary MEMT-Mentee items in the original test, T1 and T2.

Item Numbers	**Item Statements**
Item 2	used mathematics language from the current mathematics syllabus.
Item 2 - T1	yeni matematik programında yer alan matematik dilini kullandı.
Item 2 - T2	mevcut matematik dersi öğretim programında yer alan matematik dilini kullandı.
Item 5	modelled mathematics teaching.
Item 5 - T1	matematik öğretimi için model oluşturdu.
Item 5 - T2	matematik öğretimini modelledi.
Item 9	displayed enthusiasm when teaching mathematics.
Item 9 - T1	matematik öğretirken coşkulu ve istekliydi.
Item 9 - T2	matematik öğretimi sırasında ilgili ve istekli olduğunu gösterdi.

In the Turkish mathematics education context, a syllabus usually has not been prepared, but curriculum shows the required mathematics language. Therefore, in the current study, the phrase "matematik dersi öğretim programı", which is the interpretation of "mathematics curriculum" in Turkish, was preferred for the translation of Item2. Also, the word "current" was translated as "mevcut" since it was thought that "mevcut" gives the meaning of the word "current" better another word choice such as "yeni". In the translation of Item 5, "model oluşturmak" might be used, but "modellemek" was preferred as a verb since "model oluşturmak" carries the connotation of creating something concrete; however, in the Item 5, "modelling" refers to setting an example of teaching. In the Item 9, even though the phrase "coşkulu ve istekli" might correspond to "enthusiasm", the phrase "ilgili ve istekli" was considered to be more appropriate to express the word "enthusiasm" for Turkish culture within the framework of mentoring practices.

Afterwards, the equivalence of the original and translated (T2) forms were judged separately by a group of translators including four mathematics teacher educators who are expert in the content area and fluent in English and a five-year experienced mathematics teacher who is fluent in English. Then, the researcher and an expert in mathematics teacher education agreed on the final version of the Turkish MEMT-Mentee instrument, taking all the reviews into account. Based on the review, Item 27 and Item 34 were revised to the suggested items expressed in Table 5.6.

Table 5.6. Suggestions for the translation of some MEMT-Mentee items in the T2.

56	**Item Statements**
Item 27	provided strategies for me to solve my mathematics teaching problems.
Item 27 - T2	matematik öğretimi ile ilgili problemlerimi çözmeye yönelik stratejiler sundu.
Item 27 - suggested	matematik öğretimi ile ilgili sorunlarımı çözmeye yönelik stratejiler sundu.
Item 34	observed me teach mathematics before providing feedback.
Item 34 - T2	bana geri bildirim vermeden önce matematik öğretimimi gözlemledi.
Item 34 - suggested	matematik öğretimimi gözlemledikten sonra bana geri bildirim verdi.

In the Item 27, the word "problem" was suggested to change with "sorun" since "problem" might connote "mathematical problems" and in Turkish language there exists another word "sorun" which refers to "problem" as well. In the Item 34, the

suggested version was evaluated as a more fluent expression.

For the translation of MEMT-Mentor, firstly, the items of Turkish MEMT-Mentee that express mentee's perceptions were re-designed to reflect mentors' perceptions as Hudson (2010) did in English versions of the instruments. For example, the first item on the Turkish MEMT-Mentee "Uygulama (Staj) okulundaki matematik öğretmenliği uygulama (staj) deneyimim sırasında, mentör (uygulama) öğretmenim: matematik öğretimi konusunda bana destek oldu" was changed to the sentence "Matematik öğretmen adaylarının öğretmenlik uygulaması (staj) deneyimi sırasında, mentör öğretmen (uygulama öğretmeni) olarak: matematik öğretimi konusunda aday öğretmene destek oldum" for the MEMT-Mentor instrument. After the mentors' version was formed to reflect mentors' perspective, the items were checked in detail and the translation process was completed.

In this study, a pilot study could not be able to conduct because of the limited number of target population who are eligible for the intended use of the test. The reliability and validity analyses of the collected data were discussed in the following sections.

5.2.1.3. Reliability Analysis. In order to assess reliability of a measurement scale, Cronbach's coefficient, which estimates the degree to which a set of items of a scale represents the construct, should be considered the first. Therefore, reliabilities of MEMT-Mentee and MEMT-Mentor, five-point Likert scales, were assessed through internal consistency of the instruments by computing Cronbach's coefficient alpha with SPSS Statistics for Windows, Version 25.0. Ideally, an alpha above 0.7 should be accepted (George and Mallery, 2003). Moreover, a Cronbach's alpha value between 0.5 and 0.75 indicates moderate reliability (Brownlow, McMurray and Cozens, 2004). The reliability results are reported in the result section in detail.

5.2.1.4. Validity Analysis. In order to assess construct validity of the MEMT-Mentee and MEMT-Mentor scales, which estimates how well a theoretical model fits the ac-

tual data, Confirmatory Factor Analysis (CFA) was performed. In this thesis, CFA was used to confirm how well the observed variables represent constructs in the 5-Factor Mentoring Model for the data of this study. The constructs of the Five-Factor Mentoring Model are *Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback*.

To perform CFA, various assumptions need to be considered. Firstly, sample size should be preferably 200 or larger and the ratio of 10:1 for the sample size to the number of observed variables is more acceptable (Kline, 2015). Secondly, normality should be checked. The indicator WLSMV (mean- and variance-adjusted weighted least squares) is recommended to obtain more accurate factor loading estimates and fit indices when the observed data is ordinal and the sample size is small (Beauducel and Herzberg, 2006). In this study, Mplus 6 was used to perform CFA for ordinal variables since it provides the WLSMV estimator (Muthén and Muthén, 1998-2010).

To deal with missing values, it is recommended to assign a numeric value code such as "-9", "-99", or "-999" for all missing values before importing the data into Mplus 6 (Muthén and Muthén, 1998-2010). In this study, the number "-99" was used as missing value code for both data collected from mentees and mentors.

For overall and construct validity of the instruments, standardized factor loadings, some model fit indices and discriminant validity were evaluated. Hair *et al.* (2014) suggest considering variables with standardized factor loadings smaller than 0.5 to be a candidate for deletion. Yet, before deciding to delete an item, it should be discussed in detail within the context since deleting an item might affect content validity adversely. In this study, several fit indices were reported; the normed chi-square, the Root Mean Squared Error of Approximation (RMSEA), the Comparative Fit Index (CFI), the Tucker Lewis Index (TLI) and the Weighted Root Mean Residual (WRMR).

Firstly, chi-square test (X^2) shows the difference between the observed and estimated covariance matrices by depending on the sample size (Hair *et al.*,2014). For a model fit, that difference is expected to be not significant. In this study, after checking

the significance level of the X^2, the normed chi-square that is the ratio of X^2 to the degrees of freedom (X^2/df) was used. Another fit index, the Root Mean Squared Error of Approximation (RMSEA) estimates the lack of model fit considering both model complexity and sample size issues. The Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI) are mostly reported incremental fit indices that estimate how well the estimated and null models are related. A null model assumes that all observed variables are uncorrelated. Lastly, the Root Mean Residual (RMR) is briefly defined as an average of residuals. For ordinal data, Mplus provides the Weighted Root Mean Residual (WRMR) index (Muthén and Muthén, 1998-2010). In this study, the rule of cut-off points for the fit indices were shown in Table 5.7.

Furthermore, discriminant validity of factors was examined to assess the extent to which each factor is distinct from each other. In order to test discriminant validity, it is suggested that to calculate the average variance-extracted (AVE) estimate for each factor and then compare it with the squared correlations between that factor and other factors (Fornell and Larcker, 1981). The AVE estimate for a factor is calculated by dividing the total of its squared standardized factor loadings to the number of its items. In order to prove discriminant validity, the AVE is required to be greater than the squared correlations.

On the other side, Exploratory Factor Analysis (EFA) is commonly used to explore the factors and related variables in a test. There are three main reasons for conducting EFA: to express a number of variables by a smaller set of factors, to form or refine a theory and/or to provide evidence for construct validity (Williams, Onsman and Brown, 2010). In this study, in the case of rejecting the model fit based on the CFA results, EFA was performed to refine the model for the Turkish context. In the EFA, oblique rotation method was used since it allows correlations among factors (Hair *et al.*, 2014). For deciding on the number of factors to extract, eigenvalue criterion and scree test criterion were used. According to the eigenvalue criterion, only the factors with eigenvalues greater than 1 are assumed significant (Hair *et al.*, 2014). Scree test is performed based on the plot of eigenvalues against the number of factors and the number of factors corresponding to the inflection point where the graph becomes almost

a horizontal line is assumed as the maximum number of factors to extract. However, the factors before the inflection point might meet substantial amounts of variance explained. The validity, CFA and EFA results will be reported in the result section in detail.

Table 5.7. Assessment of fit indices.

Types of indices	**Cut-off**	**Source**
Chi-square/degree of freedom (X^2/df)	$\leq$	(Kline, 2015)
Root mean squared error of approximation (RMSEA)	$\leq$	(Hair *et al.*, 2014; Hooper, Coughlan and Mullen, 2008)
Comparative fit index (CFI) / Tucker Lewis Index (TLI)	$\geq$	(Hu and Bentler, 1999; Tabachnick and Fidel, 2001)
Weighted Root Mean Square Residual (WRMR)	$\leq$	(Yu, 2002)

5.2.2. Open-Ended Questionnaires

Open-ended questionnaires were conducted with mentor teachers and mentees (Appendix D; Appendix H). In the questionnaires, the participants were asked to share an experience that they evaluate as "an effective mentoring practice".

5.2.3. Semi-Structured Interviews

Semi-structured interviews were conducted with each participating supervisor to explore their perceptions about mentoring practices under five dimensions (Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback); and also to unveil the nature of the practicum course conducted in the pedagogical formation program for mathematics teaching (Appendix I).

5.3. Data Collection

Data collection procedure was carried out in three phases. In the first phase, data were gathered from the mentees while in the second phase, data were collected from the mentors. In the last phase, interviews were held with supervisors.

Firstly, 7 instructors from 7 universities were called for the request to conduct research. Data were collected from 6 universities where pedagogical formation program for mathematics teaching was available and whose instructors agreed to collaborate in research. In the first stage, after the pre-service teachers completed the internship, data was collected from the mentees towards the end of the 2019-2020 fall semester in December. In Istanbul, the researcher went to the university and administered surveys to mentees. In cities outside of Istanbul, surveys were mailed to an instructor of the determined universities and they administered surveys to teacher candidates. After collecting data, they sent surveys back to the researcher. Although a total of 296 surveys were sent back to the researcher from 6 universities, 246 of them were eligible.

Upon the completion of data collection from participant mentees, instruments for mentors were administered in January - February, with the start of the 2019-2020 spring semester. The practicum schools were called to invite the mentor teachers to participate in the research. In Istanbul, the researcher went to the practicum schools and administered surveys to mentor teachers. In cities outside of Istanbul, surveys were conducted online. Of the 114 mentors who were invited to the research, 54 volunteered to participate by filling in the paper-based instruments or their online version.

The last phase of data collection was to interview with practicum supervisors at universities. After collecting data from mentor teachers, an e-mail with a request for interview about mentors' attributes and practices was sent to supervisors from each of 6 universities. One volunteered supervisor from each university was interviewed by phone and all interviews were recorded.

5.4. Data Analysis

The process of analysing data obtained from the Mentoring for Effective Mathematics Teaching (MEMT) -Mentee and -Mentor instruments, open-ended questionnaires and semi-structured interviews were presented below separately.

5.4.1. Mentoring for Effective Mathematics Teaching

For the current study, firstly, quantitative data sources obtained from MEMT-Mentor and MEMT-Mentee instruments were analysed. Preliminary analysis including Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA) was performed to document the reliability and validity of the instruments. Then, descriptive statistics (mean and standard deviation) and item statistics (median and percentage of participants who either "agreed" or "strongly agreed") for scores obtained from the instruments were analysed. CFA and EFA performed for the validity of instruments were analysed with Mplus 6 (Muthén and Muthén, 1998-2010) and all the other statistical analysis was performed with SPSS Statistics for Windows, Version 25.0.

5.4.2. Open-Ended Questionnaires

For the analysis of the open-ended questionnaires, firstly, the responses were read in detail to understand what the participants stated. Then, code words or phrases were assigned to the responses. The assigned codes were matched with the indicators of each factor in the Five-Factor Mentoring Model (Hudson and Skamp, 2005). The indicators were considered as categories to be collected under the themes and accordingly, the factors of the Five-Factor Mentoring Model constituted the themes for the categories. However, the categories different from the pre-determined ones appeared in the data and they were able to be placed in a pre-determined theme.

In the result section, the participating mentors' and mentees' responses to the questionnaire were tabulated in terms of the frequencies of the categories and themes. The frequencies represent the numbers of the participants whose responses were coded under a particular category or theme. The participants' responses can be matched with more than one category. Therefore, the total number of frequencies for categories under a particular theme might be more than the frequency of the theme. Also, the participants' responses can be matched with more than one theme. Therefore, the total number of frequencies for themes was more than the total number of participants whose responses were analysed.

5.4.3. Semi-Structured Interviews

After transcribing the interview records, the first step for their analysis was to read the responses thoroughly for the purpose of understanding what the participants stated. Then, the open coding was completed by assigning code words or phrases that summarize the responses. The open codes from interviews yielded into the categories named "supervisors' perceptions on mentors' practices", "selection of mentors", "practicum course", and "factors affecting the interaction between mentors and mentees". Then, these categories were framed under the themes of "Supervisor-Mentor Interaction", "Supervisor-Mentee Interaction", and "Mentor-Mentee Interaction".

It is important to note that the language of interviews was Turkish; therefore, all the analysis steps for interviews were completed in Turkish. In the result section, quotes from the interviews were provided in English which were translated from Turkish by the researcher. Also, the participating supervisors were labelled as SV-1, SV-2, SV-3, SV-4, SV-5 and SV-6.

6. RESULTS

In this part, the findings of the current research will be presented in two main sections. The first section includes preliminary analyses for the reliability and validity of the MEMT-Mentee and MEMT-Mentor instruments. In the second section, findings about mentoring were presented by a model of Mentoring Triad which mainly focuses on the mentoring practices and exhibits the interactions among Supervisor, Mentor and Mentee in the context of mentoring.

6.1. Reliability and Validity Analyses

This section includes preliminary analyses for the reliability and validity of both MEMT-Mentee and MEMT-Mentor instruments separately.

6.1.1. Reliability and Validity Analyses of the MEMT-Mentee Instrument

In this section, reliability, validity and factor analyses of the MEMT-Mentee instrument are presented.

In the reliability analysis of the MEMT-Mentee scale, the Cronbach alpha coefficient for the overall instrument with 34 items is 0.96. Thus, reliability of the instrument is considered excellent (George and Mallery, 2003). The corrected item-total correlations were also reported in Table 6.1. Each correlation was higher than .30 and considered acceptable. (De Vaus, 2004).

Table 6.1. Corrected Item-Total Correlations for MEMT-Mentee Scale.

Items	Corrected Item-Total Correlation
ePA1	0.796
ePA2	0.681
ePA3	0.803
ePA4	0.841
ePA5	0.772
ePA6	0.781
eSR1	0.755
eSR2	0.781
eSR3	0.826
ePK1	0.763
ePK2	0.801
ePK3	0.849
ePK4	0.797
ePK5	0.834
ePK6	0.82
ePK7	0.827
ePK8	0.831
ePK9	0.791
ePK10	0.81
ePK11	0.754
eM1	0.774
eM2	0.747
eM3	0.763
eM4	0.784
eM5	0.835
eM6	0.792
eM7	0.711
eM8	0.732
eFB1	0.803
eFB2	0.757
eFB3	0.63
eFB4	0.727
eFB5	0.8
eFB6	0.81

In order to check the construct validity of the MEMT-Mentee instrument, Confirmatory Factor Analysis (CFA) was performed. Regarding the assumptions for CFA, the sample size of mentees is 246 with the approximate ratio of 7.2:1 to the number of variables, which can be considered acceptable. For normality, skewness values in between -1 and 1 indicate acceptable values (Hair *et al.*, 2014). In the MEMT-Mentee instrument, the skewness value was -1.284, not within the accepted range. As shown on the Figure 6.1, most of the data were accumulated on the right side of the histogram.

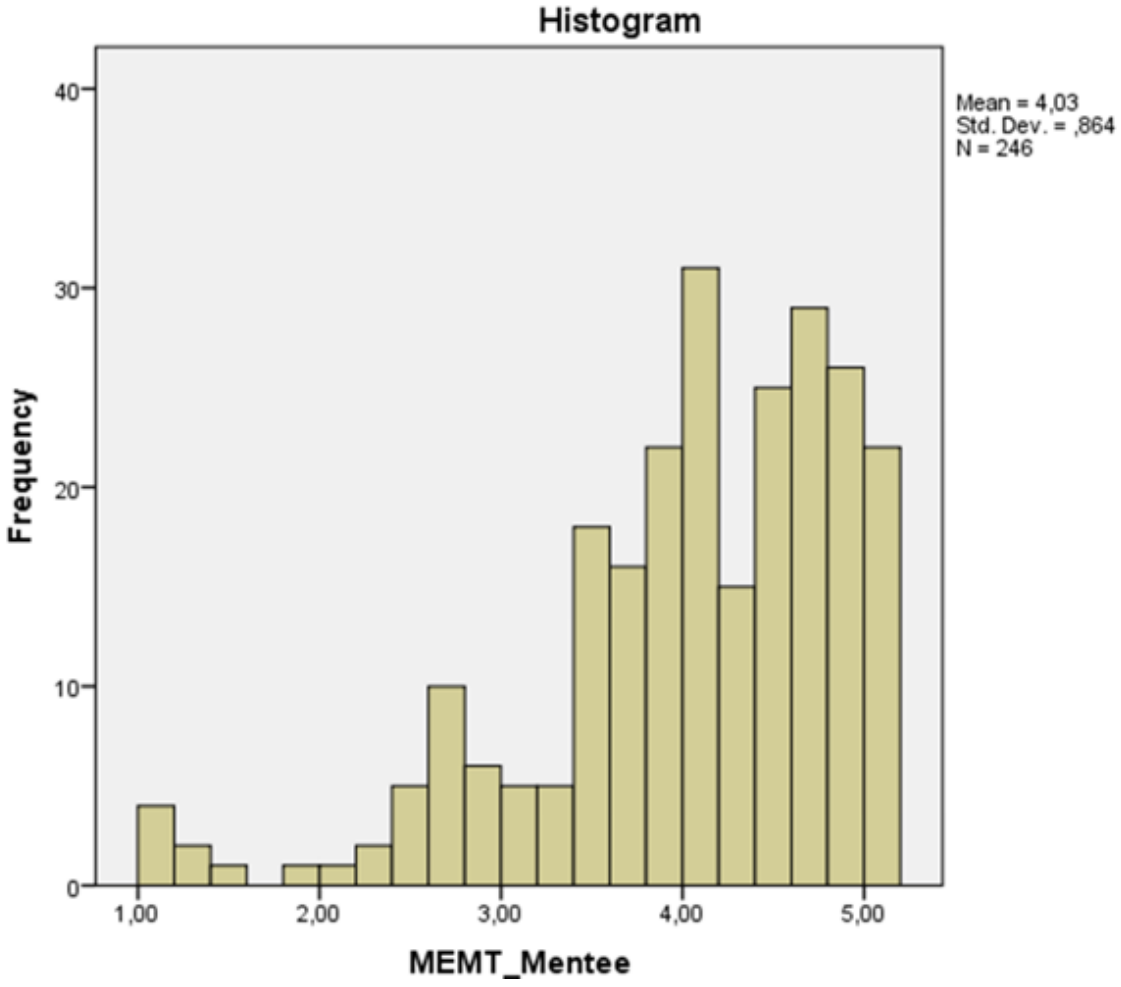

Figure 6.1. Histogram for MEMT-Mentee.

