A QUALITATIVE STUDY TO EXAMINE MATHEMATICS AND SCIENCE MENTOR TEACHERS' CONCEPTION OF EFFECTIVE MENTORING

by

Beyza Ekiz

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ABSTRACT

A QUALITATIVE STUDY TO EXAMINE MATHEMATICS AND SCIENCE MENTOR TEACHERS' CONCEPTION OF EFFECTIVE MENTORING

This qualitative study examines the mathematics and science mentor teachers' understandings on effective area specialized mentoring. Through inductive thematic analysis of interview data from a sample of mentor teachers (4 mathematics, 4 chemistry, 2 biology, 3 physics teachers) from both public and private high schools in Istanbul, the research aims to dissect the multifaceted dimensions of mentorship in specialized subject areas. Four distinct themes emerged from the inductive analysis of the data: (1) Mentoring Motivations, (2) Conception of Knowledge for Teaching, (3) Mentoring Practices, and (4) Mentoring Perceptions. The findings indicate that mentor teachers across disciplines initiate their descriptions of effective mentoring by articulating conceptions of knowledge for teaching, specifically linking their mentoring practices to the requisite subject matter knowledge (SMK) and pedagogical content knowledge (PCK) that teachers ought to possess or develop. While both disciplines emphasize the critical importance of SMK and PCK, they apply these concepts differently. Mathematics mentors prefer enhancing knowledge through proofs and problem-solving, whereas science mentors focus on experiential learning with labs and hands-on activities, often integrating technology to foster engaging environments. The study also distinguishes between mentor teachers who identify as 'teacher educators'—who engage in detailed pedagogical discussions and reflective practices—and those who do not, with the latter group focusing more on providing emotional support and improving communicative competencies with students.

ÖZET

MATEMATİK VE FEN BİLİMLERİ MENTOR ÖĞRETMENLERİNİN ETKİLİ MENTORLUK ALGISINI İNCELEMEK ÜZERE NİTEL BIR ÇALIŞMA

Bu nitel çalışma, matematik ve fen bilimleri mentor öğretmenlerinin etkili alan odaklı mentorluk anlayışlarını incelemektedir. İstanbul'daki hem devlet hem de özel liselerden seçilmiş mentor öğretmenlerden (4 matematik, 4 kimya, 2 biyoloji, 3 fizik) alınan mülakat verilerinin indüktif tematik analizi yoluyla, araştırma, mentorluğun çok yönlü boyutlarını detaylandırmayı amaçlamaktadır. Verilerin indüktif analizinden dört belirgin tema ortaya çıkmıştır: (1) Mentorluk Motivasyonları, (2) Öğretim İçin Bilgi Kavrayışı, (3) Mentorluk Uygulamaları, ve (4) Mentorluk Algıları. Bulgular, mentor öğretmenlerin, etkili mentorluk tanımlamalarına öğretim için bilgi kavrayışlarını ifade ederek başladıklarını, özellikle mentorluk uygulamalarını öğretmenlerin sahip olması veya geliştirmesi gereken gerekli konu bilgisi (SMK) ve pedagojik içerik bilgisi (PCK) ile ilişkilendirdiklerini göstermektedir. Her iki disiplin de SMK ve PCK'nın kritik önemini vurgulamakla birlikte, uygulamaları kendi öğretim bağlamlarında farklı şekillerde özelleştirilmiştir. Matematik mentor öğretmenleri, matematiksel kanıtlar ve problem çözme egzersizleri yoluyla ileri matematik bilgisini pekiştirmeye odaklanan öğretim faaliyetlerini tercih etmektedir. Fen mentor öğretmenleri ise, laboratuvar çalışmaları ve teknoloji entegrasyonuyla uygulamalı öğrenme faaliyetlerini tercih etmektedir. Araştırma ayrıca, kendilerini 'öğretmen eğitmeni' olarak tanımlayan mentor öğretmenlerle, öğretmen eğitimcisi roluünü benimsemeyenleri ayırt etmektedir. Öğretmen eğitimcisi rolünü üstlenenler detaylı pedagojik tartışmalar ile yansıtıcı pratiklerde bulunurken diğer grup daha çok duygusal destek sağlamak ve öğrencilerle iletişim yeteneklerini geliştirmeye odaklanmaktadır.

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LIST OF ACRONYMS/ABBREVIATIONS

AMK	Advanced Mathematical Knowledge
CK	Curricular Content Knowledge
HEC	Higher Education Council
KCS	Knowledge of Content and Students
KCT	Knowledge of Content and Teaching
MERID	The Mentor Teachers Roles in Dialogues
MKT	Mathematical Knowledge for Teaching
MoNE	Ministry of National Education
MT	Mathemtmatics Teachers
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
SMK	Subject Matter Knowledge
ST	Science Teachers

1. INTRODUCTION

The landscape of education is constantly evolving, demanding innovative approaches to teacher preparation and professional development. Central to this evolution is the understanding that teaching is not merely a transfer of knowledge but a complex and multifaceted endeavor that requires a deep understanding of pedagogy and the subject matter.

While subject matter knowledge is crucial for teaching effectiveness, its impact on teaching performance follows a curvilinear pattern, where it initially enhances performance up to a certain level but then diminishes in influence (Darling-Hammond 2000). In contrast, pedagogical knowledge, encompassing learning strategies, teaching methods, and curriculum understanding, tends to have a more consistent and stronger positive effect on teaching performance compared to subject matter knowledge (Darling-Hammond 2000). Individuals who do not have a comprehensive teacher education often have a limited cognitive and cultural perspective, restricting their capacity to understand the experiences, viewpoints, and knowledge backgrounds that shape the learning processes of students from diverse backgrounds (Darling-Hammond 2000). Understanding others is not something innate; rather, it's cultivated through active engagement in study, reflection, guided experience, and inquiry (Darling-Hammond 2000).

The process of learning how to teach requires a combination of theoretical knowledge and practical experience. This recognition underscores the critical importance of pre-service teacher education and, more specifically, the role of teaching practicum in shaping the competencies and instructional strategies of future educators (Allen and Wright, 2014). Field experiences have the potential to greatly enhance the teacher education curriculum by providing opportunities for future educators to learn through observing, reflecting on, and actively engaging in teaching practices (Butler, 2012). Mentor teachers, due to their close and interactive relationships with practicum stu-

dents, are often seen as primary sources of guidance and valued for their extensive teaching experience (Zanting, 2001).

In the educational context of Turkey, teacher education has evolved significantly over time, particularly with the formalization of mentoring processes in teacher training programs by the late 1990s (Yılmaz *et al.* ., 2021). Recent regulations by the Ministry of National Education (MoNE) and the Council of Higher Education in Turkey have underscored the importance of mentoring and defined the roles of mentor teachers, pre-service teachers, and supervisors (MEB, 2018). While there have been efforts to reform and enhance the mentoring within teacher education programs in Turkey, these efforts have not been entirely effective or consistent (Yemez *et al.*, 2022). The recommendations by Kuter and Koç (2009) to clarify definitions and roles for all stakeholders involved in the teaching practicum highlight the ongoing challenges in the mentoring system. Given this backdrop, the purpose of this study is to examine the understanding of effective mentoring among mathematics and science mentor teachers in Turkey. By focusing on identifying the practices and perceptions that shape effective mentorship in the crucial fields of mathematics and science, this study seeks to contribute valuable insights into the mentorship practices.

2. REVIEW OF LITERATURE

2.1. Teacher Education

In today's educational landscape, classrooms are increasingly diverse with students from different backgrounds, abilities, and learning styles; technology is rapidly developing and becoming an integral part of education; educational standards and policies are constantly evolving to meet the demands of a changing society and workforce. Even very intelligent people who are enthusiastic about teaching in this educational environment find that they cannot easily succeed without preparation (Darling- Hammond 2000). Indeed, teacher education is a central and critical focus in educational research, given its pivotal role in shaping the next generation of educators, preparing students in an ever-evolving world, and contributing significantly to societal progress.

The early 1980s to the early 2000s witnessed a paradigm shift in teacher education research towards a more comprehensive and diverse exploration of learning processes, knowledge development, and contextual influences (Cochran and Smith, 2008). The research focused on teachers' subject matter expertise, pedagogical content knowledge, and the transformation of subject matter knowledge into effective classroom practices (Cochran and Smith, 2008). This shift aimed to build and explore the professional knowledge base of teachers, considering not only what and how teachers should know but also understanding the learning processes in preservice programs and schools. This approach aligns with cognitive psychology and interpretive perspectives on the classroom's environment, recognizing knowledge as constructed and fluid, and teaching as an intellectual and decision-making activity (Zeichner, 1999; Shulman, 1986).

In this evolving landscape of educational research, Shulman (1986) highlights that teaching involves more than practical abilities or subject matter expertise; it requires an in-depth understanding of how to convey knowledge and facilitate learning. He beautifully expresses this idea: *Those who can, do; those who understand, teach* (Shul-

man, 1986). In his review of paradigms, Shulman (1986) identified a missing paradigm in research on how teachers understand and use subject matter knowledge. He introduced a theoretical distinction between three components of content knowledge: subject matter content knowledge (SMK), pedagogical content knowledge (PCK), and curricular content knowledge (CK) (Shulman, 1987). The first one, subject matter content knowledge refers to the amount and organization of knowledge in the mind of the teacher. SMK is not only about knowing the facts, methods, and concepts of a subject, but it is also about conducting a detailed knowledge of them as well as understanding the underlying reasons for those facts, procedures, and concepts, among other things. Teachers must not simply be able to define the accepted truths, but they must also be able to explain why it is important to understand, and how it links to other concepts, both inside and beyond the discipline, in theory and practice.