CFA of five-factor model for MEMT-Mentee was conducted with Mplus 6 by using the WLSMV (mean- and variance-adjusted weighted least squares) estimator because the data were categorical. A visual diagram depicting the 5-Factor Mentoring Model with item loads and correlations is illustrated in Figure 6.2. All paths in the Figure 6.2

are statistically significant (p<.001). The model displays 34 observed variables and 5 latent constructs. Each of the constructs is indicated by at least 3 measured items.

According to the model testing results, the chi-square, X^2 is 114.611 with the degrees of freedom, df=517 and the statistical significance level (p=0.00) is less than 0.05. The model fit indices obtained through CFA are acceptable for the five-factor model except the Weighted Root Mean Residual (WRMR) index as shown in Table 6.2. It is 1.120, which slightly higher than the cut-off point 1.00. Moreover, all of the factor loadings are statistically significant and have acceptable values varying between 0.737 and 0.905 as seen in Figure 6.2, which provides further information about the construct validity.

Table 6.2. Confirmatory factor analysis of five-factor model for MEMT-Mentee.

	X^2	*df*	X^2/df	RMSEA	CFI	TLI	WRMR
5-Factor Model	1114.61	517	2.156	0.069	0.976	0.973	1.120

Proceeding with the reliability of each factors, Cronbach's alphas of the five factors are as follows: Personal Attributes (6 items) is 0.91, *System Requirements* (3 items) is 0.84, *Pedagogical Knowledge* (11 items) is 0.95, Modelling (8 items) is 0.92, Feedback (6 items) is 0.89. Thus, the reliability of each factor is considered good (George and Mallery, 2003).

However, the correlations between factors vary from 0.937 to 0.997, which refers that factors are strongly correlated with each other. Examining the discriminant validity in terms of factors, all average variance-extracted (AVE) estimates in Table 6.3 are smaller than the corresponding squared correlations between the factors in Table 6.4, which indicates there are some problems with discriminant validity for the five-factor CFA model. Therefore, the model may not consist five factors for this study and it should be refined by Exploratory Factor Analysis for the Turkish context in question.

Table 6.3. Average variance-extracted (AVE) estimates of five factors for MEMT-Mentee.

	Personal Attributes	System Requirements	Pedagogical Knowledge	Modelling	Feedback
AVE estimates	0.643	0.734	0.74	0.701	0.701

Table 6.4. The squared correlation matrix of five factors for MEMT-Mentee.

	Personal Attributes	System Requirements	Pedagogical Knowledge	Modelling	Feedback
Personal Attributes	1.000				
System Requirements	0.878	1.000			
Pedagogical Knowledge	0.982	0.994	1.000		
Modelling	0.941	0.941	0.984	1.000	
Feedback	0.966	0.895	0.966	0.937	1.000

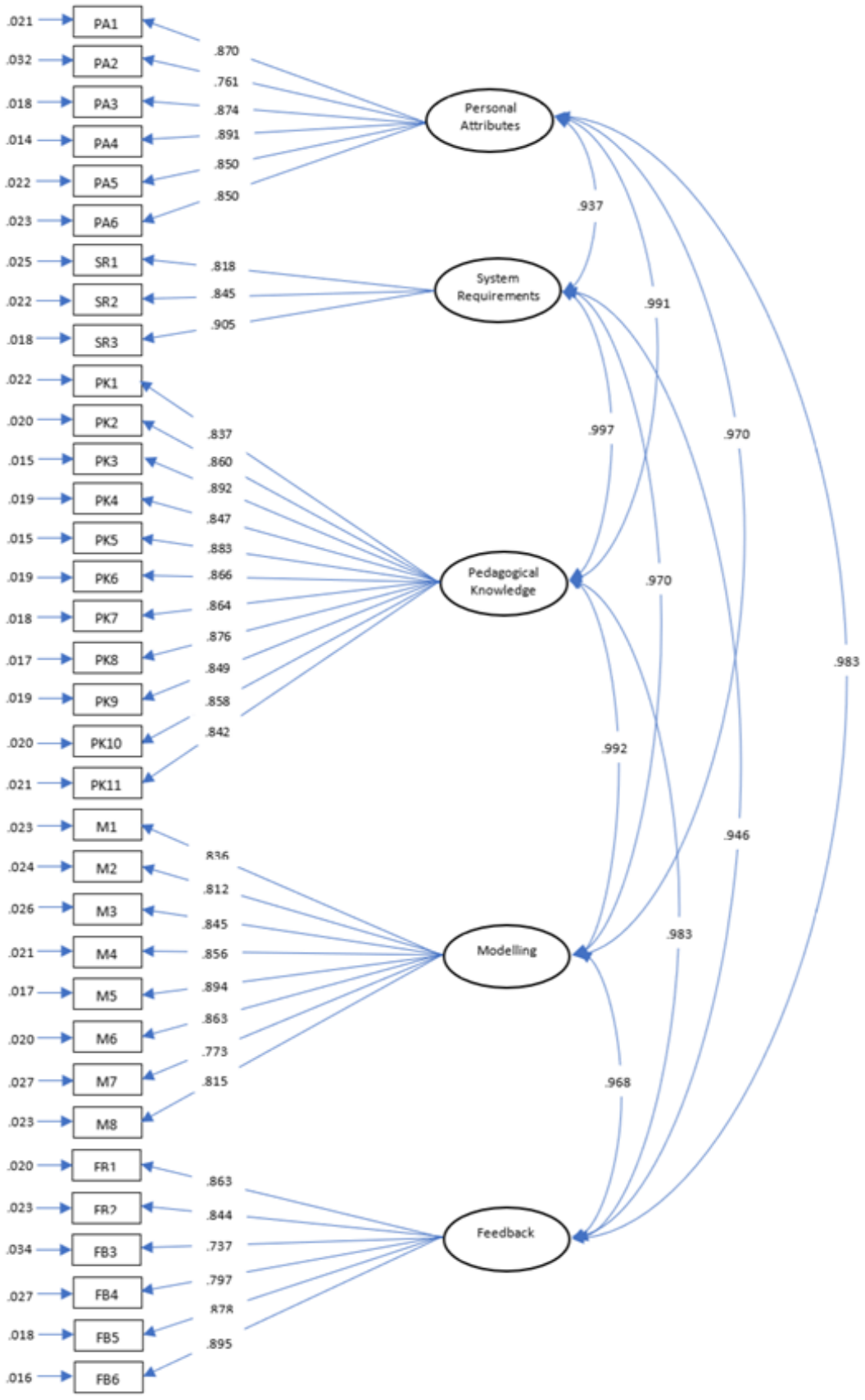

Figure 6.2. Five-factor mentoring model for MEMT-Mentee with standardized factor loadings and correlations.

6.1.1.1. Exploratory Factor Analysis of the MEMT-Mentee Instrument. Exploratory Factor Analysis (EFA) for the MEMT-Mentee instrument was conducted with Mplus 6 by using the WLSMV (mean- and variance-adjusted weighted least squares) estimator and oblique rotation with goemin. As the extraction method, both eigenvalue criterion and scree test criterion were used. Examining the eigenvalue criterion, there were two factors with significant eigenvalues that greater than one. However, there were a dramatic decrease in eigenvalues as going from the first factor to the second one. Therefore, scree plot criterion was also checked. Scree plot showed that the graph became almost straight after the first factor as illustrated in the Figure 6.3. Thus, one-factor model was assumed and approximately 63% of the variance explained by this factor model. EFA suggested to measure all items under one factor depicting mentoring attributes and practices and there was a need to conduct a new CFA with one-factor.

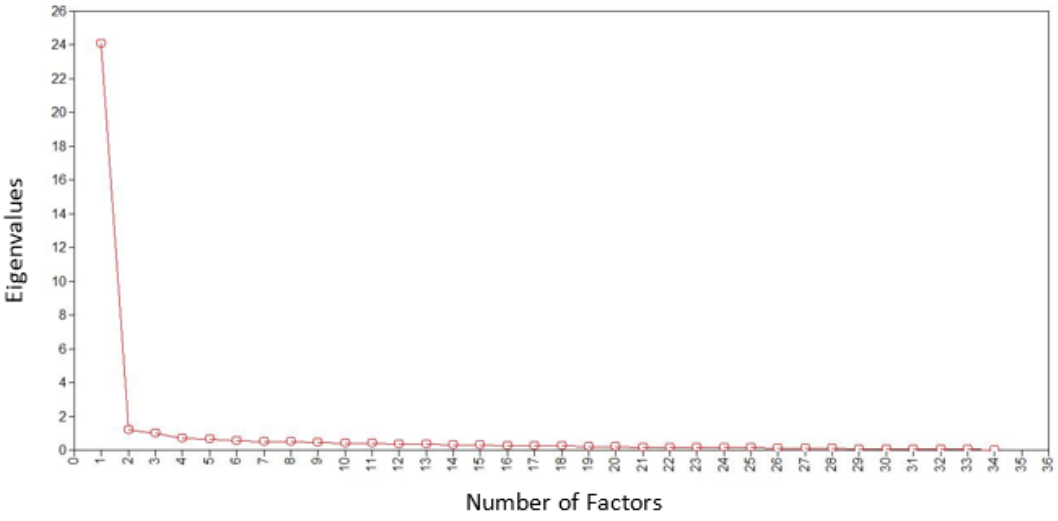

Figure 6.3. Scree plot of MEMT-Mentee items.

The model fit indices obtained through CFA of MEMT-Mentee are acceptable for the five-factor model except the Weighted Root Mean Residual (WRMR) index which is slightly higher than the cut-off point 1.00 (i.e., X^2=1139.953, df=527, X^2/df=2.163, RMSEA=0.069, CFI=0.975, TLI=0.973, WRMR=1.139, Table 6.5). Moreover, all of the factor loadings are statistically significant and have acceptable values varying between 0.726 and 0.893 as seen in Figure 6.4.

Table 6.5. Confirmatory factor analysis of one-factor model for MEMT-Mentee.

	X^2	*df*	X^2/df	RMSEA	CFI	TLI	WRMR
1-factor model	1139.95	527	2.163	0.069	0.975	0.973	1.139

The EFA results showed that all the items can be represented by one factor; however, the five-factor model for effective mentoring was developed based on intensive literature review and critiques by experts (Hudson, Skamp and Brooks, 2005). Even in the original instrument, the correlations between factors were high and so the discriminant validity was low as well; but the five-factor model was accepted. Similarly, in this study, for the five-factor model, even though the instrument's discriminant validity was low, many other statistics indicated a good model fit. For example, correlations of the five factors were significant ($p<.001$), standardized factor loadings ranged from 0.737 to 0.905 were substantial and significant ($p<.001$), all standard errors were smaller than 1, most of the model fit indices were acceptable and each of the five factors is measured reliable. In addition to these test statistics, the five-factor model for the instrument was strongly supported by the literature. Therefore, in the current study, MEMT-Mentee instrument was assumed providing a good fit with the five-factor model.

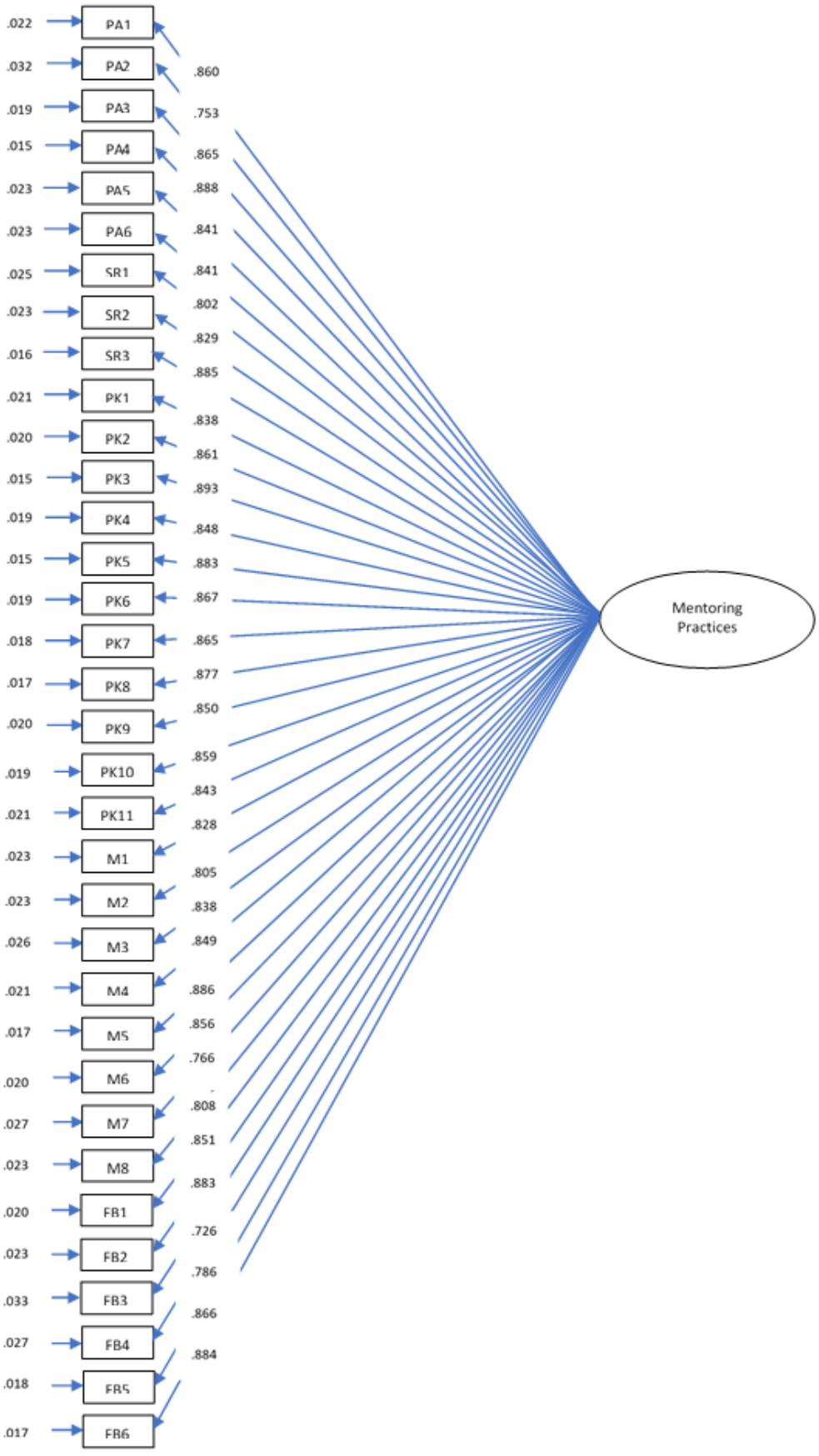

Figure 6.4. One-factor mentoring model for MEMT-Mentee with standardized factor loadings.

6.1.2. Reliability and Validity Analyses of the MEMT-Mentor Instrument

In this section, reliability and validity analyses of the MEMT-Mentor instrument are presented.

In the reliability analysis of the MEMT-Mentor scale, the Cronbach alpha coefficient for the overall instrument with 34 items is 0.92. Thus, the reliability of the instrument is considered excellent (George and Mallery, 2003). The corrected item-total correlations were also placed in Table 6.6. The item-total correlations of items rFB1 and rFB3 were lower than the acceptable value of .30 (De Vaus, 2004) with the correlations .282 and .048, respectively.

Before performing CFA, sample size and normality were checked. The sample size of mentors is 54. For normality of the MEMT-Mentor instrument, skewness value was -0.965, within the acceptable range of ±1. Yet, as shown on theFigure 6.5, most of the data were accumulated on the right side of the histogram (in between 4.5 and 5 in the five-point likert type scale).

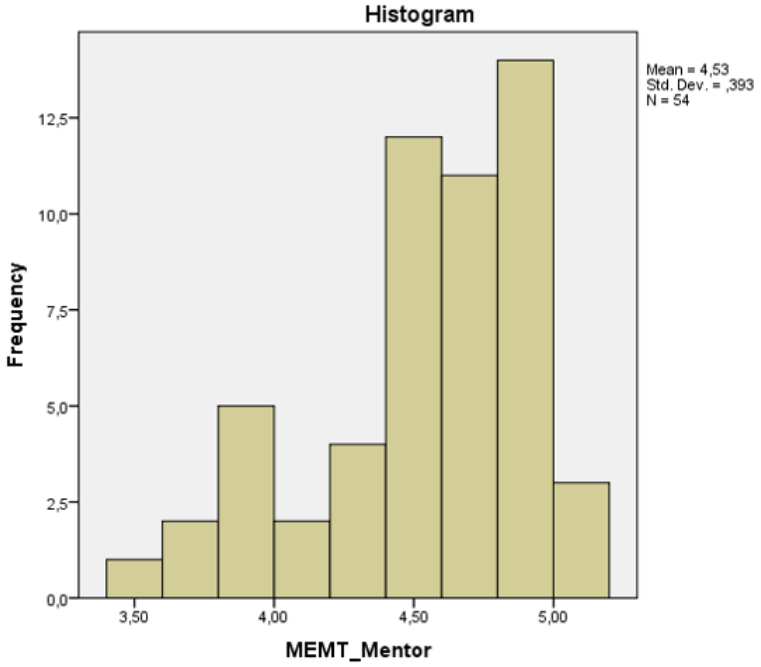

Figure 6.5. Histogram for MEMT-Mentor.

Table 6.6. Corrected Item-Total Correlations for MEMT-Mentor Scale.n

Items	Corrected Item-Total Correlation
rPA1	0.661
rPA2	0.381
rPA3	0.749
rPA4	0.61
rPA5	0.761
rPA6	0.551
rSR1	0.554
rSR2	0.651
rSR3	0.565
rPK1	0.381
rPK2	0.652
rPK3	0.659
rPK4	0.62
rPK5	0.735
rPK6	0.607
rPK7	0.597
rPK8	0.584
rPK9	0.734
rPK10	0.625
rPK11	0.459
rM1	0.598
rM2	0.599
rM3	0.783
rM4	0.609
rM5	0.425
rM6	0.751
rM7	0.465
rM8	0.319
rFB1	0.282
rFB2	0.423
rFB3	0.048
rFB4	0.413
rFB5	0.509
rFB6	0.413

The CFA was implemented for scale validation by Mplus 6 with the mean- and variance-adjusted weighted least squares (WLSMV) estimator since the sample size is small and the data are categorical. The model displays 34 observed variables and 5 latent constructs. Each of the constructs is indicated by at least 3 measured items.

The fit indices were as follows: $X^2/df = 1.186$; RMSEA = .059; CFI = .966; TLI = .963; WRMW = .937 (Table 6.7). All of the loading estimates were statistically significant except the factor loading of the observed variable rFB3 (p=0.174). Moreover, its' standardized factor loading was 0.159 while all the other standard factor loadings were in acceptable range varying between 0.507 and 0.920 (Figure 6.6).

Furthermore, Cronbach's coefficient alpha of the five factors are as follows: Personal Attributes (6 items) is 0.81, *System Requirements* (3 items) is 0.57, *Pedagogical Knowledge* (11 items) is 0.89, *Modelling* (8 items) is 0.83, *Feedback* (6 items) is 0.39. Three factors representing Personal Attributes, Pedagogical Knowledge and Modelling indicate reasonable internal consistency reliability and the alpha of System Requirements is moderately acceptable for this study since the factor has few items; however, the Feedback factor has reliability below the level of 0.50. Therefore, the item-total statistics was examined in detail. Two items, namely rFB1 and rFB3, had corrected item-total correlations lower than 0.3 which is not an acceptable value to claim for an item to be at least moderately correlated with the other items (De Vaus, 2004). It was noticed that the item coded as rFB3 "I believe I provided written feedback on the mentee's mathematics teaching". was the most problematic item with 0.048 corrected item-total correlation.

Even though the fit indices were acceptable for the overall validity of the model, the item *rFB3* weakened the validity and reliability of the Feedback construct since its factor loading and corrected item-total correlation were lower than acceptable levels. However, the expression of the item rFB3 in Turkish might not be clear. In Turkey, mentor teachers have an obligation to evaluate mentees through an online system called MEBBIS. Some mentors may have had tended to give the highest score because they thought this type of evaluation was a kind of written feedback. On the other side,

some mentors might have inclined to give the lowest score considering that they did not give written feedback to the mentee directly. Briefly, the sentence was not clear in the Turkish context and it should be clearly expressed in further research.

Table 6.7. Confirmatory factor analysis of five-factor model for MEMT-Mentor.

	X^2	*df*	X^2/df	RMSEA	CFI	TLI	WRMR
5-Factor Model	613.221	517	1.186	0.059	0.966	0.963	0.937

The factor correlations vary from 0.817 to 1.107, which shows that factors are strongly correlated with each other. Examining the discriminant validity in terms of factors, all average variance-extracted (AVE) estimates in Table 6.8 are smaller than the corresponding squared correlations between the factors in Table 6.9, which shows that the discriminant validity of factors is low. On the other side, many other test statistics indicated a good model fit. For example, correlations of the five factors were significant (p<.001), standardized factor loadings ranged from 0.737 to 0.905 were substantial and significant (p<.001) except only one item (*rFB3*), all standard errors were smaller than 1, all of the model fit indices were acceptable and each of the five factors is measured highly or moderately reliable. In addition to these test statistics, the five-factor model for the instrument was strongly supported by the intensive literature review and critiques by experts (Hudson, Skamp and Brooks, 2005). Therefore, in the current study, MEMT-Mentor instrument was assumed providing a good fit with the five-factor model.

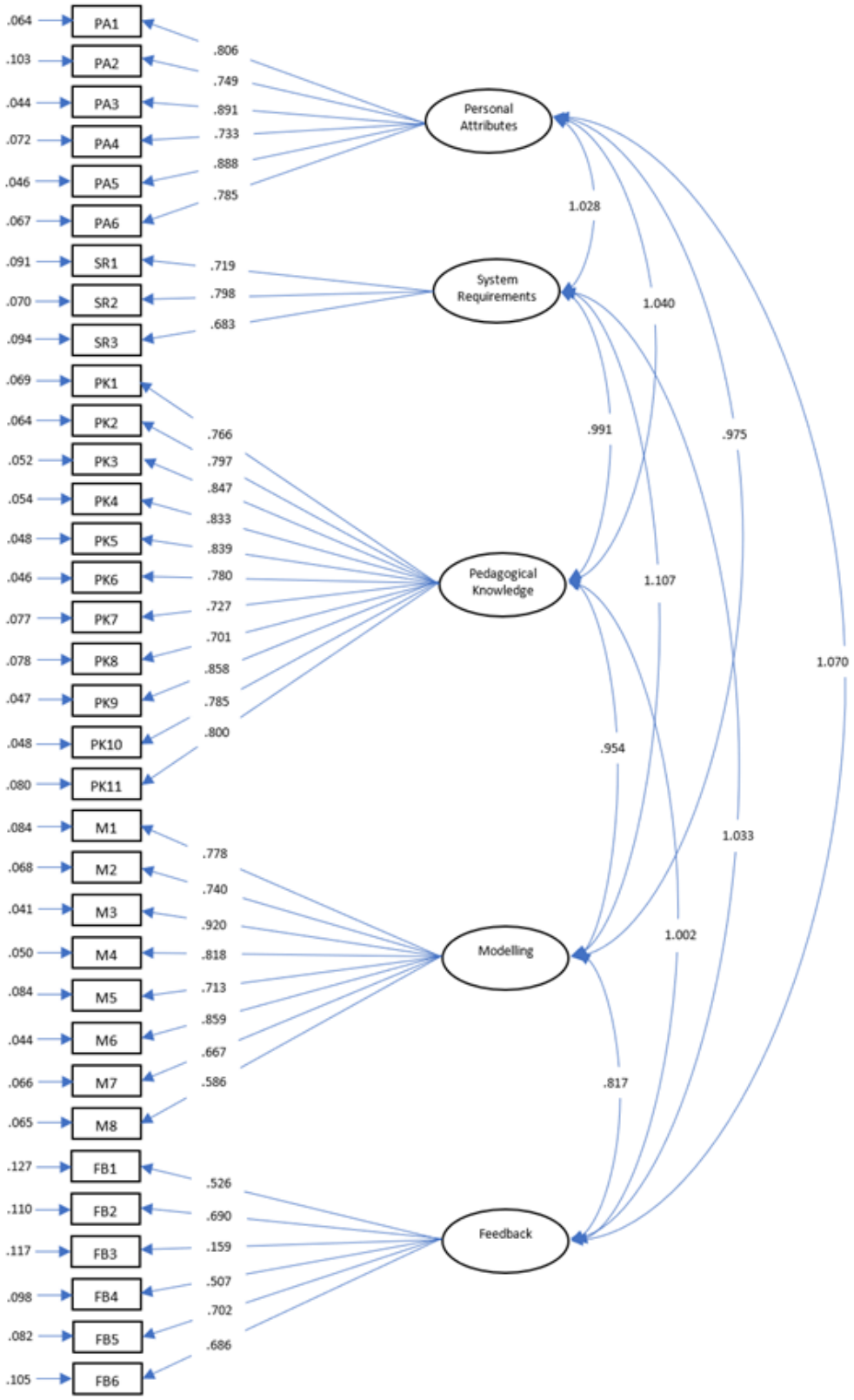

Figure 6.6. Five-factor mentoring model for MEMT-Mentor with standardized factor loadings and correlations.

Table 6.8. Average variance-extracted (AVE) estimates of five factors for MEMT-Mentor.

	Personal Attributes	System Requirements	Pedagogical Knowledge	Modelling	Feedback
AVE estimates	0.658	0.541	0.629	0.588	0.333

Table 6.9. The squared correlation matrix of five factors for MEMT-Mentor.

	Personal Attributes	System Requirements	Pedagogical Knowledge	Modelling	Feedback
Personal Attributes	1.000				
System Requirements	1.057	1.000			
Pedagogical Knowledge	1.081	0.982	1.000		
Modelling	0.950	1.225	0.910	1.000	
Feedback	1.145	1.067	1.004	0.667	1.000

6.2. Mentoring Triad

The current research mainly focused on effective mentoring practices and examined the interactions among the stakeholders of the mentoring process, namely the interactions between Mentor-Supervisor, Supervisor-Mentee and Mentee-Mentor within the context of mentoring. One can consider these three stakeholders as the vertices of a triangle with a centre of effective pre-service teacher practicum. Each of the sides of this triangles represents an interaction within school practicum:

- Supervisor-Mentor: their perceptions on mentoring practices and how these perceptions differ; how these stakeholders communicate about practicum, the school

and mentor selection process.

- Supervisor-Mentee: teaching practicum course requirements, applications and how practicum mentoring reflects in university practicum course.
- Mentor-Mentee: their perceptions on mentoring practices and how these perceptions differ; what the effective mentoring practices are.

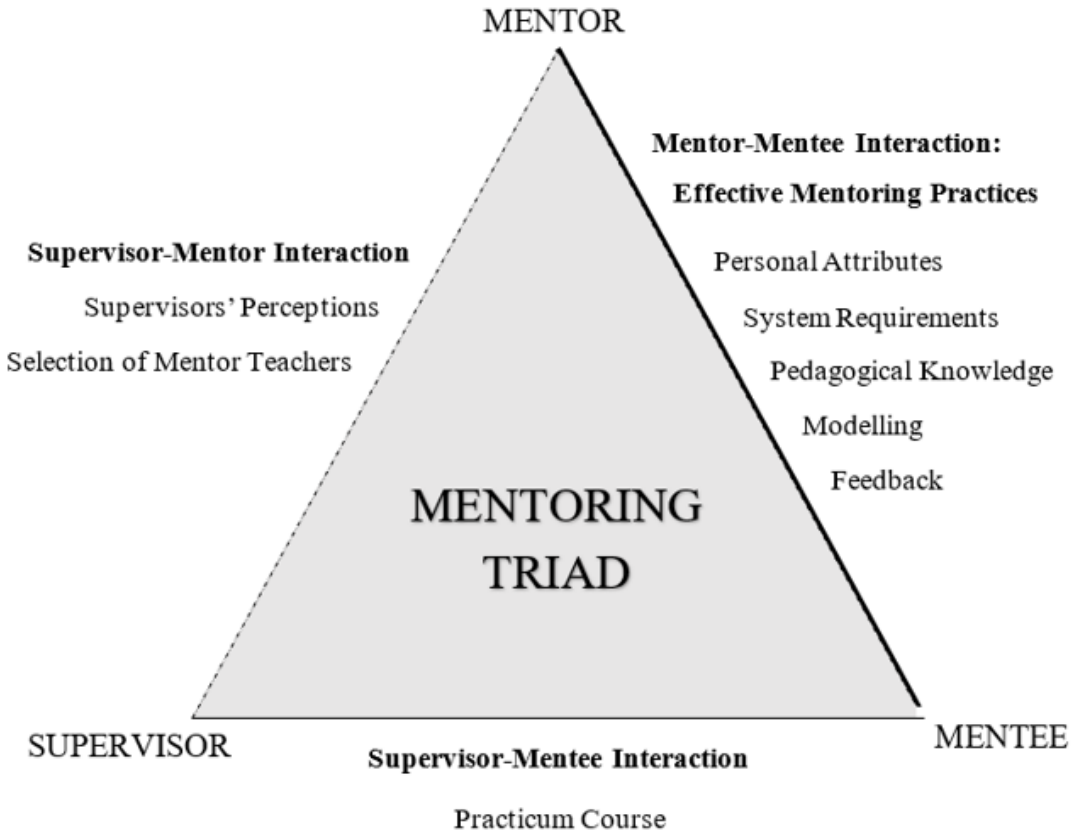

Figure 6.7. Mentoring Triad.

6.2.1. Supervisor-Mentor Interaction

The interaction between Supervisors and Mentors can be considered as part of a larger framework which is partnership between faculty and school. In this section, this interaction was presented in the context of mentoring, particularly, supervisors' perceptions on mentors' attributes and practices and selection of mentors along with practicum schools based on the thematic analysis of individual interviews with one supervisor from each university (n=6).

6.2.1.1. Supervisor's Perceptions. Supervisors' perceptions on mentors' personal attributes and practices related to system requirements, pedagogical knowledge, modelling and feedback were mostly based on mentees' reports and feedback, partly based on their own observations. All supervisors emphasized that mentors were "very experienced teachers" and stated that their personal characteristics were satisfactory. In general, they said that there was a mentor profile that communicates and guides mentees properly. However, they thought that the mentors helped the mentees "as far as possible", "within their own experience", that is, without relying on any criteria. In other words, there was no standardization for mentoring practices; thus, it cannot be said that all mentees were mentored based on the same objectives. The following provides some supporting views:

SV-3: Of course, I do not know how accurate it would be to say something about its (mentoring's) effectiveness. As a result, they all tried to assist in the scope of their own experience. I can say that they have good intentions, our mentor teachers... They helped as much as possible. I do not know because I did not meet them directly. However, in line with the feedback I received from the teacher candidates, I can say that they helped them in this process and approached them in good faith.

Although generally the profile of the mentors was supportive, supervisors also mentioned the presence of mentors' practices which do not model the communication and approach to the students well. The following statement from SV-6 provides an example of such practices:

SV-6: During the last fall, the mentor said, 'Now our lesson is in this class' and he entered that class sneeringly. Why? TM (Turkish-Mathematics equally weighted) class. I saw that when the mentor went there, "they don't know", whereas I believe that everyone learns, only enough concern is required.

Supervisors did not know much about mentors' practices involved in sharing information about the system requirements and discussing and modelling their pedagogical knowledge.

In the issue of feedback, it was stated that mentors mostly gave verbal feedback to mentees, made assessment from a digital system called "MEBBIS", and made weekly evaluations via a digital platform called "e-okul". However, supervisors thought that mentors gave verbal feedback based on their own experience, that is, without relying on a set of certain criteria. Also, many supervisors believed the process of assessment was not taken seriously and professionally. The following excerpt from SV-5 provides some insight:

SV-5: Mentor teachers signed the activities of the students, but I am not sure if they signed after reading or signed without reading. They also made weekly evaluations via e-school. The evaluations are based on the rating such as good, very good, acceptable and need to be supported. But it is not an objective assessment. For the student to get a high grade. The grades of one or two students are rated as acceptable not to get all of them have a grade of 100. Some of them get a grade of 95 or 96. So that, the grades are not questioned since it would not be possible for all students to be perfect. Some teachers see this as paperwork burden. They see this as a burden. Thus, I do not think the assessment is a very accurate assessment.

It has been observed that the perceptions of supervisors about mentoring attributes and practices was generally based on mentees' experiences. Therefore, there was a need to examine the interaction between supervisors and mentors in the process of internship, starting from the selection of practicum schools.

6.2.1.2. Selection of Mentor Teachers. In order to examine the interaction between supervisors and mentors, individual interviews with one supervisor from each university (n=6) was conducted. All the participants, except SV-1, pointed out the pedagogical formation unit or another unit rather than education faculty as responsible for selecting practicum schools for the internship of teacher candidates studying in pedagogical formation programs. SV-2 explained that the formation unit published a list of practicum schools and supervisors and did not know which school he was going to until the list was published. He added:

SV-2: As the process of determining the school in the formation is a bit difficult, as I said, the officers determine the schools and even in the determination of the teachers (supervisors), I did not know which school I would visit. But, when determining, they often contact the schools near the university.

Like SV-2, most participating supervisors indicated that the location of practicum schools was one of the initial criteria in selecting a school. Moreover, they expressed that they were not too much selective for practicum schools since teacher candidates would not be that much selective as a teacher after graduated. The views of SV-1 about selecting practicum schools are provided in the following:

SV-1: If our students are satisfied, if we are satisfied, we are trying to continue with that school. But, of course, we are not very selective in this regard. Because our students can go to any school when they graduate, they will not be so selective. Of course, location is important for us. We want them to be close to our school. In terms of both the students' and our transportation.

Mentor teachers were not particularly mentioned as a current criterion for selecting practicum schools. However, SV-5 touched on the significance of mentor selection:

SV-5: As a suggestion; extending the duration of this teaching practice, selection of schools, mentor selection... It is necessary to find some idealistic teachers who are willing to do this job (mentoring) in the idea that this is not only as an additional income, but also a contribution to the teachers who raise new generations. But the nature of the formation is the opposite. Because too many formation students are taken, too many teachers are needed.

These comments of SV-5 also points out the interaction between these stakeholders, yet it is found to be limited. The interaction between supervisors and mentors provides a bridge between faculties and practicum schools. Based on the thematic analysis, supervisors usually interacted with mentors when they came to the school to observe mentees' teaching practices. It was found that not all of these observa-

tions yielded to an interaction opportunity between supervisors and mentors to discuss mentees' performances or overall process of the practicum. For example, SV-2 gave an example of the discussion with a mentor on observation of mentee's teaching not as a routine practice but as a one unique example to remember.

SV-2: I just remember it. For example, we observe the lesson. The mentor teacher asked 'how you found, what do you think' or something for a student. I talked in general, I asked, 'what you think', and he said his own opinion. I said, 'please share this with the student in an appropriate way.

This means that the interaction between these two stakeholders are not well established with pre-determined practices. Only a few supervisors (two universities) expressed they went to the practicum school to meet mentors and organize the practicum program together with mentors and mentees. It was also realized from almost all the participating supervisors' expressions that there were some supervisors who could never visited the practicum school and, accordingly, they did not know mentors. This means that there was no interaction at all. SV-3 stated that she could not visit any practicum schools because of the high number of teacher candidates she supervised informally.

SV-3: Normally, we had to visit the students whom we advised within the scope of teaching practice course 4 times in one semester and listen to their teaching practices they had made in the school. But 120 teacher candidates... I have not been able to go even once. Obviously, I did not have a chance to go and meet with the mentors and observe their situation at the practice school.

Also, SV-3 expressed that some academic members from departments other than mathematics education were officially assigned as supervisors due to the limited number of mathematics educators (MoNE declares that each academic member can supervise a maximum of 8 mentees during the practicum process (MEB, 2018).), but the teacher candidates had no connection with their official supervisors. Most of the participating supervisors were aware of this situation occurring in some universities.

This also brings the discussion of selection of supervisors for formation teacher candidates. Based on the interviews with the supervisors, it is found that there are many supervisors from unrelated disciplines in order to fulfil 1-8 ratio of supervisor to mentee. The participating supervisors from Faculty of Education expressed that they did not support this situation. Yet, one participant (a member of the Faculty of Arts and Science) brought up another view on this issue; having supervisors not from teaching department of the discipline but supervisors from the Faculty of Arts and Sciences departments.

SV-6: In the past, they did not give us such jobs (supervising), were not giving it to a teacher who would do this job overenthusiastically. When they finally got stuck, they started giving something like that. What is right? Supervisors should be selected according to the branch of the teacher candidates.

6.2.2. Supervisor-Mentee Interaction

The practicum course provides the connection between supervisors and mentees. It contains two parts; the theoretical (lecture) part in which supervisors and mentees meet up and the practice part which mentees go to practicum schools to gain teaching experience. However, SV-6 said they had only the practice part of the practicum course for the pedagogical formation students. In this section, practicum course requirements and discussion of mentees' experiences at practicum schools in the scope of the practicum course were analysed based on supervisors' responses to the semi-structured individual interviews.

6.2.2.1. Practicum Course. The supervisors addressed the expectations from mentees in the scope of the practicum course. Almost all of them expressed that mentees were required to go to their practicum schools for six hours once a week and practice teaching at least four times. They stated that there was not the school experience course in the pedagogical formation programs, thus its requirements such as observing the school, teachers' practices and students' practices were also integrated in the practicum course.

Except SV-6, all the five supervisors expected the mentees to write weekly reports based on their observations and practices. In the lecture part of the course, they usually expected the mentees to discuss their experiences obtained from the practicum schools and talk about their reports. Unlike the others, SV-3 stated that she also initiated discussions on the factors improving the quality of mathematics teaching based on a theoretical framework and asked mentees to perform a fifteen-minute demo lesson in the practicum course since she could not visit the practicum schools to observe mentees' teaching practices.

SV-3: There is a theoretical framework called MQI, Mathematical Quality of Instruction, that is a framework for how we can evaluate the mathematical quality of a teaching or what characteristics a teaching should have as a quality teaching. A theory developed within the context of teachers, students and content. I wanted to talk about this theory as well, creating an environment for discussion. (...) During the course, throughout the semester, I felt that just sharing ideas would not be enough and I had to do some practical things. After the midterm exams, I asked each teacher candidate to explain a topic, a concept of mathematics they chose and prepared for 10-15 minutes in the classroom.

As a requirement of the practicum course, mentees were sharing their experiences at the practicum school on their weekly reports and/or in the classroom. Those experiences were including both effective and disappointing examples of mentors' attributes and practices. As interviewing with supervisors, most of them mentioned mentees' experiences shared on the reports or discussed in the classroom. SV-1 gave an example of effective mentoring practices related to modelling based on his students' experiences.