The second component is Pedagogical Content Knowledge (PCK), which is a combination of pedagogical knowledge and content knowledge. It involves the ability to translate subject-matter knowledge into forms that are suitable for teaching, considering the needs and understanding of students. He includes the strategies of representing and articulating the subject that make it understandable to others under the category of pedagogical content knowledge. The third component is Curricular Knowledge, which encompasses the entire spectrum of programs designed for teaching specific subjects and topics at a particular level. It includes an understanding of the instructional materials available in relation to those programs and their use in specific circumstances (Shulman, 1986).

Following Shulman (1986, 1987), other models have been developed, each expanding on and enhancing Shulman's concepts. Within the field of mathematics, the Mathematical Knowledge for Teaching (MKT) model, developed by Ball *et al.* (2008), expands and provides more details on Shulman's three categories by dividing them into six subdomains.

The model illustrates the alignment between the MKT model and two of Shulman's initial categories: subject matter knowledge and pedagogical content knowledge. One of the categories under the SMK domain is common content knowledge (CCK), which includes mathematical knowledge and skills that can be used in various settings beyond teaching (Ball *et al.*, 2008). This encompasses understanding the content, recognizing mistakes, and using correct terminology and notation. Teaching-specific mathematical knowledge and abilities are referred to as SCK. This encompasses the capacity to do tasks such as identifying patterns in student errors and requires a unique understanding of mathematics and reasoning (Ball *et al.*, 2008). Knowledge of content and students (KCS), one of the categories under PCK, requires a combination of understanding students and mathematics, anticipating student thinking, and tailoring tasks to their abilities. Knowledge of content and teaching (KCT) combines understanding of teaching methods and mathematics, providing guidance for designing lessons, organizing content, and choosing examples to improve student learning (Ball *et al.*, 2008). In this representation, Shulman's third category, curricular knowledge, is tentatively placed within pedagogical content knowledge (Ball *et al.*, 2008). The diagram also introduces a third category within subject matter knowledge, termed "horizon knowledge" by Ball (1993). Horizon knowledge refers to an understanding of how mathematical topics interrelate across the entire span of mathematics curriculum. This category involves a forward-looking vision that aids in recognizing connections to more advanced mathematical concepts, providing valuable insights for instructional decisions (Ball *et al.*, 2008).

Similarly, Magnusson *et al.* (1999) introduced PCK for science teaching model which identifies five components. These components are: (a) Orientations Toward Teaching Science, involving teachers' knowledge and beliefs about the purposes and goals of science teaching at a specific grade level; (b) Knowledge of Science Curriculum, encompassing mandated goals and objectives, as well as familiarity with specific curricular programs and materials; (c) Knowledge of Students' Understanding of Science; (d) Knowledge of Assessment in Science, which includes awareness of the dimensions of science learning to assess and methods for assessment; and (e) Knowledge of Instruc-

tional Strategies, consisting of subject-specific and topic-specific strategies tailored for effective science instruction.

Understanding what teachers should know, the various aspects that constitute teacher competencies, how teachers acquire these competencies, and how they effectively apply their skills in practical teaching situations is a multifaceted challenge (Kaiser *et al.*, 2023). While Shulman provides structured frameworks for teacher knowledge, his static view of knowledge-critiqued for its mechanistic approach-led to the expert paradigm, which emphasizes the dynamic and context-dependent nature of PCK (Kaiser *et al.*, 2023). This shift towards considering competence within specific teaching situations has led to conceptualizations, such as the concept of teacher noticing as discussed by Kaiser *et al.* (2017). This dynamic perspective explores PCK's evolution through practical application in teaching contexts, supported by empirical studies, and a strong emphasis on professional development and reflective teaching (Kaiser *et al.*, 2023). This emphasis highlights the importance of comprehensive pre-service teacher education in equipping teachers with the skills and insights necessary to navigate diverse teaching environments effectively.