SV-1: Until now we have always had good feedback. And as I said, there are very interesting cases. We are very used to the direct instruction (traditional approach) of mathematics, but we had one teacher. He used a lot of game-based learning in the classroom. In other words, he created a positive environment for the children and the children enjoyed the lesson. I am talking about these according to the feedback from our own students.

Besides effective mentoring experiences, there were also some disappointing experiences about mentor attributes and practices. Supervisors emphasized that there were mentors in many different profiles based on the sharing of their students and SV-3 gave an extreme example of a practice that a mentor performed but should not.

SV-3: Let me give an example like this, I think this is an absurd example. I was very surprised when I heard it, I could not believe it. But really a teacher candidate faced such a situation. When he first went to school, to get to know each other, when no process has passed... When he first went to class, began to observe a lesson, his mentor's mother passed away and the mentor has told students how shrouded and washed her mother in the classroom and there were students in front of her and the teacher candidate entered to observe there and the mentor explained this at first. I was very surprised to hear that. So maybe she might be in pain, she may be going through a very troubled period, but I think that a teacher should never do this, a normal person should not do it in any way. I encountered such an example. This is of course a bad example.

6.2.3. Mentor-Mentee Interaction: Effective Mentoring Practices

In this section, the interaction between mentors and their mentees will be reported from three data sources: supervisors' insights on mentor-mentee interaction, MEMT instruments (Mentor and Mentee) and open-ended questions on exemplary mentoring practices (Mentor and Mentee). The last two results will be discussed based on each factor of Five-Factor Mentoring Model.

To start with, the analysis of the semi-structured individual interviews with the supervisors (n=6) showed that the participating supervisors evaluated school profile and mentee qualifications as factors affecting the interaction between mentors and mentees. Some supervisors, whose mentees were practicing at "good high schools" (Selective Anatolian High Schools) argued that the university entrance exam leads mentors to focus on solving more questions for their students and to place modelling effective teaching for mentees behind. SV-5 expressed that "*as long as there is the*

university entrance exam that students have to take at the end of high school", he believed "*it is difficult for teachers (mentors) to show teacher candidates an example of effective teaching*" since "*the more questions you solve, the better teacher you become*" as a common conception. As another example, SV-1 believed that mentors do not trust mentees and allow them to teach 12th graders who are preparing for the university entrance exam.

SV-1: Obviously, when we go to that type of school (Anatolian high schools), teachers have trouble trusting our students (pre-service teachers). We can say that they have good reasons. Students are eager to learn, particularly twelfth graders. In short, let us say they do not allow them to be in their 12th grade courses.

On the other side, the supervisors, whose mentees were practicing at vocational high schools or public schools in which students with low achievement level were enrolled, argued that some factors such as classroom atmosphere and students' level of readiness in such schools may affect teachers' mentoring practices. As responding the questions asking teachers' mentoring practices, SV-2 stated the following excerpt and emphasized mentor teachers' weariness.

SV-2: Teachers do not have such a motivation for anything extra. Even if they have, the classroom atmosphere, teaching, teaching processes are not at a level to allow it. They do less than they can do. Teachers are already worn out due to the difficulty of keeping discipline at school and the low level of students' readiness.

As another example, SV-4 particularly pointed out students' level of readiness as a factor affecting mentors' practices related to modelling.

SV-4: Now a teacher... If the students do not know the numbers... Let us assume that she/he works in a school with a low socioeconomic level... The student who came there may not know the numbers exactly. Now, how can we tell this teacher that 'get students solve many questions.' Now this teacher will teach the learning steps below so that she/he comes to the topic she/he will teach. Therefore, I cannot condemn the

teacher at this point too much on the grounds that they do not show different strategies for our children (mentee).

Mentees who studying a pedagogical formation program were usually final year students in or graduated from the undergraduate mathematics program. During the semi-structured interviews, most of the supervisors had a tendency to compare mentees enrolling a pedagogical formation program with the ones studying an undergraduate program of mathematics education. SV-3 stated:

SV-3: I believe there is a great difference between an undergraduate student who has studied mathematics teaching and a formation student logically, mentally and in terms of practice.

SV-2 expressed that students of the Faculty of Education were more ready to become a teacher and mentors' expectation from mentees studying pedagogical formation program were lower, which affects mentors' practices. The supervisor emphasized that those mentees studying pedagogical formation program were not qualified to do extra work assigned by mentors.

SV-2: Now, because the teacher candidates who graduate from or study at the Faculty of Education have completed that mental process that they can be a teacher for 4 years or are raised in such an atmosphere. They are different. Of course, when considering the university entrance scores, there is also a difference. Formation students' score is far behind. When this is the case, it would be a little difficult for the mentors to request something extra from the formation students and to perform practices accordingly. There is nothing going on even if they want to, because formation students do not have such features.

As the quotes show, supervisors viewed the school profile and mentee qualifications as factors affecting the interaction between mentors and mentees. However, the fundamental stakeholders of this interaction are mentors and mentees. The following quantitative and qualitative data provide their insights on the mentoring practices.

The quantitative data were obtained from the MEMT-Mentor and MEMT-Mentee instruments and the qualitative data were obtained from the open-ended questions on exemplary mentoring practices. In order to examine mentors' and mentees' perspectives on mentoring practices, quantitative and qualitative findings will be presented together for each factor of Five-Factor Mentoring Model.

In the quantitative part, there were 54 mentor participants (Females=28, Males=26) and 246 mentee participants (Females=192, Males=53). Their perceptions of mentoring practices were presented separately in terms of minimum and maximum scores, means and standard deviations of the data within five-factors; *personal attributes, system requirements, pedagogical knowledge, modelling and feedback* (Table 6.10, Table 6.11).

Table 6.10. Mentors' perceptions on five factors of mentoring.

	Mentors (n=54, Females=28, Males=26)			
Five Factors of Mentoring Score	Minimum Score	Maximum Score	Mean Score	SD
Personal Attributes	3.50	5.00	4.70	0.39
System Requirements	3.00	5.00	4.50	0.55
Pedagogical Knowledge	3.45	5.00	4.56	0.44
Modelling	3.00	5.00	4.46	0.48
Feedback	3.00	5.00	4.62	0.43

According to the minimum scores (3.00 to 3.50) presented in Table 6.10, there are some mentors who were not certain if they displayed some mentoring practices. Nevertheless, minimum scores (3.00 to 3.50), mean scores (4.46 to 4.70) and standard deviations (0.39 to 0.55) indicated that the majority of mentors "agreed" or "strongly agreed" that they exhibited effective mentoring practices associated with personal attributes (M=4.70, SD=0.39), feedback (M=4.62, SD=0.43), pedagogical knowledge (M=4.56, SD=0.44), system requirements (M=4.50, SD=0.55) and modelling (M=4.46, SD=0.48).

Table 6.11. Mentees' perceptions on five factors of mentoring.

	Mentees (n=246, Females=192, Males=53)			
Five Factors of Mentoring	Minimum Score	Maximum Score	Mean Score	SD
Personal Attributes	1.00	5.00	4.20	0.85
System Requirements	1.00	5.00	3.97	0.97
Pedagogical Knowledge	1.00	5.00	4.02	0.91
Modelling	1.00	5.00	4.01	0.87
Feedback	1.00	5.00	3.95	0.95

The results in Table 6.11 indicates that mentees typically perceived their mentors to exhibit effective personal attributes (M=4.20, SD=0.85) in comparison to other practices on system requirements (M=3.97, SD=0.97), pedagogical knowledge (M=4.02, SD=0.91), modelling (M=4.01, SD=0.87) and feedback (M=3.95, SD=0.95). The standard deviations of each factor vary between 0.85 and 0.97.

Regarding the qualitative data, mentors' and mentees' responses to the questionnaire asking for their experiences they regarded as "effective mentoring practices" were analysed quantitatively. In total, out of 54, 30 mentors' responses to the questionnaire were analysed via open coding, since 6 mentors' answers were not meaningful and 18 mentors did not respond to the question. It is also important to note that when the expressions of mentors in the open-ended questionnaire were examined, many mentors preferred the verbs such as "teach" and "warn" rather than "help" or "discuss" which are preferred in the instruments. Even though they preferred a verb connoting a less-collaborative approach, the sentences were coded under the related items as in the instruments. Out of 246, 118 mentees responded to the questionnaire, but 102 responses were analysed since 16 were not meaningful. The categories obtained from coding were collected under the themes *of Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback*. Table 6.12 indicates separately the percentage of mentors and mentees who gave an example of mentoring practices related to the factors of Five-Factor Mentoring Model.

Table 6.12. Mentors' and mentees' exemplars of mentoring practices related to five factors.

Five Factors of Mentoring	Mentors (%*)	Mentees (%*)
Personal Attributes	14.8%	6.91%
System Requirements	0%	0.41%
Pedagogical Knowledge	20.4%	4.88%
Modelling	13.0%	24.0%
Feedback	16.7%	10.2%
*Percentage of mentors/mentees giving an example of mentoring practices related to the specific mentoring factors.		

As shown on the Table 6.12, most of the participating mentors (20.4%) gave typical examples related to their mentoring practices associated with pedagogical knowledge whereas only 4.88% of mentees shared their experiences of mentoring practices on pedagogical knowledge as effective mentoring practices. Mentees (24.0%) mostly stated modelling practices they received as effective mentoring practices. However, the percentage of both mentors and mentees who gave examples related to system requirements was not satisfactory.

In order to examine each of the five factors in more detailed manner, the findings from both quantitative and qualitative data sources for mentors and mentees will be presented together. Under each factor, firstly, mentors' perceptions on their own mentoring practices by examining item statistics (median, range and percentage of participants who either "agreed" or "strongly agreed") and examples of effective mentoring practices will be presented. Then, mentees' perceptions on their mentors' practices by examining item statistics (median, range and percentage of participants who either "agreed" or "strongly agreed") and examples of effective mentoring practices will be presented.

6.2.3.1. Personal Attributes. Starting with the quantitative data obtained from MEMT-Mentor instrument, Table 6.13 presents that median scores (5.00), ranges (1.00 to 3.00) and percentages of mentors who either "agreed" or "strongly agreed" that they provided each specific mentoring practice related to personal attributes.

Table 6.13. Mentors' perceptions: Personal attributes.

Mentoring Practices	Median	Range	Percentage*
Supportive	5.000	2.000	96.3%
Comfortable in talking	5.000	1.000	100%
Instilled positive	5.000	2.000	94.4%
Assisted in reflecting	5.000	2.000	98.2%
Instilled confidence	5.000	3.000	92.6%
Listened attentively	5.000	2.000	98.2%
*Percentage of mentors who either "agreed" or "strongly agreed" they provided that specific mentoring practice			

The percentages of mentors believing that they provided the personal attributes specified by the 6 items were all above 90%. That is, all of the mentors claimed that they were comfortable in talking with the mentee about mathematics teaching, 98% of mentors assisted the mentee in reflecting to improve mathematics teaching practices and listened attentively to the mentee on mathematics teaching matters, 96% of them were supportive of the mentee and 94% instilled positive attitudes for teaching mathematics. Also, 93% made the mentee feel more confident as a teacher of mathematics.

When considering the qualitative data obtained from the open-ended question, Table 6.14 shows typical mentoring practices related to personal attributes along with the frequency and percentage of mentors who stated that they had specifically implemented those practices. Eight mentors out of 54 (14.8%) expressed their practices associated with personal attributes as effective mentoring practices. In particular, they believed that they made the mentee feel confident as a mathematics teacher (11.1%)

and was supportive of mentee for teaching mathematics (5.56%) and only one mentor stated instilling positive attitudes for teaching mathematics as his/her effective mentoring practice (1.85%).

Table 6.14. Mentors' exemplars: Personal attributes.

Mentoring Practices	**Mentor Labels**	**Frequency**	**%**
rPA1: (I) was supportive of the mentee for teaching mathematics.	Mentor 16, 21, 32	3	5.56%
rPA3: (I) instilled positive attitudes in the mentee for teaching mathematics.	Mentor 42	1	1.85%
rPA5: (I) made the mentee feel more confident as a mathematics teacher.	Mentor 10, 11, 16, 19, 21, 43	6	11.1%
Exemplars of effective mentoring practices related to personal attributes	Mentor 10, 11, 16, 19, 21, 32, 42, 43	8	14.8%

The following quantitative and qualitative data provide insights into mentees' perceptions and exemplars related to their mentors' personal attributes. About the quantitative data, Table 6.15 provides median scores (4.00 to 5.00), ranges (4.00) and percentages of mentees who either "agreed" or "strongly agreed" that their mentors provided each specific mentoring practice related to mentors' personal attributes.

Table 6.15. Mentees' perceptions: Personal attributes.

Mentoring Practices	Median	Range	Percentage*
Supportive	4	4	84.9%
Comfortable in talking	5	4	89.8%
Instilled positive	4	4	82.1%
Assisted in reflecting	4	4	79.7%
Instilled confidence	4	4	77.3%
Listened attentively	4	4	83.4%
*Percentage of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.			

According to the analysis of the mentees' perceptions on their mentors' personal attributes, a majority of mentors (90%) appeared comfortable in talking about mathematics teaching and 85% of mentors were supportive for their mentees' mathematics teaching. In addition, 83% of mentees perceived that their mentors listened attentively to them on mathematics teaching matters and 82% believed that their mentors instilled positive attitudes towards teaching mathematics. However, about 20% of mentees did not agree that their mentors aided them to reflect on their mathematics teaching practices (80% of mentors agreed/strongly agreed their mentors facilitated this practice) and instilled confidence for teaching mathematics (77% agreed/strongly agreed).

On the issue of the qualitative data obtained from mentees, Table 6.16 shows mentees' typical mentoring experiences related to personal attributes along with the frequency and percentage of mentees who stated that they had experienced those practices. Seventeen mentees out of 246 (6.91%) expressed their mentors' practices associated with personal attributes as effective mentoring practices. The findings illustrated that "instilling confidence" was the most common mentoring practice related to personal attributes, so that 11 mentees had experienced it. This was followed by "being supportive for teaching mathematics" experienced by 4 mentees. There were also few mentees who expressed "being comfortable in talking", "instilling positive attitudes", "assisting in reflecting", and "listening attentively" as effective mentoring practices their mentors performed.

Table 6.16. Mentees' exemplars: Personal attributes.

Mentoring Practices	**Mentee Labels**	**Frequency**	**%**
ePA1: (My mentor) was supportive of me for teaching mathematics.	Mentee18, 42, 102, 215	4	1.63%
ePA2: (My mentor) seemed comfortable in talking with me about mathematics teaching.	Mentee10	1	0.41%
ePA3: (My mentor) instilled positive attitudes in me towards teaching mathematics.	Mentee213	1	0.41%
ePA4: (My mentor) assisted me to reflect on improving my mathematics teaching practices.	Mentee19, 94	2	0.81%
ePA5: (My mentor) made me feel more confident as a mathematics teacher	Mentee5, 23, 25, 48, 102, 112, 114, 128, 150, 207, 215	11	4.47%
ePA6: (My mentor) listened to me attentively on mathematics teaching matters.	Mentee215	1	0.41%
Mentee experiences of effective mentoring practices related to personal attributes	Mentee5, 10, 18, 19, 23, 25, 42, 48, 94, 102, 112, 114, 128, 150, 207, 213, 215	17	6.91%

6.2.3.2. System Requirements. In accordance with the quantitative data obtained from mentors, Table 6.17 provides median scores (5.00), ranges (2.00 to 4.00) and percentages of mentors who either "agreed" or "strongly agreed" that they provided each specific mentoring practice associated with system requirements.

Table 6.17. Mentors' perceptions: System requirements.

Mentoring Practices	Median	Range	Percentage*
Discussed policies	5.00	4.00	88.9%
Outlined curriculum	5.00	2.00	96.3%
Discussed aims	5.00	2.00	87.0%
*Percentage of mentors who either "agreed" or "strongly agreed" they provided that specific mentoring practice			

Most of the mentors agreed or strongly agreed that they outlined the mathematics curriculum to the mentee (96.3%). Around 90% of mentors claimed that they discussed school policies and aims of teaching mathematics with the mentee. However, there were no mentors evaluating mentoring practices related to system requirements as an effective mentoring practice in the qualitative data.

The following quantitative and qualitative data provide insights into mentees' perceptions and experiences of mentoring practices aligned with system requirements. Table 6.18 provides median scores (4.00), ranges (4.00) and percentages of mentees who either "agreed" or "strongly agreed" that their mentors provided each specific mentoring practice associated with system requirements.

Table 6.18. Mentees' perceptions: System requirements.

Mentoring Practices	Median	Range	Percentage*
Discussed policies	4.00	4.00	70.7%
Outlined curriculum	5.00	4.00	74.0%
Discussed aims	4.00	4.00	77.2%
*Percentage of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.			

The percentage of mentees claiming that their mentors provided some mathematics mentoring practices related to system requirements varies in between 70% and 80%. To illustrate, 77% of mentors discussed aims for teaching mathematics, 74% of them outlined mathematics curriculum and 71% discussed the school policies used for mathematics teaching.

However, according to the qualitative data, only one mentee, Mentee74, mentioned the mentoring experience related to system requirements (Table 6.19). Mentee74 viewed her/his mentor's practice of outlining curriculum as an effective mentoring practice.

Table 6.19. Mentees' exemplars: System requirements.

Mentoring Practices	**Mentee Labels**	**Frequency**	**%**
eSR2: (My mentor) outlined the mathematics curriculum to me.	Mentee74	1	0.41%
Mentee experiences of effective mentoring practices related to system requirements	Mentee74	1	0.41%

6.2.3.3. Pedagogical Knowledge. Starting with the quantitative data obtained from mentors, Table 6.20 provides median scores (4.50 to 5.00), ranges (2.00 to 3.00) and percentages of mentors who either "agreed" or "strongly agreed" that they provided each specific mentoring practice aligned with pedagogical knowledge.

Table 6.20. Mentors' perceptions: Pedagogical knowledge.

Mentoring Practices	Median	Range	Percentage*
Guided preparation	5.00	2.00	92.6%
Assisted with classroom management	5.00	2.00	94.5%
Assisted with implementing teaching strategies	5.00	2.00	96.3%
Assisted with timetabling	5.00	2.00	98.2%
Developed teaching strategies	4.50	2.00	87.0%
Discussed questioning skills	5.00	2.00	98.1%
Discussed content knowledge	5.00	2.00	98.1%
Guided planning	4.50	3.00	92.6%
Provided strategies to solve teaching problems	5	3	90.7%
Provided new viewpoints	5.00	2.00	87.0%
Discussed assessment	5.00	2.00	96.3%
*Percentage of mentors who either "agreed" or "strongly agreed" they provided that specific mentoring practice			

According to the mentors' perceptions, almost all of the mentors assisted the mentee with timetabling their mathematics lessons (98%), implementing mathematics

teaching practices (96%) and classroom management strategies (95%) and discussed with the mentee questioning techniques for effective mathematics teaching (98%), the knowledge the mentee needed for teaching mathematics (98%) and assessment for the students' learning of mathematics (96%). Moreover, 93% agreed or strongly agreed that they guided the mentee with mathematics lesson preparation and planning to teach mathematics. In addition, 91% of mentors provided strategies to solve the mentee's problems about mathematics teaching, 87% developed their mentees' strategies for teaching mathematics and gave them new viewpoints on teaching mathematics.

When it comes to the qualitative data obtained from mentors, Table 6.21 shows typical mentoring practices related to pedagogical knowledge along with the frequency and percentage of mentors who stated that they had specifically implemented those practices. It indicates that 11 mentors out of 54 (20.4%) expressed their practices associated with pedagogical knowledge as effective mentoring practices. In particular, they believed that they assisted the mentee with implementing classroom management (5.56%) and mathematics teaching strategies (3.70%), developed the mentee's strategies for teaching mathematics (3.70%) and discussed with the mentees the knowledge they needed for teaching mathematics (5.56%). Apart from the practices placed in the Five-Factor Mentoring Model, two mentors (3.70%) stated that they assisted the mentees with implementing teaching strategies for special education students.

Table 6.21. Mentors' exemplars: Pedagogical knowledge.

Mentoring Practices	**Mentor Labels**	**Frequency**	**%**
rPK2: (I) assisted the mentee with classroom management strategies.	Mentor6, 36, 45	3	5.56%
rPK3: (I) assisted the mentee with implementing mathematics teaching strategies.	Mento30, 48	2	3.70%
rPK5: (I) developed the mentee's strategies for teaching mathematics.	Mentor4, 48	2	3.70%
rPK7: (I) discussed with the mentee the knowledge the mentee needed for teaching mathematics.	Mentor15, 27, 49	3	5.56%
(I) assisted the mentee with implementing teaching strategies for special education.	Mentor22, 40	2	3.70%
Exemplars of effective mentoring practices related to pedagogical knowledge.	Mentor4, 6, 15, 22, 27, 30, 36, 40, 45, 48, 49	11	20.4%

The following quantitative and qualitative data provide insights into mentees' perceptions and experiences of mentoring practices aligned with pedagogical knowledge. About the quantitative data, Table 6.22 provides median scores (4.00), ranges (4.00) and percentages of mentees who either "agreed" or "strongly agreed" that their mentors provided each specific mentoring practice associated with pedagogical knowledge.

Table 6.22. Mentees' perceptions: Pedagogical knowledge.

Mentoring Practices	Median	Range	Percentage*
Guided preparation	4.00	4.00	81.3%
Assisted with classroom management	4.00	4.00	80.1%
Assisted with implementing teaching strategies	4.00	4.00	78.1%
Assisted with timetabling	4.00	4.00	76.5%
Developed teaching strategies	4.00	4.00	76.4%
Discussed questioning skills	4.00	4.00	75.7%
Discussed content knowledge	4.00	4.00	76.9%
Guided planning	4.00	4.00	77.2%
Provided strategies to solve teaching problems	4	4	75.6%
Provided new viewpoints	4.00	4.00	67.8%
Discussed assessment	4.00	4.00	77.3%
*Percentage of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.			

According to the mentees' perceptions, 81% of mentors guided their mentees for mathematics lesson preparation and 80% assisted their mentees with classroom management strategies for mathematics teaching. Yet, more than 20% of mentees may not have been provided with some mentoring practices. For example, 78% of mentees perceived that their mentors assisted them towards implementing mathematics teaching strategies. In addition, 77% of mentees believed that their mentors assisted them with timetabling mathematics lessons of mentees, guided clearly for planning to teach mathematics and discussed the knowledge mentees needed for mathematics teaching and how to assess the students' learning of mathematics. Moreover, 76% of

mentees agreed that their mentors developed mentees' mathematics teaching strategies, discussed questioning skills for effective mathematics teaching and provided strategies to solve mentees' problems about teaching mathematics. Among the practices related to pedagogical knowledge, the least perceived practice of mentor teachers was providing new viewpoints on teaching mathematics (68%).

Regarding the qualitative data obtained from mentees, Table 6.23 shows typical mentoring practices related to pedagogical knowledge along with the frequency and percentage of mentees who stated that they had experienced those practices. It indicates that 12 mentees out of 246 (4.88%) expressed their mentors' practices associated with pedagogical knowledge as effective mentoring practices. Among the practices related to pedagogical knowledge, the number of mentees (5) who viewed "assisting with classroom management" as effective mentoring practice was the most. This was followed by "developing teaching strategies" which had experienced by 3 mentees. There were also few mentees who expressed "guiding preparation", "providing strategies to solve teaching problems", "providing new viewpoints", and "discussing assessment" as effective mentoring practices their mentors performed.

Table 6.23. Mentees' perceptions: Pedagogical knowledge.

Mentoring Practices	**Mentee Labels**	**Frequency**	**%**
ePK1: (My mentor) guided me with mathematics lesson preparation.	Mentee124	1	0.41%
ePK2: (My mentor) assisted me with classroom management strategies for mathematics teaching.	Mentee20, 103, 121, 127, 229	5	2.03%
ePK5: (My mentor) developed my *strategies for teaching mathematics.*	Mentee44, 45, 74	3	1.22%
ePK9: (My mentor) provided strategies for me to solve my mathematics teaching problems.	Mentee158	1	0.41%
ePK10: (My mentor) gave me new viewpoints on teaching mathematics	Mentee80, 146	2	0.81%
ePK11: (My mentor) showed me how to assess the students' learning of mathematics.	Mentee228	1	0.41%
Mentee experiences of effective mentoring practices related to pedagogical knowledge	Mentee20, 44, 45, 74, 80, 103, 124, 127, 146, 158, 228, 229	12	4.88%

6.2.3.4. Modelling. In regards to the quantitative data of mentors, Table 6.24 provides median scores (4.00 to 5.00), ranges (2.00 to 4.00) and percentages of mentors who either "agreed" or "strongly agreed" that they provided each specific mentoring practice related to modelling.

Table 6.24. Mentors' perceptions: Modelling.

Mentoring Practices	Median	Range	Percentage*
Used syllabus language	5.00	2.00	96.3%
Modelled mathematics teaching	5.00	3.00	87.1%
Modelled rapport with students	5.00	2.00	94.4%
Displayed enthusiasm	5.00	3.00	94.4%
Modelled classroom management	5.00	2.00	98.1%
Effective in mathematics teaching	4.00	3.00	90.7%
Used hands-on materials	4.00	4.00	81.4%
Had well-designed activities	4.50	4.00	88.9%
*Percentage of mentors who either "agreed" or "strongly agreed" they provided that specific mentoring practice			

Many mentors believed that they modelled effective classroom management (98%), used syllabus language (96%), modelled rapport with students (94%) and displayed enthusiasm when modelling mathematics teaching (94%). Even though 91% of mentor perceived that they were effective in mathematics teaching, the percentage of mentors believing that they modelled mathematics teaching was slightly lower (87%). In addition, considering mentors' perceptions on their modelling practices, the percentage of mentors who perceived themselves to use hands-on materials was the least one (81%).

Concerning the qualitative data of mentors, Table 6.25 presents typical mentoring practices related to modelling along with the frequency and percentage of mentors who stated that they had specifically implemented those practices. It indicates that 7 mentors out of 54 (13%) expressed their practices associated with modelling as effective mentoring practices. In particular, four mentors believed that they modelled effective

classroom management (7.41%) and another mentor, Mentor11, stated that he/she modelled mathematics teaching. Apart from the modelling practices placed in the Five-Factor Mentoring Model, a mentor expressed that he/she implemented some teaching strategies for special education students; and also, another mentor stated that he/she used technology for mathematics teaching as an effective mentoring practice.

Table 6.25. Mentors' exemplars: Modelling.

Mentoring Practices	**Mentor Labels**	**Frequency**	**%**
rM2: (I) modelled mathematics teaching.	Mentor11	1	1.85%
rM5: (I) modelled effective classroom management when teaching mathematics.	Mentor13, Mentor20, Mentor45, Mentor46	4	7.41%
(I) modelled teaching strategies for special education.	Mentor40	1	1.85%
(I) modelled the use of technology in education.	Mentor39	1	1.85%
Exemplars of effective mentoring practices related to modelling.	Mentor11, Mentor13, Mentor20, Mentor39, Mentor40, Mentor45, Mentor46	7	13.0%

The following quantitative and qualitative data provide insights into mentees' perceptions and experiences of mentoring practices aligned with modelling. In relation to the quantitative data, Table 6.26 provides median scores (4.00 to 5.00), ranges (4.00) and percentages of mentees who either "agreed" or "strongly agreed" that their mentors provided each specific mentoring practice associated with modelling.

Table 6.26. Mentees' perceptions: Modelling.

Mentoring Practices	Median	Range	Percentage*
Used syllabus language	4.00	4.00	87.4%
Modelled mathematics teaching	4.00	4.00	69.1%
Modelled rapport with students	4.00	4.00	82.5%
Displayed enthusiasm	5.00	4.00	79.7%
Modelled classroom management	4.00	4.00	74.0%
Effective in mathematics teaching	4.00	4.00	83.7%
Used hands-on materials	4.00	4.00	59.4%
Had well-designed activities	4.00	4.00	63.4%
*Percentage of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.			

Out of eight practices, modelling syllabus language (87%), effective mathematics teaching (84%), rapport with students (83%), enthusiasm (80%) and effective classroom management (74%) were perceived to be mostly exhibited by mentors. Even though the majority of mentees believed that mentors were effective in mathematics teaching, the percentage of mentees believing that their mentors modelled mathematics teaching was lower (69%). Moreover, over 35% of mentees claimed that their mentors neither had well-designed mathematics activities nor used hands-on materials in the lesson.

Upon the qualitative data of mentees, Table 6.27 shows some typical mentoring practices related to modelling along with the frequency and percentage of mentees who stated that they had experienced those practices. In total, the number of mentees who expressed modelling practices as effective mentoring practices was 59 out of 246 (24.0%). The findings illustrated that most of mentees evaluated mentors' relationships with the students and their classroom management strategies as effective mentoring practices. So that 23 mentees stated that their mentors "had a good rapport with the students", and 29 expressed that their mentors "modelled effective classroom management". These were followed by "modelling mathematics teaching" experienced by

8 mentees and "being effective in teaching mathematics" experienced by 4 mentees. There were also 2 mentees who expressed "displaying enthusiasm when teaching mathematics", as effective mentoring practices their mentors performed. Apart from the modelling practices placed in the Five-Factor Mentoring Model, a mentee expressed that his/her mentor modelled behaviour management strategies for special education; and also, another mentee viewed his/her mentor's use of technology as an effective mentoring practice.

Table 6.27. Mentees' exemplars: Modelling.

Mentoring Practices	**Mentee Labels**	**Frequency**	**%**
eM2: (My mentor) modelled mathematics teaching.	Mentee9, 15, 82, 110, 191, 193, 245, 246	8	3.25%
eM3: (My mentor) had a good rapport with the students learning mathematics.	Mentee39, 41, 55, 58, 61, 65, 75, 88, 93, 99, 100, 101, 107, 109, 118, 123, 136, 216, 217, 220, 223, 230, 239	23	9.35%
eM4: (My mentor) displayed enthusiasm when teaching mathematics.	Mentee61, 115	2	0.81%
eM5: (My mentor) modelled effective classroom management when teaching mathematics.	Mentee31, 37, 50, 55, 62, 64, 84, 107, 109, 111, 130, 131, 142, 151, 164, 169, 183, 187, 188, 189, 194, 195, 198, 210, 212, 219, 220, 239, 247	29	11.8%
eM6: (My mentor) was effective in teaching mathematics.	Mentee41, 61, 64, 70	4	1.63%
(My mentor) modelled behaviour management strategies for special education.	Mentee4	1	0.41%
(My mentor) modelled the use of technology in education.	Mentee218	1	0.41%
Mentee experiences of effective mentoring practices related to modelling	Mentee4, 9, 15, 31, 37, 39, 41, 50, 55, 58, 61, 62, 64, 65, 70, 75, 82, 84, 88, 93, 99, 100, 101, 107, 109, 110, 111, 115, 118, 123, 130, 131, 136, 142, 151, 164, 169, 183, 187, 188, 189, 191, 193, 194, 195, 198, 210, 212, 216, 217, 218, 219, 220, 223, 230, 239, 245, 246, 247	59	24.0%

6.2.3.5. Feedback. Pertaining to the quantitative data of mentors, Table 6.28 provides median scores (5.00), ranges (1.00 to 4.00) and percentages of mentors who either

"agreed" or "strongly agreed" that they provided each specific mentoring practice associated with feedback.

Table 6.28. Mentors' perceptions: Feedback.

Mentoring Practices	Median	Range	Percentage*
Discussed evaluation on teaching	5.00	3.00	96.3%
Provided oral feedback	5.00	4.00	98.1%
Provided written feedback	4.00	4.00	55.6%
Reviewed lesson plans	5.00	3.00	87.1%
Articulated what the mentee needed	5.00	3.00	92.6%
Observed teaching for feedback	5.00	1.00	100%
*Percentage of mentors who either "agreed" or "strongly agreed" they provided that specific mentoring practice			

In accordance with the mentors' perceptions, all of them provided the mentee feedback after observing mentees' teaching and 98% gave oral feedback. Ninety-six percent pf mentors claimed that they discussed the evaluation of the mentee's mathematics teaching and ninety-three percent of mentors perceived that they articulated what the mentee needed to do to improve their mathematics teaching. Moreover, less than 90% of mentors perceived that they reviewed the mentee's lesson plans (87%).

When it comes to the qualitative data of mentors, Table 6.29 presents typical mentoring practices related to feedback along with the frequency and percentage of mentors who stated that they had specifically implemented those practices. It indicates that 9 mentors out of 54 (16.7%) evaluated their practices associated with feedback as effective mentoring practices. In particular, eight mentors expressed that they provided feedback after observing the mentee's mathematics teaching (14.8%), four mentors stated that they discussed the evaluation of the mentee's mathematics teaching (7.41%) and only two mentors reviewed their mentees' lesson plans before teaching mathematics.

Table 6.29. Mentors' exemplars: Feedback.

Mentoring Practices	**Mentor Labels**	**Frequency**	**%**
rFB1: (I) discussed evaluation of the mentee's mathematics teaching.	Mentor2, 24, 26, 31	4	7.41%
rFB4: (I) reviewed the mentee's mathematics lesson plans before teaching mathematics.	Mentor12, 48	2	3.70%
rFB6: (I) observed the mentee's teaching mathematics before providing feedback.	Mentor2, 12, 24, 26, 31, 44, 49, 50	8	14.8%
Exemplars of effective mentoring practices related to feedback.	Mentor2, 12, 24, 26, 31, 44, 48, 49, 50	9	16.7%

The following quantitative and qualitative data provide insights into mentees' perceptions and experiences of mentoring practices aligned with feedback. Regarding the quantitative data, Table 6.30 provides median scores (4.00 to 5.00), ranges (4.00) and percentages of mentees who either "agreed" or "strongly agreed" that their mentors provided each specific mentoring practice related to feedback.

Table 6.30. Mentees' perceptions: Feedback.

Mentoring Practices	Median	Range	Percentage*
Discussed evaluation on teaching	4.00	4.00	80.5%
Provided oral feedback	5.00	4.00	84.5%
Provided written feedback	4.00	4.00	53.2%
Reviewed lesson plans	4.00	4.00	73.2%
Articulated what the mentee needed	4.00	4.00	70.3%
Observed teaching for feedback	5.00	4.00	82.1%
*Percentage of mentees who either "agreed" or "strongly agreed" their mentor provided that specific mentoring practice.			

In accordance with the mentees' perceptions, 85% of the mentors provided oral feedback. However, almost half of them provided written feedback on their mentees' mathematics teaching, which shows that oral feedback is more representative mentoring practice than written feedback. In addition, the percentage of mentees claiming that

their mentors gave feedback after observing mentees' teaching (82%) was consistent with the one that their mentors shared the evaluation of mentees' teaching (81%). Moreover, less than three-quarters of mentors were perceived to review mentees' lesson plans (73%) and articulate what mentees need to do to improve their mathematics teaching (70%).

Concerning the qualitative data of mentees, Table 6.31 shows some typical mentoring practices related to feedback along with the frequency and percentage of mentees who stated that they had experienced those practices. It indicates that 25 mentees out of 246 (10.2%) expressed their mentors' feedback practices as effective mentoring practices. The findings illustrated that most mentees (13) evaluated "providing oral feedback" as an effective feedback practice. This was followed by "articulating what the mentee needed" which had experienced by 8 mentees. There were also few mentees who expressed "reviewing lesson plans" and "observing teaching for feedback" as effective mentoring practices their mentors performed. In addition, apart from the feedback practices placed in the Five-Factor Mentoring Model, a mentee expressed that his/her mentor asked the mentees to evaluate the mentor's own mathematics teaching. Also, another mentee viewed his/her mentor's evaluation of weekly reports, which supervisors asked them to write, as an effective mentoring practice.

Table 6.31. Mentees' exemplars: Feedback.

Mentoring Practices	**Mentor Labels**	**Frequency**	**%**
eFB2: (My mentor) provided oral feedback on my mathematics teaching.	Mentee2, 19, 26, 49, 94, 105, 162, 167, 182, 200, 203, 204, 232	13	5.28%
eFB4: (My mentor) reviewed my mathematics lesson plans before teaching mathematics.	Mentee27, 150, 166, 209	4	1.63%
eFB5: (My mentor) clearly articulated what I needed to do to improve my mathematics teaching.	Mentee40, 44, 49, 80, 94, 175, 184, 228	8	3.25%
eFB6: (My mentor) observed my teaching mathematics before providing feedback.	Mentee105, 182, 195, 200	8	3.25%
(My mentor) asked me to evaluate his/her mathematics teaching.	Mentee40	1	0.41%
(My mentor) reviewed my weekly reports related to practicum process.	Mentee214	1	0.41%
Exemplars of effective mentoring practices related to feedback.	Mentee2, 19, 26, 27, 40, 44, 49, 80, 94, 105, 150, 162, 166, 167, 175, 182, 184, 195, 200, 203, 204, 209, 232, 214, 228	25	10.2%

7. DISCUSSION

In this part, the findings of the current research will be discussed under three sections. In the first section, the measurement of mentoring perceptions will be discussed based on the results obtained from quantitative data reflecting the views of participating mentors and mentees. In the second section, the context of teaching practicum in Turkey will be explored taking into account the participating supervisors' views. In the last section, mentoring practices will be examined based on the perceptions of all three stakeholders: participating supervisors, mentors and mentees.

One can consider these three stakeholders as the vertices of a triangle representing a mentoring triad with a centre of effective pre-service teacher practicum. Each of the sides of this triangle represents an interaction within school practicum:

- Supervisor-Mentor: their perceptions on mentoring practices and how these perceptions differ; how these stakeholders communicate about practicum, the school and mentor selection process.
- Supervisor-Mentee: teaching practicum course requirements, applications and how practicum mentoring reflects in university practicum course.
- Mentor-Mentee: their perceptions on mentoring practices and how these perceptions differ; what the effective mentoring practices are.

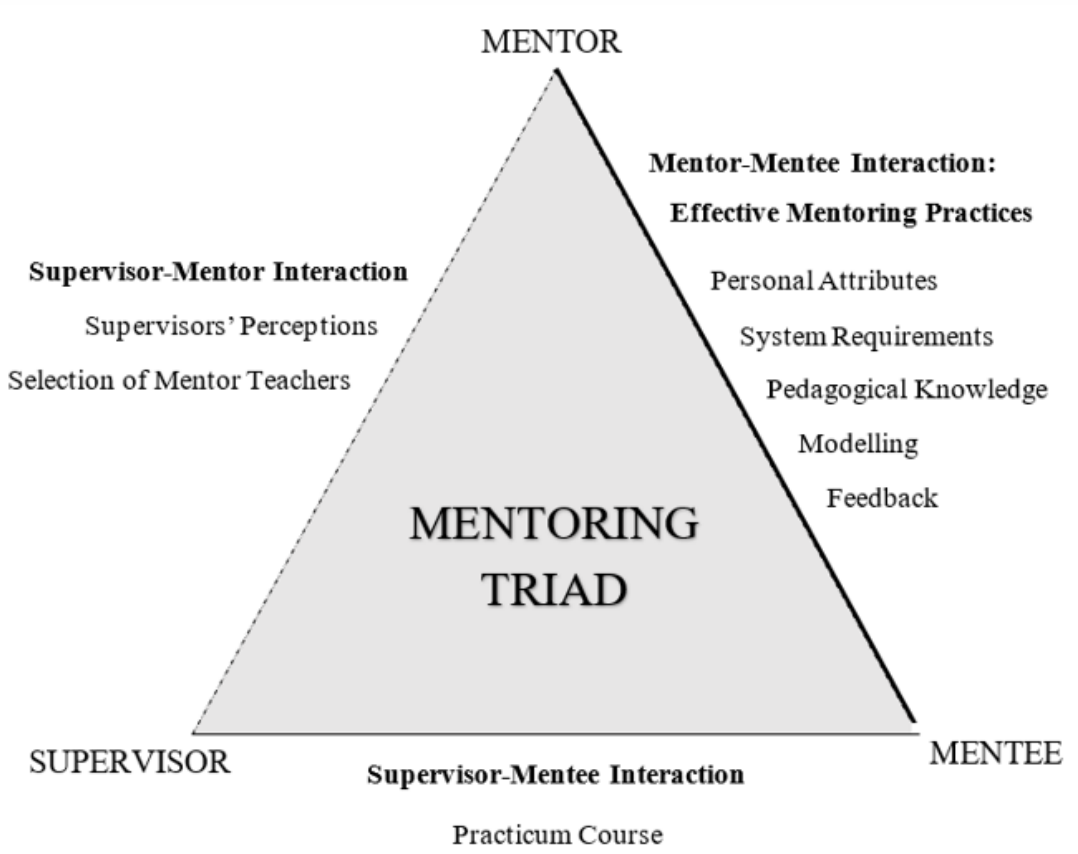

Figure 7.1. Mentoring Triad.

In this study, the discussion on the teaching practicum context and effective mentoring practices will be conducted based on the mentoring triad above representing the interactions among the stakeholders.

7.1. Measuring Perceptions on Mentoring Practices

One of the purposes of this research was to adapt MEMT-Mentee and MEMT-Mentor instruments for Turkish context, which served to examine the perceptions on mentoring practice. In the current study, the perceptions of mentors and mentees about mentoring practices were examined via MEMT-Mentee and MEMT-Mentor survey instruments. An open-ended questionnaire was implemented to mentors and mentees requiring them to share a mentoring practice they had experienced. With this open-ended questionnaire along with the survey instruments, their effective mentoring practices were attempted to be understood.

The survey instruments were designed to explore the perceptions of mentoring practices associated with five factors: Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback. In order to measure how well these factors fits the actual data, Confirmatory Factor Analysis (CFA) was conducted for both MEMT-Mentee and MEMT-Mentor instruments. For the CFA, at least 200 participants are recommended (Kline, 2015); however, MEMT-Mentor instrument could be implemented to 54 participating mentors in the current research since there were even limited number of mentors in the fall semester of 2019-2020. In spite of this, according to the CFA results, the MEMT-Mentor instrument was assumed to fit with the Five-Factor Mentoring Model.

In the Five-Factor Mentoring Model, the factors are theoretically correlated with one another (Hudson, Skamp and Brooks, 2005). Considering the current study, the correlations among the factors were strong (all $> .70$) for both of the survey instruments. Yet, the Five Factor Mentoring Model was overwhelmingly supported by the intensive literature review and critiques by experts (Hudson *et al.*, 2005). Therefore, in the current study, MEMT-Mentee and MEMT-Mentor instruments were assumed providing a fit with the Five-Factor Mentoring Model.

On the other side, particularly in the MEMT-Mentor instrument, the percentage of the mentors who agreed or strongly agreed that they provided the specific mentoring practices placed in the survey were all above 80%, the minimum score was 3.00 over 5.00 in all the factors and accordingly the means of the factors were too high (4.50 to 4.70 over 5.00). This result reveal that the participating mentors had a tendency to assign higher scores about their mentoring practices in comparison with the mentees, which is in line with the forecast of Hudson (2010) such that mentors' perceptions on their own mentoring practices might be higher than the mentees' perceptions on the mentors' practices. The reason behind this fact might be that mentors may have perceived the MEMT-Mentor survey as a self-efficacy test. A similar result was obtained in the study of Sarac and Aslan-Tutak (2013) about teachers' confidence level to teach trigonometry; such that the participating teachers marked the highest scores for almost all items in the teaching trigonometry efficacy scale. They stated that their findings may not

represent teachers' self-efficacy on trigonometry teaching since teachers perceived that their qualities were tested through the scale. Bandura (1986) defines self-efficacy as "people's judgements of their capabilities to organize and execute courses of action required to attain designated types of performance" (p. 391). Based on this definition, as filling out the survey, the participating mentors might have reflected their perceptions on their ability to implement the mentoring practices rather than their perception on what practices they had performed. Therefore, the survey question might be revised to "How much of your mentoring time have you devoted to... (a particular practice)?" and the response options can also be adjusted accordingly in future research. In this study, in order to examine mentor teachers' practices from a broader perspective, they were asked some open-ended questions.

7.2. Context of Teaching Practicum in Turkey

When the context of teaching practicum in Turkey is considered, one of the first things that should be examined is the regulation issued in 1998 about the teaching practice of teacher candidates. That regulation points out two different courses: teaching practicum course and school experience course (MEB, 1998). The former is described as a course which includes not only a teaching practice section but also a lecture section. It aims to provide pre-service teachers with teaching experience in a classroom and includes discussion and evaluation of those experiences. In the latter, pre-service teachers are expected to properly perceive the teaching profession by observing teachers, students and the school environment. The regulation was updated in 2018 and some critical changes came to the forefront (MEB, 2018). One of the major changes is the mentor training program constructed on clinical supervision model. Even though a 3-day mentor training was introduced by the Ministry of National Education in 1998, it could not be performed consistently (Yılmaz and Bıkmaz, 2020). Yet, the mentor training is made compulsory for teachers to become mentors in 2018, which is a significant step for quality mentoring. The duration of the training program is 24 hours in total (4 days, 6 hours a day). Additionally, MEB developed an online tool for teacher candidates' evaluation in 2018, assessment of those teaching practices is done by both supervisors and mentors via the digital system called "MEBBIS".

The current study reveals some aspects of the teaching practicum process experienced by teacher candidates who study a pedagogical formation program in mathematics teaching. Ideally, this practicum course should be carried out in the same way as the practicum course in the mathematics teaching program. However, the findings show that the practicum course process in the pedagogical formation program is performed in a slightly different way than the one specified in the regulation.

7.2.1. Selection of Practicum Schools

According to the new regulations, education faculties and the Provincial/District Directorates of National Education are expected to collaborate in determining practicum schools (MEB, 2018). In this study, it was not the Faculty of Education, but the pedagogical formation unit or another unit in 5 out of 6 participating universities, which performed the task of selecting practicum schools. Most of the participating supervisors expressed the location of practicum schools as a criterion in selecting a school. The findings showed that the school selection was undervalued in most of the participating universities, based on the idea that teacher candidates will not be too selective for the schools they will work in post-graduation.

On the other side, Du Plessis and colleagues (2010) advocated that practicum schools should provide the required environment, opportunities and resources for teacher candidates' needs and learning and should be selected accordingly. The current study's findings on supervisors' views on mentoring process supported that the context of practicum schools might have a role in effectiveness of the mentoring process, which was also claimed in the Turkish context of mentoring in teaching English (Aydın, 2016). As an example, from the current study, some supervisors claimed that mentors could not perform some mentoring practices because of the students' level of readiness or the disciplinary problems which they mostly had to focus on. Also, some of the supervisors stated that in some practicum schools with high-performing students, mentors tended to put mentoring practices into the background since their primary role was to prepare their students well for the university entrance exams. As discussed in several studies (e.g. Kolman, Roegman and Goodwin, 2017; Yılmaz and Bıkmaz, 2020), the

mentor teachers primarily focus on meeting their students' needs and they perceive the mentoring profession as their secondary role.

7.2.2. Selection of Mentors

Mentors are described as teachers who have the Certificate of Teaching Practice Training issued by the Ministry of National Education after attending Mentor Training Program and who will guide pre-service teachers within the scope of the teaching practices required by the teaching profession (MEB, 2018). Teaching practicum coordinators at schools are stated to identify mentors; however, in the 2018 regulation, there is not a clearly defined set of criteria on mentor selection other than having the Certificate of Teaching Practice Training.

Even though the context of schools might not be supportive for the mentees' needs and professional development, mentors could perform a collaborative effort for mentees' development together with mentees themselves and their supervisors. Mtika (2011) advocated that mentors' practices are significant as well as the context of school for mentees to form their own teaching practices. Therefore, as stated in the studies of Aydın (2016), Darling-Hammond (2006), Kiraz (2003) and Kiraz and Yıldırım (2007), it is critical to select mentors who will guide mentees effectively and improve their teaching skills.

Darling-Hammond (2006) argued that the quality and types of mentoring practices was not a criterion for mentor selection in the traditional approach, but their years of teaching experience. Another study investigated that less-experienced teachers were perceived as more competent in mentoring compared to more-experienced teachers (Kiraz and Yıldırım, 2007), resulting in that the years of experience in teaching should not be deemed as the only criterion for mentor selection. Feiman-Nemser and Parker (1993), in their study comparing mentoring in two U.S. programs, mentioned several criteria the programs determined for mentor selection such as teaching performance, views on teaching and learning, student activities, being open to learning, being tolerant to individual differences, effective communication with colleagues and so on. In the

current study, the findings, which were obtained from supervisors' views, showed that the mentors were experienced teachers, but they had not been considered specifically as a criterion for the selection of practicum schools. Yet, similar to the above-mentioned studies, Aydın (2016), in the study investigating mentoring practices in teaching English, pointed out the importance of a criterion-based selection of mentors, rather than a random selection, for an effective mentoring process. On the other side, according to the current regulations in Turkey (MEB, 2018), a criterion for selecting mentors is to have the Certificate of Teaching Practice Training. However, this type of selection does not appear to be as a competency-based selection as every teacher can receive the mentoring training in order to be certificated.

7.2.3. Assigning Practicum Supervisors

According to the regulations (MEB, 2018), an academic member with a bachelor's degree in education can be assigned as a supervisor and supervisors are expected to be responsible for at most 8 pre-service teachers, but not 15 pre-service teachers as in the 1998 regulation. However, one of the participating supervisors stated that the supervisor was informally responsible for a cohort of 120 teacher candidates in the pedagogical formation program of mathematics teaching and put this situation as a reason for not being able to visit the schools. The mentees' formal supervisors were from different departments other than teaching mathematics. Those formally identified supervisors did not take the responsibility of supervision since their expertise was not related to mathematics teaching.

On the other side, there were supervisors from the Faculty of Arts and Sciences departments or other unrelated departments who took the responsibility of supervision. However, their competency in supervision is open to discussion. As Shulman (1987) stated, teachers should have content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, knowledge of educational foundations, purposes and values. Therefore, for the supervision of a mathematics teacher candidate, supervisors who are not from the Faculty of Education may not provide

the required support and guidance not only for mentees but also for mentors since their expertise is not related to mathematics teaching. At this point, the discussion of assigning supervisors for pedagogical formation students emerges.

7.2.4. School-Faculty Interaction in the Context of Practicum

The unique nature of teaching practicum calls for collaboration and interaction between schools and faculties (Shen, 2002; Yılmaz and Bıkmaz, 2020). The person who are concerned in initiating and maintaining the process of teaching practicum is the supervisor (Willems *et al.*, 1986). Supervisors' interactions with mentors and mentees can give the insight on that process. The need for collaboration between supervisors and mentors will be discussed as many studies emphasized (e.g. Akyar, 2020; Aydın and Ok, 2020; Aydın, Selcuk and Yesilyurt, 2007; Ekiz, 2006; Mtika, 2011; Sağ, 2008; Willems *et al.*, 1986; Yılmaz and Bıkmaz, 2020).

About the interaction between supervisors and mentors, Mtika (2011) expressed that if supervisors and mentors directly work with each other, then the relationship between mentors and mentees also gets stronger. That is because supervisors could provide a bridge between mentors and mentees (Rakıcıoğlu-Söylemez, 2012) by providing mentors information about mentees' needs and informing mentees about their mentors' expertise and perspectives (Mtika, 2011).

In both documents of MEB (1998) and MEB (2018), supervisors are expected to visit the practicum schools for observing each pre-service teacher's teaching practices; but, there was no suggestion for number of visits to schools in 1998 while there is a requirement of visiting schools at least 4 times per semester in 2018. However, in this study, it was expressed that some supervisors could never visit the practicum schools and so, never observed the mentees' practices and never had a face-to-face interaction with mentors. Similarly, Yılmaz (2011) found that supervisors did not visit the practicum schools to observe mentees' teaching practices. It was apparent that supervisors mostly received information about mentors and their practices through mentees and not by directly working with mentors.

According to the reformed regulations in Turkey, supervisors are responsible, in the practicum part of the teaching practicum course, for meeting mentors and mentees, planning the practicum activities with mentors, observing mentees' teaching practices and evaluating them together with mentors and mentees (MEB, 2018). Also, the literature suggests supervisors to meet mentors and mentees at the beginning of the practicum process in order to talk about goals (Willems *et al.*, 1986) and expectations (Pungur, 2007). However, in this study, there were only 2 out of 6 participant supervisors who visited the practicum schools at the beginning of the semester to meet mentors and mentees and organize the practicum process. Moreover, mentors were not included in determining the practicum activities which was seen as the responsibility of supervisors. The findings supported that there was not a strong interaction between practicum schools and the Faculties of Education (Akyar, 2020; Aydın and Ok, 2020; Aydın, Selçuk and Yeşilyurt, 2007; Ekiz, 2006; Sağ, 2008; Yılmaz and Bıkmaz, 2020). The limited cooperation between mentors and supervisors may cause inconsistency between their practices in the scope of the practicum course, which may negatively affect pre-service teachers' practicum process (Akyar, 2020; Ekiz, 2006).

From the answers given by mentors to the open-ended questions, implicitly mentors do not position themselves as teacher educators but as teachers in their interaction with mentees. This result is also supported in Hangül (2018) study on teacher educators. In the context of positioning theory, Harré and Moghaddam (2003) interpret positions as "rights and duties to think, act and speak in certain ways (p. 8)"; so, the verbs that the mentors choose might imply how they position themselves in the mentor-mentee relationship. Considering literature suggestion on supervisors to initiate and maintain the interaction with mentors as a crucial stakeholder of teaching practicum process (Willems *et al.*, 1986), the results of limited interaction of supervisors with mentor teachers may explain mentors' not positioning themselves as teacher educators. Also, the literature support that many teachers cannot conceptualize their mentoring roles in their teaching profession (Gardiner, 2009) and they perform teaching strategies as mentoring (Jones and Straker, 2006).

In the context of Turkish teacher education, because teaching diploma is guaran-

teed by universities and faculty members are the teacher educators, it may be necessary for supervisors to provide opportunities for mentors to collaborate as an actor of teacher educators. Furthermore, the expressions of mentors in the open-ended questionnaire seemed not reflecting of a collaborative approach to the mentoring process even though the current trends have instilled mentoring as a collaborative effort, which was in line with the findings of Yılmaz and Bıkmaz (2020). Also, in the Turkish literature, the study of Hangül (2018) supported that teachers do not position themselves as teacher trainers even though they have the mentoring role. It seems that teachers need continuous professional development in mentoring to position themselves as mentors within their teaching profession (Gardiner, 2009).

7.2.5. Supervisor Interaction with Mentees

When it comes to the interaction between supervisors and mentees in the Turkish context, it often takes place in the lecture part of the practicum course. According to the regulations, supervisors are in charge of managing the discussion on the practicum experiences of mentees in the lecture part of the course (MEB, 2018). Also, as stated in several research studies, supervisors mostly focused on encouraging mentees to discuss their experiences at the practicum school (Ajayi and Lee, 2005; Dinsmore and Wegner, 2006). The current study reached similar findings such that 5 out of 6 participating supervisors stimulated discussion among mentees about their experiences at the practicum schools by referring to weekly reports requested from the mentees based on their observations and practices.

One of the supervisors stated that she also discussed the factors of improving the quality of mathematics teaching based on a theoretical framework with mentees. Other supervisors did not mention any practice made specifically for teaching mathematics in the practicum course. Moreover, one supervisor expressed that they did not have a lecture part of the course, which may lead to an even less of an interaction between supervisors and mentees.

Besides the practicum course, as stated in the regulation of 1998, the school experience course provides a first step to schools in order for pre-service teachers to perceive the teaching profession by observing teachers, students and the school environment in general terms (MEB, 1998). However, this course is not included in the mathematics teaching pedagogical formation program. Therefore, the participating supervisors expressed that its requirements were also integrated in the practicum course. As one of the supervisors (SV-5) emphasized, after the 6 weeks of school experience requirements are met, the remaining 6 weeks are not enough for mentors to train mentees for the teaching profession. Also, Ekiz (2006) expressed the allocated time for teaching practicum as a "pre-requisite" for effective mentoring. Thus, integrating the requirements of the two courses into a single course may result in reduced time allocated for teaching practice, which may adversely affect effective mentoring and implicitly mentees' professional development.

Briefly, even though there are regulations, in practice, the internship process is not carried out as in the regulations. Literature supports strong relationship between supervisors and mentors (e.g. Aydın and Ok, 2020; Ekiz, 2006; Mtika, 2011; Willems *et al.*, 1986; Yılmaz and Bıkmaz, 2020); but it is seen that the relationship between these stakeholders is weak during the internship process within the formation program in teaching mathematics.

7.3. Mentoring Practices

General mentoring related to mentoring roles, practices, conceptions and/or models have been discussed over the decades (e.g. Gardiner, 2009; Gilles and Wilson, 2004; Hennissen *et al.*, 2008; Kiraz, 2003; Kiraz and Yıldırım, 2007; Koç and Yıldız, 2012; Mtika, 2011; Ngara and Ngwarai, 2012; Sağ, 2008; Yılmaz, 2011; Yılmaz and Bıkmaz, 2020). However, as Curran and Goldrick (2002) stated, being subject-specific is one of the main components of effective mentoring. In the recent years, subject-specific mentoring have been examined both in the Turkish (Aydın and Ok, 2020; Hudson, Uşak and Savran-Gencer, 2010; Rakıcıoğlu-Söylemez, 2012) and international literature (Duah, 2011; Hudson, 2007; Hudson and Peard, 2006; Smolik, 2010).

Even though several studies examined mentoring in mathematics teaching (Duah, 2011; Hudson, 2007; Hudson, 2009; Hudson, 2010; Smolik, 2010), there was limited research about mentoring particularly in Turkish mathematics education context. Therefore, the current study's main purpose is to unveil the mentoring practices in mathematics education within five factors of Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback. Those practices were examined from the perspectives of all three stakeholders: supervisors, mentees and mentors themselves. Bringing out the current mentoring practices in mathematics teaching may aid in determining effective mentoring practices that mentors need to develop.

7.3.1. Supervisors' Perceptions

Most of the participating supervisors defined the mentors as very experienced teachers and argued that they had good intentions to aid mentees during their practicum. However, being an experienced teacher does not always imply to being a competent mentor (Kiraz and Yıldırım, 2007; Smith, 2015). Also, similar to Borko's and colleagues' (1992) idea that having good intentions is not sufficient to be a good teacher, having good intentions towards mentees is not enough to be a good mentor. It is also important to note that supervisors' perceptions about mentoring practices had been shaped mostly based on mentees' views, not on their own observations or interactions with mentors.

7.3.2. Mentees' and Mentors' Perceptions

In this section, mentors' and mentees' perceptions on mentoring practices based on both quantitative and qualitative data sources along with the literature about the mentoring practices within the five factors of *Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling and Feedback* will be discussed.

7.3.2.1. Personal Attributes. In the current study, when considering the results of MEMT scales, the perceptions of both mentees and mentors on personal attributes

(Mentees: M=4.20, SD=0.85; Mentors: M=4.70, SD=0.39) were relatively higher than their perceptions on the practices aligned with other factors. However, the practice of instilling confidence as a mathematics teacher was less perceived by mentees and mentors than other personal attributes. This result may reopen the discussion on positioning which mentioned above under the context of school-faculty interaction. Turkish literature argues that mentees need their mentors to behave them as teachers not students (Sağ, 2008; Yılmaz, 2011). If mentors position mentees as teachers and behave accordingly, then mentees can feel more self-confident as a teacher and it may be also easier for mentors to position themselves as teacher educators.

On the other side, in this study, when mentees and mentors were asked to give an example of effective mentoring practices they experienced, 6.91% of mentees and 11.1% of mentors gave exemplars related to personal attributes. Considering the practices under the factor of personal attributes, the numbers of mentees and mentors who gave an example related to instilling confidence as a mathematics teacher were relatively higher, which may indicate that there were mentees and mentors who valued such an attribute as an effective mentoring practice.

7.3.2.2. System Requirements. For effective mentoring, mentors needed to perform practices aligned with the system requirements (such as outlining curriculum, discussing aims and policies) in order for mentees to be aware of the requirements of the curriculum and policies (Hudson, 2004b). Outlining curriculum and articulating its aims might give mentees subject-related directions for their teaching. In the Turkish context, some schools might use mathematics curricula different than the one offered by the Ministry of National Education in Turkey. Therefore, such mentoring practices along with the articulation of school policies may give mentees school-specific directions (Hudson, 2007) in order to understand how mentors have taught mathematics to the students in a specific school context.

In this study, in accordance with the results of MEMT scales, the percentages of mentees and mentors who perceived the mentors articulated the system requirements

(such as outlining curriculum, discussing aims and policies) were relatively low in comparison to many other practices. Also, when mentors and mentees were asked to give an example of effective mentoring practices, none of the mentors gave an example of practices related to system requirements; and only one mentee expressed that his/her mentor outlined the mathematics curriculum. These results were congruent with the literature, such that in many research studies, the practices related to system requirements were the lowest on the scale according to mentees' perceptions (e.g. Duah, 2011; Hudson, 2007; Hudson and Peard, 2006) and mentors' perceptions (e.g. Hudson, 2010). Considering the Turkish literature, it was argued that mentees needed to be informed about their practicum schools' systems (Sağ, 2008), but mentors did not provide enough practices related to system requirements (Aydın, 2016; Rakıcıoğlu-Söylemez, 2012).

7.3.2.3. Pedagogical Knowledge. In the context of mentoring in mathematics education, the mentoring practices related to pedagogical knowledge imply the guidance on pedagogical content knowledge (Hudson, 2004b), which refers to the knowledge of how to teach a specific content (Shulman, 1987). In this study, according to the findings obtained from MEMT scales, the participating mentors and mentees perceived that mentors performed practices related to pedagogical knowledge (Mentee: M=4.02, SD=0.91; Mentor: M=4.56, SD=0.44). When mentors' responses to the open-ended questionnaire examined, 20.4% of mentors gave examples of practices aligned with pedagogical knowledge, which is relatively higher than the percentages of mentors giving exemplars related to other factors. Appleton (2008) and Ma (2010) discussed how mentees' pedagogical content knowledge can develop by effective mentoring situated in schools. In such a mentoring, the roles of mentors as a source of pedagogical content knowledge are significant (Appleton, 2008).

On the other side, Smith and Ulvik (2015) argued that the difficulty of mentoring was not having pedagogical content knowledge as teachers, but articulating it as mentors and they raised the concept of "pedagogical content knowledge of mentoring" referring to how to mentor a mentee in teaching a specific content. In the current study, when mentees were asked to give an exemplary about effective mentoring prac-

tices they received, 4.88% of mentees gave examples of practices related to pedagogical knowledge, which is lower than the percentages of mentees who gave examples of practices associated with personal attributes, modelling and feedback. Given the difficulty of articulating pedagogical content knowledge, it was not surprising that there were insufficient exemplars of mentees about such mentoring practices.

7.3.2.4. Modelling. The literature argues that modelling practices have a great impact on improving mentees' pedagogical content knowledge (Appleton, 2008; Carlson and Gooden, 1999). In this study, according to the results of MEMT scales, mentees and mentors perceived that mentors provided practices related to modelling (Mentee: M=4.01, SD=0.87; Mentor: M=4.46, SD= 0.48). When examining the responses to the open-ended questionnaires asking exemplary mentoring practices, 13.0% of mentors gave examples of modelling as effective practices and most of the mentees' (24.0%) examples accumulated under modelling practices, particularly on having a good rapport with the students and modelling effective classroom management.

However, based on both mentors' and mentees' views obtained from both MEMT scales and open-ended questionnaires, the mentors were not perceived as competent at modelling pedagogical content knowledge, well-designed materials and activities. This situation might stem from the mentors' teaching practices, which do not include materials and activities, not directly from their mentoring practices. Hence, targeting mentors through such specific mentoring practices may also help mentors to improve their teaching practices (Hobson *et al.*, 2009).

7.3.2.5. Feedback. Various research on mentoring advocate the need for providing feedback in the context of mentoring (e.g. Monk and Dillon, 1995; Showers and Joyce, 1996). When the mentor training program content introduced in 2018 by the Turkish MoNE is examined, there are mostly discussions on providing feedback to mentees. In this study, according to the results of MEMT scales, the participating mentees and mentors perceived that the mentors implemented practices related to feedback (Mentees: M=3.95, SD=0.95; Mentors: M=4.62, SD= 0.43). Also, the results of ques-

tionnaires indicated that 10.2% of mentees and 16.7% of mentors evaluated feedback practices, which they experienced, as effective mentoring practices. However, when we examined the results item by item, the mentees' perceptions demonstrated that there were still many mentors who did not perform some practices related to feedback. For example, even though most of the mentors were perceived to observe mentees' teaching practices (82.1%) and to provide oral feedback (84.5%), more than a quarter of them were perceived as not to articulate the mentees' needs. Yet, Hudson (2004a) argues that feedback becomes more beneficial when it clearly reflects the mentees' needs to develop their teaching in a specific content. Critically examining the content of mentorship training of mentors provided by the MoNE since 2018 shows that the training was focused on general mentoring feedback practices (Hennissen *et al.*, 2008; Ngara and Ngwari, 2012), but not pedagogical content knowledge focused feedback.

Examining mentees' lesson plans and giving feedback about them might provide mentees new viewpoints on how to teach a specific content for a particular group of students and assess students' learning and accordingly enrich mentees' pedagogical content knowledge. In this study, according to both participating mentees' and mentors' perceptions, there was a difference between the number of mentors who observed the mentees' teaching (Mentees: 82.1%; Mentors: 100%) and the number of ones who reviewed the mentees' lesson plans (Mentees: 73.2%; Mentors: 87.1%). This might imply that there were mentors who observed the mentees' teaching practices without examining their lesson plans. The result seems incompatible with the content of mentor training program framed under the Clinical Supervision Model. That model consists of a cycle of preparation, observation and evaluation and mentors should review the lesson plans and provide feedback before observing teaching practices (Reilkoff, 1981). If mentors review their mentees' lesson plans before their teaching practices, then mentees not only can improve their pedagogical content knowledge but also can feel more confident in teaching mathematics; and, mentors may observe mentees' teaching in a more structured way and give quality feedback accordingly (Hudson, 2004a). From another perspective, as in Duah's (2011) study in which a similar finding emerged, it is uncertain whether mentors do not review their mentees' lesson plans or mentees do not give the mentors their lesson plans to review. Therefore, it should be investigated

in a more detailed manner.

The mentees' perceptions further indicated that providing written feedback was a considerably less-perceived mentoring practice (53%), which was parallel to some other studies (e.g. Hudson, 2007; Hudson and Peard, 2006). This may stem from the convenience of giving oral feedback in comparison with written feedback. It also implies that written feedback is not a formally requested part of the mentoring. However, oral feedback may not substitute written feedback since the recorded version of mentors' feedback might be more useful to the mentee as reflecting on their own teaching performances (Hudson and Peard, 2006). Therefore, mentors needed to provide written feedback as well as oral feedback.

7.3.2.6. Mentoring Practices Emerging from the Exemplars of Mentees and Mentors.
Apart from the feedback practices placed in the Five-Factor Mentoring Model, two practices were stated as examples for effective mentoring practices: asking the mentee to give feedback on the mentors' mathematics teaching and reviewing the mentee's weekly practicum reports that were asked by supervisors. The literature provide evidence in that mentoring is beneficial not only for mentees but also for the professional development of mentors (Ekiz, 2006; Hobson *et al.*, 2009). Mentors can learn by reflecting on their own teaching (Lopez-Real and Kwan, 2005; Simpson, Hastings and Hill, 2007) and by discussing mentees' teaching and their own teaching with mentees and supervisors (Lopez-Real and Kwan, 2005). Therefore, the practice of receiving feedback from their mentees can help mentors improve their teaching. Also, the practicum of reviewing the mentee's weekly reports might facilitate the mentors' assessment of the mentee's progress.

Moreover, the practices related to articulating and modelling some practices about inclusive/special education emerged from the exemplars of both mentors and mentees. In Turkey, inclusive and special education have become an issue of discussion in the recent years. The increasing number of immigrant Syrian children has required many schools to adapt to inclusive education. Therefore, mentors should be able to

perform the practices such as modelling and articulating teaching strategies and the classroom management strategies for inclusive/special education in the Turkish context.

Lastly, the practices related to articulating and modelling the use of technology in the classroom emerged from the exemplars of mentors and mentees. The integration of technology into education has become a subject of debate in Turkey by a project called FATIH Project (Movement of Enhancing Opportunities and Improving Technology), which aimed to increase the equality of opportunity in education for each student to be able to access the most beneficial resources via technology (FATIH Project, n.d.). Without a doubt, nowadays when the world has been suffering from Covid-19 (corona virus), the need for the use of technology in education has been increased and technology has become an integral part of education almost all around the world. Therefore, teacher candidates should be able to learn how to use technology for teaching their subject in a more effective way. At this point, the effect of mentors' modelling the use of technology is undeniable for mentees to be able to integrate technology into their future teaching (Nelson, 2017). Yet, to be able to model the integration of technology, they first need to learn it. As Yılmaz and Bıkmaz (2020) mentioned, one of the areas that mentors need a professional update is the use of technology in classrooms.

Briefly, the current study exhibited the perceptions of supervisors, mentees and mentors on the mentoring practices as well as the exemplars of mentees and mentors about their effective mentoring experiences. The results revealed that even though many mentors implemented various mentoring practices, there were some mentors who could not perform some of the mentoring practices. Also, it was shown that the mentoring practices implemented to the mentees who study a pedagogical formation program might be different from the ones implemented to the mentees who study at the Faculty of Education. However, each mentee deserves to be mentored effectively based on a set of standards providing equal opportunities for the practicum (Aydın and Ok, 2020). Therefore, the mentoring practices should be grounded on subject-specific objectives that are pre-determined, clear and obtainable (Curran and Goldrick, 2002). This study aiming to unpack the current mentoring practices might contribute to de-

termining such obtainable objectives in the Turkish education context. Yet, the quality of the mentoring practices should also be examined in further research.

8. LIMITATIONS AND SUGGESTIONS

The current research examined the mentoring practices and process carried out in pedagogical formation programs for teaching mathematics from the viewpoints of three stakeholders of the mentoring process: supervisors, mentors and mentees. However, it is not guaranteed to generalize the findings for the mentoring process directed in education faculties and programs of teaching other subjects different from mathematics. Also, as noted in the findings, mentee qualifications might affect mentoring practices; and the qualifications of the teacher candidates studying at the Faculty of Education might be different from those who study in the pedagogical formation program. In this respect, further research may be conducted with participating mentees studying at the Faculty of Education. Also, the mentoring practices carried out in teaching other subjects, such as physics, chemistry, biology, literacy, history and so on, may be examined in future research.

The number of participating mentors might be the main limitation of this study, particularly for the factor analyses. For the Confirmatory Factor Analysis (CFA), at least 200 participants are recommended (Kline, 2015); however, 54 mentors participated in the current research since there were even limited number of mentors in the fall semester of 2019-2020. In spite of the limited number of participating mentors, the CFA results showed that MEMT-Mentor instrument was assumed to fit with the Five-Factor Mentoring Model. Yet, further research can be conducted with more participants to support the factor analysis results of this study.

As another limitation, the participants had a tendency to give high scores for the items in the MEMT tests, particularly in MEMT-Mentor test. The reason behind this tendency for mentors was explained in the discussion part by the argument that the mentors might have perceived the MEMT-Mentor as a self-efficacy test, but not as a test investigating their perceptions on what practices they had performed. Also, if mentors performed a particular practice at least once, the mentees might have agreed/strongly agreed that their mentors implemented that practice. Therefore, the survey question

might be revised to "How much of your mentoring time have you devoted to... (a particular practice)" and the response options can also be adjusted accordingly (e.g. as percentages) in future research. Moreover, in the MEMT-Mentor instrument, one of the items (rFB3) was problematic with non-significant factor loading and weak correlation with the scale. The item was "I believe I provided written feedback on the mentee's mathematics teaching". However, its expression in the Turkish context might have caused the weak results. In Turkey, mentor teachers have an obligation to evaluate mentees through an online system called MEBBIS. Some mentors may have had tended to give the highest score because they thought this type of evaluation was a kind of written feedback. On the other side, some mentors might have inclined to give the lowest score considering that they did not give written feedback to the mentee directly. Thus, future research should express the item *rFB3* more clearly, accentuating to provide written feedback directly to the mentee.

As examining the mentoring practices, this study shed light on the interaction of stakeholders with one another. Mentoring practices were examined based on the perceptions of all stakeholders. However, supervisor-mentor and supervisor-mentee interactions were examined only from the perspectives of supervisors. Thus, another limitation of the study might be the scope of qualitative instruments implemented to mentors and mentees; such that questions asking mentors and mentees about their relationship with supervisors could be included. Furthermore, in the Turkish education context, the focus of the mentor training might be extended to be more comprehensive encompassing all the mentoring practices aligned with Personal Attributes, System Requirements, Pedagogical Knowledge, Modelling, as well as Feedback. In addition, since the literature suggests subject-specific and objective-based mentoring (Curran and Goldrick, 2002), the mentor training programs should be redesigned specifically for each subject area and there should be greater clarity on the objectives of mentoring.

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APPENDIX A: INFORMED CONSENT FORM (FOR MENTEES)

T.C.

BOĞAZİÇİ ÜNİVERSİTESİ

SOSYAL VE BEŞERİ BİLİMLER İNSAN ARAŞTIRMALARI ETİK KURULU

KATILIMCI BİLGİ ve ONAM FORMU

Araştırmayı destekleyen kurum: Boğaziçi Üniversitesi Bilimsel Araştırma Projeleri

Araştırmanın adı: Matematik Öğretiminde Etkin Mentörlük (MÖEM): Öğretmen Adayları ve Öğretmenlik Uygulaması Mentörlerinin Algılarının İncelenmesi

Proje Yürütücüsü/Araştırmacının adı: Doç. Dr. Fatma Aslan Tutak

Adresi: Boğaziçi Üniversitesi, Eğitim Fakültesi, No:510, bebek 34342, İstanbul

E-mail adresi: fatma.tutak@boun.edu.tr

Telefonu: +90-212-359-4610

Sayın öğretmen adayı,

Boğaziçi Üniversitesi Matematik ve Fen Bilimleri Eğitimi Bölümü öğretim üyesi Dr. Fatma Aslan Tutak "*Matematik Öğretiminde Etkin Mentörlük (MÖEM): Öğretmen Adayları ve Öğretmenlik Uygulaması Mentörlerinin Algılarının İncelenmesi*" adı altında bilimsel bir araştırma projesi yürütmektedir. Bu çalışmanın amacı öğretmenlik uygulaması yapan öğretmen adaylarının ve onların uygulama (mentör)öğretmenlerinin etkili mentörlük algılarını ve arasındaki ilişkiyi incelemektir. Çalışmanın yürütülmesi için öğrencisi olduğunuz üniversitenin ilgili birimlerinden gerekli izinler alınmıştır. Bu araştırmada bize yardımcı olmanız için siz öğretmenlik uygulaması yapmakta olan öğretmen adaylarınız da projemize davet ediyoruz. Kararınızdan önce araştırma hakkında sizi bilgilendirmek istiyoruz. Bu bilgileri okuduktan sonra araştırmaya katılmak isterseniz lütfen bu formu imzalayıp kapalı bir zarf içinde bize ulaştırınız.

Bu araştırmaya katılmayı kabul ettiğiniz takdirde öğretmenlik uygulaması kapsamında mentörlük deneyimleriniz hakkında 34 soruluk bir anket ve matematik öğretimi-öğrenimine ilişkin inanışlar üzerine 26 soruluk bir anket doldurmanızı rica edeceğiz. Her bir anketi doldurmanız en çok 15 dakikanızı alacaktır.

Bu araştırma bilimsel bir amaçla yapılmaktadır ve katılımcı bilgilerinin gizliliği esas tutulmaktadır. Verinin analizi ve farklı ortamlarda paylaşılmasında katılımcıların isim, okul vb. belirleyici bilgileri paylaşılmayacaktır. Toplanan elektronik ve basılı veri araştırma projemiz süresince kilitli bir dolapta muhafaza edilip araştırma sona erdiğinde silineceklerdir. Seçilmiş veri ve veri analizi sonuçları katılımcıların kimliği belirtilmeden matematik öğretmen eğitiminde veya bilimsel nitelikte yayın ve sunumlarda kullanılabilir.

Bu araştırmaya katılmak tamamen isteğe bağlıdır. Çalışmaya katılımınız üniversitedeki öğretmenlik uygulaması ders notunuzu veya öğretmenlik uygulaması ile ilgili işlemleri etkilemeyecektir. Katıldığınız takdirde çalışmanın herhangi bir aşamasında herhangi bir sebep göstermeden onayınızı çekmek hakkına da sahipsiniz. Araştırma projesi hakkında ek bilgi almak istediğiniz takdirde lütfen Boğaziçi Üniversitesi Matematik ve Fen Bilimleri Eğitimi Bölümü Öğretim Üyesi Dr. Fatma Aslan Tutak ile temasa geçiniz (Telefon: +90-212-359-4610 Adres: Boğaziçi Üniversitesi, Eğitim Fakültesi, No:510, 34342 Bebek, İstanbul). Araştırmayla ilgili haklarınız konusunda Boğaziçi Üniversitesi Sosyal ve Beşeri Bilimler İnsan Araştırmaları Etik Kurulu'na (sbinarek@boun.edu.tr) danışabilirsiniz.

Eğer bu araştırma projesine katılmasını kabul ediyorsanız, lütfen bu formu imzalayıp kapalı bir zarf içerisinde bize geri yollayınız.

Ben, (katılımcının adı) ....., yukarıdaki metni okudum ve katılmam istenen çalışmanın kapsamını ve amacını, gönüllü olarak üzerime düşen sorumlulukları tamamen anladım. Çalışma hakkında soru sorma imkânı buldum. Bu çalışmayı istediğim zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabileceğimi ve bıraktığım takdirde herhangi bir olumsuzluk ile karşılaşmayacağımı anladım.

Bu koşullarda söz konusu araştırmaya kendi isteğimle, hiçbir baskı ve zorlama olmaksızın katılmayı kabul ediyorum.

Formun bir örneğini aldım (bu durumda araştırmacı bu kopyayı saklar)/ almak istemiyorum.

Katılımcının Adı-Soyadı:.....

İmzası:.....

Adresi (varsa Telefon No, Faks No):.....

.....

Tarih (gün/ay/yıl):...../...../.....

Figure A.1. Informed Consent Form (for Mentees).

APPENDIX B: DEMOGRAPHIC INFORMATION (MENTEES)

Yaşınız:

Cinsiyetiniz:

Mezuniyet Durumunuz:

- ☐ Son Sınıf Öğrencisi
- ☐ Mezun

Okumakta olduğunuz / Mezun olduğunuz üniversite ve bölüm:

Pedagojik Formasyon Eğitimi Aldığınız Üniversite ve bölüm:

Öğretmenlik Uygulaması Stajı Yaptığınız Okulun Adı:

Staj Okulunuzdaki Uygulama Öğretmeninizin (Mentör) Adı:

Üniversitedeki Süpervizörünüzün (Uygulama Öğretim Elemanı) Adı:

Daha önce öğretmenlik deneyiminiz oldu mu?

- ☐ Evet
- ☐ Hayır

Cevabınız evet ise ne tür deneyimleriniz oldu ve ne kadar süre ile?

Deneyim	Evet	Hayır	Branş	Sınıf Seviyesi	Süre
Özel ders					
Etüt merkezi					
Sözleşmeli öğretmenlik					
Üniversitede araştırma görevliliği					
Diğer					

Figure B.1. Demographic Information (Mentees).

APPENDIX C: MENTORING FOR EFFECTIVE MATHEMATICS TEACHING SCALE - MENTEES (MEMT-MENTEE)

Aşağıda en son yaptığınız staj süresince uygulama okulunuzda matematik öğretimi üzerine aldığınız mentörlük hakkında birtakım ifadeler verilmiştir. Bu ifadelere katılıp katılmadığınızı Kesinlikle Katılmıyorum, Katılmıyorum, Kararsızım, Katılıyorum, Kesinlikle Katılıyorum cevaplarından bir tanesini işaretleyerek belirtiniz.

Uygulama (Staj) okulundaki matematik öğretmenliği uygulama (staj) deneyimim sırasında, mentör (uygulama) öğretmenim	**Kesinlikle Katılmıyorum**	**Katılmıyorum**	**Kararsızım**	**Katılıyorum**	**Kesinlikle Katılıyorum**
1. matematik öğretimi konusunda bana destek oldu.					
2. mevcut matematik dersi öğretim programında yer alan matematik dilini kullandı.					
3. matematik dersi hazırlarken bana rehberlik etti.					
4. matematik öğretimi için kullanılan okul politikalarını benimle paylaştı.					
5. matematik öğretimi modelledi					
6. matematik öğretimi için sınıf yönetimi stratejileri konusunda bana yardımcı oldu.					
7. öğrencileri ile birbirilerinin fikir, duygu ve düşüncelerini anlayan bir ilişkisi vardı.					
8. matematik öğretim stratejilerini uygulamada bana yardımcı oldu.					
9. matematik öğretimi sırasında ilgili ve istekli olduğunu gösterdi.					
10. uyguladığım matematik derslerinin zaman planlamasında bana yardımcı oldu.					
11. bana matematik öğretim programının ana hatlarından bahsetti.					
12. matematik öğretimi sırasında etkili sınıf yönetimini modelledi					
13. uyguladığım matematik öğretimi hakkındaki değerlendirmesini benimle paylaştı.					
14. matematik öğretimi stratejilerimi geliştirdi.					
15. matematik öğretiminde etkiliydi.					
16. matematik öğretimim hakkında sözlü geri bildirimde bulundu.					
17. benimle matematik öğretimi üzerine konuşmada rahat görünüyordu.					
18. etkili matematik öğretimi için gerekli soru sorma becerileri hakkında benimle fikir alışverişinde bulundu.					
19. matematik öğretimi için sınıfta kullanılabilir materyaller kullandı.					
20. matematik öğretimim hakkında yazılı geri bildirimde bulundu.					
21. matematik öğretimi için ihtiyacım olan bilgiler hakkında benimle fikir alışverişinde bulundu.					
22. matematik öğretimine yönelik bana olumlu tutumlar aşıladı.					
23. matematik öğretimi uygulamalarımı geliştirmeye yönelik yansıtma yapmamda (kendimi incelememde) bana destek oldu.					
24. matematik öğretimini planlama konusunda bana açık yönlendirmelerde bulundu.					
25. matematik öğretiminin amaçları konusunda benimle fikir alışverişinde bulundu.					
26. matematik öğretmeni olarak öz güvenimi yükseltti.					
27. matematik öğretimi ile ilgili sorunlarımı çözmeye yönelik stratejiler sundu.					
28. matematik ders planlarımı, ders anlatımlarımdan önce gözden geçirdi.					
29. öğrenciler için iyi tasarlanmış matematik etkinliklerine sahipti.					
30. matematik öğretimi hakkında bana yeni bakış açıları kazandırdı.					
31. matematik öğretimi ile ilgili konularda beni dikkatle dinledi.					
32. öğrencilerin matematik öğrenimlerinin nasıl değerlendirileceğini gösterdi.					
33. matematik öğretimimi geliştirmek için neler yapmam gerektiğini tane tane açıkladı.					
34. matematik öğretimimi gözlemledikten sonra bana geri bildirim verdi.					

Figure C.1. Mentoring for Effective Mathematics Teaching Scale - Mentees (MEMT-Mentee).

APPENDIX D: OPEN-ENDED QUESTIONNAIRE FOR MENTEES

2019-2020 güz döneminde yaptığınız öğretmenlik uygulamasındaki deneyimlerinizi göz önünde bulundurarak aşağıdaki soruyu cevaplayınız.

1. Öğretmenlik uygulaması stajı sırasında "etkili mentörlük örneği" olduğunu düşündüğünüz bir deneyiminizi paylaşır mısınız? Bu örnek neden etkili bir mentörlük örneğidir açıklayınız.

Figure D.1. Open-Ended Questionnaire for Mentees.

APPENDIX E: INFORMED CONSENT (FOR MENTORS)

T.C.
BOĞAZİÇİ ÜNİVERSİTESİ
SOSYAL VE BEŞERİ BİLİMLER İNSAN ARAŞTIRMALARI ETİK KURULU
KATILIMCI BİLGİ ve ONAM FORMU

Araştırmayı destekleyen kurum: Boğaziçi Üniversitesi Bilimsel Araştırma Projeleri

Araştırmanın adı: Matematik Öğretiminde Etkin Mentörlük (MöEM): Öğretmen Adayları ve Öğretmenlik Uygulaması Mentörlerinin Algılarının İncelenmesi

Proje Yürütücüsü/Araştırmacının adı: Doç. Dr. Fatma Aslan Tutak

Adresi: Boğaziçi Üniversitesi, Eğitim Fakültesi, No:510, bebek 34342, İstanbul

E-posta adresi: fatma.tutak@boun.edu.tr

Telefonu: +90-212-359-4610

Sayın öğretmen,

Boğaziçi Üniversitesi Matematik ve Fen Bilimleri Eğitimi Bölümü öğretim üyesi Dr. Fatma Aslan Tutak "*Matematik Öğretiminde Etkin Mentörlük (MöEM): Öğretmen Adayları ve Öğretmenlik Uygulaması Mentörlerinin Algılarının İncelenmesi*" adı altında bilimsel bir araştırma projesi yürütmektedir. Bu çalışmanın amacı öğretmenlik uygulaması yapan öğretmen adaylarının ve onların uygulama (mentör) öğretmenlerinin etkili mentörlük algılarını ve arasındaki ilişkiyi incelemektir. Çalışmanın yürütülmesi için İl Milli Eğitim Müdürlüğünden gerekli izinler alınmıştır. Bu araştırmada bize yardımcı olmanız için siz mentör öğretmenleri de projemize davet ediyoruz. Kararınızdan önce araştırma hakkında sizi bilgilendirmek istiyoruz.

Bu bilgileri okuduktan sonra araştırmaya katılmak isterseniz lütfen bu formu imzalayıp kapalı bir zarf içinde bize ulaştırınız.Bu araştırmaya katılmayı kabul ettiğiniz takdirde öğretmenlik uygulaması kapsamında 2019-2020 eğitim-öğretim yılının 1. döneminde gerçekleştirmiş olduğunuz mentörlük hakkında 34 maddelik bir anket, matematik öğretimi-öğrenimine ilişkin inanışlar üzerine 26 maddelik bir anket, mentör olmak için motivasyonlarınız hakkında 19 maddelik bir anket ve mentörlük anlayışınıza ilişkin 48 maddelik bir anket doldurmanızı rica edeceğiz. Her bir anketi doldurmanız yaklaşık 15 dakikanızı alacaktır.

Çalışmaya katılan mentör öğretmenler arasından seçilecek 30 kişi ile bireysel yarı-yapılandırılmış görüşmeler yapılarak onların belirleyeceği bir gün ve saate bir ders gözlemi yapılacaktır. Ders gözlemi için proje ekibinden bir araştırmacı ders sırasında gözlem notları tutacak ve öğretmen masasına yerleştirilecek bir ses kayıt cihazı ile ses kaydı yapacaktır. Bireysel görüşmelerin yaklaşık 30 dakika sürmesi planlanmaktadır.

Bu araştırma bilimsel bir amaçla yapılmaktadır ve katılımcı bilgilerinin gizliliği esas tutulmaktadır. Verinin analizi ve farklı ortamlarda paylaşılmasında katılımcıların isim, okul vb. belirleyici bilgileri paylaşılmayacaktır. Toplanan elektronik ve basılı veri, araştırma projemiz süresince kilitli bir dolapta muhafaza edilip, araştırma sona erdiğinde silinecektir. Seçilmiş veri ve veri analizi sonuçları katılımcıların kimliği belirtilmeden matematik öğretmen eğitiminde veya bilimsel nitelikte yayın ve sunumlarda kullanılabilir.

Bu araştırmaya katılmak tamamen isteğe bağlıdır. Katıldığınız takdirde çalışmanın herhangi bir aşamasında herhangi bir sebep göstermeden onayınızı çekmek hakkına da sahipsiniz. Araştırma projesi hakkında ek bilgi almak istediğiniz takdirde lütfen Boğaziçi Üniversitesi Matematik ve Fen Bilimleri Eğitimi Bölümü Öğretim Üyesi Dr. Fatma Aslan Tutak ile temasa geçiniz (Telefon: +90-212-359-4610 Adres: Boğaziçi Üniversitesi, Eğitim Fakültesi, No:510, 34342 Bebek, İstanbul). Araştırmayla ilgili haklarınız konusunda Boğaziçi Üniversitesi Sosyal ve Beşeri Bilimler İnsan Araştırmaları Etik Kurulu'na (sbinarek@boun.edu.tr) danışabilirsiniz.

Eğer bu araştırma projesine katılmasını kabul ediyorsanız, lütfen bu formu imzalayıp kapalı bir zarf içerisinde bize geri yollayınız.

Ben, (katılımcının adı) ....., yukarıdaki metni okudum ve katılmam istenen çalışmanın kapsamını ve amacını, gönüllü olarak üzerime düşen sorumlulukları tamamen anladım. Çalışma hakkında soru sorma imkânı buldum. Bu çalışmayı istediğim zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabileceğimi ve bıraktığım takdirde herhangi bir olumsuzluk ile karşılaşmayacağımı anladım.

Bu koşullarda söz konusu araştırmaya kendi isteğimle, hiçbir baskı ve zorlama olmaksızın katılmayı kabul ediyorum.

Formun bir örneğini aldım (bu durumda araştırmacı bu kopyayı saklar) / almak istemiyorum.

Katılımcının Adı-Soyadı:.....

İmzası:.....

Adresi (varsa Telefon No, Faks No):.....

.....

Tarih (gün/ay/yıl):...../...../.....

Figure E.1. Informed Consent Form (for Mentors).

APPENDIX F: DEMOGRAPHIC INFORMATION (MENTORS)

Yaşınız:

Cinsiyetiniz:

Mezun Olduğunuz Üniversite ve Bölüm/Program:

Çalıştığınız Şehir:

Çalıştığınız Okulun Adı:

Çalıştığınız Okul:

- ☐ Devlet Okulu
- ☐ Özel Okul
- ☐ Diğer:.....

Kaç yıldır öğretmenlik yapıyorsunuz?

Kaç yıldır mentör öğretmenlik (stajda uygulama öğretmenliği) yapıyorsunuz?

2019-2020 eğitim-öğretim yılının 1. döneminde mentörlük yaptığınız öğretmen adayı sayısı:

Figure F.1. Demographic Information (Mentors).

APPENDIX G: MENTORING FOR EFFECTIVE MATHEMATICS TEACHING SCALE - MENTORS (MEMT-MENTOR)

Aşağıda mentörlük hakkında birtakım ifadeler verilmiştir. Bu ifadelere katılıp katılmadığınızı (1) Kesinlikle Katılmıyorum, (2) Katılmıyorum, (3) Kararsızım, (4) Katılıyorum, (5) Kesinlikle Katılıyorum cevaplarından bir tanesini işaretleyerek belirtiniz.

Matematik öğretmen adaylarının öğretmenlik uygulaması (staj) deneyimi sırasında, mentör öğretmen (uygulama öğretmeni) olarak	Hiç Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Tamamen Katılıyorum
1. matematik öğretimi konusunda aday öğretmene destek oldum.					
2. mevcut matematik dersi öğretim programında yer alan matematik dilini kullandım.					
3. matematik dersi hazırlarken aday öğretmene rehberlik ettim.					
4. matematik öğretimi için kullanılan okul politikalarını aday öğretmenle paylaştım.					
5. matematik öğretimini modelledim.					
6. matematik öğretimi için sınıf yönetimi stratejileri konusunda aday öğretmene yardımcı oldum.					
7. matematik öğretirken, birbirlerinin fikir, duygu ve düşüncelerini anlayan öğretmen-öğrenci ilişkisinin nasıl kurulacağını gösterdim.					
8. matematik öğretim stratejilerini uygulamada aday öğretmene yardımcı oldum.					
9. matematik öğretimi modellerken heyecanlı, ilgili ve istekliydim.					
10. uyguladığı matematik derslerinin zaman planlamasında aday öğretmene yardımcı oldum.					
11. aday öğretmene matematik programının ana hatlarından bahsettim.					
12. matematik öğretimim sırasında etkili sınıf yönetimini modelledim.					
13. aday öğretmenin uyguladığı matematik öğretimi hakkındaki değerlendirmemi onunla paylaştım.					
14. aday öğretmenin matematik öğretimi stratejilerini geliştirdim.					
15. matematik dersinin öğretimini modellemede etkiliydim.					
16. aday öğretmenin matematik öğretimi hakkında ona sözlü geri bildirimde bulundum.					
17. aday öğretmenle matematik öğretimi üzerine konuşma konusunda rahattım.					
18. etkili matematik öğretimi için gerekli soru sorma becerileri hakkında aday öğretmenle fikir alışverişinde bulundum.					
19. matematik öğretimi için sınıfta kullanılabilir materyaller kullandım.					
20. aday öğretmenin matematik öğretimi hakkında ona yazılı geri bildirimde bulundum.					
21. matematik öğretimi için ihtiyacı olan bilgiler hakkında aday öğretmenle fikir alış verişinde bulundum.					
22. aday öğretmene matematik öğretimine yönelik olumlu tutumlar aşıladım.					
23. matematik öğretimi uygulamalarını geliştirmeye yönelik yansıtma yapmada (kendisini incelemede) aday öğretmene destek oldum.					
24. matematik öğretimini planlama konusunda aday öğretmene açık yönlendirmelerde bulundum.					
25. matematik öğretiminin amaçları konusunda aday öğretmenle fikir alışverişinde bulundum.					
26. aday öğretmenin matematik öğretmeni olarak daha özgüvenli hissetmesini sağladım.					
27. aday öğretmenin matematik öğretimi ile ilgili sorunlarını çözmeye yönelik stratejiler sundum.					
28. aday öğretmenin ders planlarını, ders anlatımlarından önce gözden geçirdim.					
29. öğrenciler için iyi tasarlanmış matematik etkinliklerini gösterdim.					
30. matematik öğretimi hakkında aday öğretmenlere yeni bakış açıları kazandırdım.					
31. matematik öğretimi ile ilgili konularda aday öğretmeni dikkatle dinledim.					
32. aday öğretmene öğrencilerin matematik öğrenimlerinin nasıl değerlendirileceğini gösterdim.					
33. aday öğretmenin matematik öğretimini geliştirmek için neler yapması gerektiğini tane tane açıkladım.					
34. aday öğretmenin matematik öğretimini gözlemledikten sonra ona geri bildirim verdim.					

Figure G.1. Mentoring for Effective Mathematics Teaching Scale - Mentors (MEMT-Mentor).

APPENDIX H: OPEN-ENDED QUESTIONNAIRE FOR MENTORS

2019-2020 güz döneminde yaptığınız öğretmenlik uygulamasındaki deneyimlerinizi göz önünde bulundurarak aşağıdaki soruyu cevaplayınız.

1. Bu dönem yapmış olduğunuz uygulama öğretmenliği (mentörlük) sırasında "etkili mentörlük örneği" olduğunu düşündüğünüz bir deneyiminizi paylaşır mısınız?

Figure H.1. Open-Ended Questionnaire for Mentors.

APPENDIX I: INTERVIEW PROTOCOL

1. 2019-2020 güz dönemi matematik öğretmenliği formasyon programı öğretmenlik uygulaması dersi kapsamında ne tür uygulamalar yaptınız? (Uygulama öğrencilerinin öğretimlerini gözlemleme imkanınız oldu mu? Uygulama öğrencilerini nasıl değerlendirdiniz? Hangi uygulamalarına dayanarak?)

2. Uygulama öğrencilerinden staj okulunda ya da staj dersi kapsamında hangi uygulamaları yapmalarını bekliyordunuz? Yapılanlarla beklentileriniz ne kadar örtüştü?

3. Uygulama okullarını belirlerken dikkat ettiğiniz faktörler nelerdir? (Bir uygulama okulu ile çalışmaya devam edip etmemeye nasıl karar veriliyor?)

4. 2019-2020 güz döneminde süpervizörlüğünü yaptığınız aday öğretmenlerin uygulama okullarındaki mentörlerinin uygulamalarını göz önünde bulundurduğunuzda;
    a. Mentör öğretmenlerin kişisel nitelikleri hakkındaki gözlemleriniz nelerdir? Hangi kişisel nitelikleri matematik öğretiminde etkili mentörlük için önemliydi?

    b. Mentör öğretmenlerin sistem gereklilikleri konusundaki uygulamaları nelerdi? Matematik dersi öğretim programı ve amaçları, okul politikaları gibi konularda aday öğretmenle paylaşımları/yaptıkları çalışmalar nelerdi?

    c. Mentör öğretmenlerin pedagojik bilgi paylaşımı/alışverişi konusundaki uygulamaları nelerdi? Mentör öğretmenler, aday öğretmenlerin pedagojik ve pedagojik içerik bilgisini geliştirmeleri konusunda nasıl yardımcı olmuştu?

    d. Mentör öğretmenlerin ders modellemelerini (ders anlatımı, sınıf yönetimi, vs. modelleme) etkili mentörlük bağlamında nasıl değerlendiriyorsunuz?

    e. Mentör öğretmenlerin aday öğretmene dönüt (sözlü/yazılı) konusundaki uygulamaları nelerdi? Hangi aşamalarda, nasıl dönüt veriliyordu?

5. Uygulama öğretmenlerinin uygulamalarını değerlendirirseniz ne derece etkiliydi?

Figure I.1. Interview Protocol.