Pre-service teacher education, as the initial phase in becoming a teacher, holds significant value in preparing high-quality teachers who fulfill the demands of the profession. Musset (2010) categorized the primary elements of pre-service teacher education in OECD nations as subject-matter courses, teaching methods courses and teaching practicum. These components are crucial for equipping pre-service teachers with the necessary skills and knowledge to effectively teach in classrooms. Among these components, the teaching practicum stands out as particularly essential. It allows pre-service teachers to apply the theoretical knowledge gained from their coursework in real classroom environments (Allen and Wright, 2014). Significant learning opportunities emerge during the teaching practicum through structured and focused activities (Wilson *et al.*, 2001), enabling pre-service teachers to develop crucial teaching competencies (Lindgren, 2005). In this context, mentor teachers play a pivotal role in shaping the learning experience of pre-service teachers. With their extensive experience and

close interaction with mentees, mentors serve as valuable guides and sources of support (Zanting, 2001), aiding in the socialization process and offering emotional and psychological support (Hennissen *et al.*, 2011).

2.2. Mentoring

The etymology of the term mentor can be traced back to Greek mythology. In the Odyssey, Mentor is shown as a legendary figure who served as a reliable advisor and mentor to Telemachus, the son of King Odysseus. Mentor was responsible for protecting, guiding, and fostering the growth of Telemachus while his father was away at war. The term "mentor" originally meant "wise advisor", and it was used to refer to someone who might serve as a guide, counselor, or role model.

Mentoring finds notable applications in also Turkish culture. Atabey and Lala play roles like mentors in Greek mythology and are significant in Turkish history. Atabey, a high-ranking official, educated young princes, especially during the Seljuk and early Ottoman periods.

Similarly, the Lala served as a mentor, developing the character and abilities of future Ottoman leaders. Another instance is the Ahi tradition, in which the experienced "hami" (mentor) novice "himaye edilen" (mentee) encouraging mutual understanding, exchanging career goals, and offering opportunities for skill development-a testimonial to knowledge transfer between generations.

While the concept of mentorship dates to ancient Greek mythology, most of the research on mentorships has been carried out in the last two decades (Chao, 1997). There are several definitions of mentoring in literature, its meanings are changing and expanding. Jacobi (1991) identified 15 distinct definitions of mentoring across educational, psychological, and management literature. According to Merriam's (1983):

The phenomenon of mentoring is not clearly conceptualized, leading to confusion as to just what is being measured or offered as an ingredient in success. Mentoring appears to mean one thing to developmental psychologists, another thing to business-people, and a third thing to those in academic settings, (p. 169).

However, despite this range of definitions, Eby *et al.* (2008) identified five characteristics of mentoring that provide a common framework for understanding this phenomenon. Firstly, mentoring is seen as a unique relationship between individuals, with each mentorship being different. This uniqueness is shaped by distinct interpersonal exchanges and interaction patterns. Secondly, mentoring is viewed as a learning partnership, emphasizing the acquisition of knowledge, even if the goals may differ across different settings and relationships. Thirdly, mentoring is considered a process characterized by the support provided by the mentor to the protégé (i.e., a person who is guided and supported). This support is broadly classified as emotional or psychosocial (e.g., friendship, acceptance, support) and instrumental or career-related (e.g., coaching, information, advocacy, sponsorship). Fourthly, the mentoring relationship is seen as reciprocal but asymmetrical, meaning both mentor and protégé benefit, but the primary goal is the growth and development of the protégé. Lastly, mentoring relationships are dynamic, changing over time, and the impact of mentoring tends to increase as time passes.

Mullen and Klimaitis (2019) signify the importance of not just defining mentoring, but also clarifying what it is not with emphasizing that mentoring should not be confused with various concepts such as coaching, induction, training, passive endeavors, therapy, one-way interactions, or a one-time intervention to fix a problem. Coaching typically involves short-term, goal-oriented support with a focus on skill development, while mentoring is a longer-term relationship providing multifaceted support beyond immediate goals, encompassing various aspects of personal and professional growth (Nora and Crisp, 2007; Mullen, 2017). Likewise, induction is typically a formal, time-limited training program designed for organizational integration and individual outcomes, whereas mentoring encompasses a broader and longer-term re-

lationship focused on multifaceted support for the mentee's growth and development (Mullen and Klimaitis, 2019).

In traditional mentoring situations, a mentor and mentee share a learning experience throughout time (Mullen and Klimaitis, 2019). Mentees, often younger and far less experienced, benefit from the mentors' wisdom, knowledge, and experience (Kram, 1983). The concept of learning in traditional mentoring assumes that knowledge can be transferred from one person to another. This process is characterized by a hierarchical, one-way relationship. The paradigm shifts in teacher education research from the early 1980s to the early 2000s, emphasizing a more comprehensive understanding of learning processes, has influenced mentoring perspectives. This shift in educational research reflects a shift toward more inclusive, technology-integrated mentoring approaches that consider diverse teacher needs, encourage reflective practices, and adapt to the evolving complexities of modern education.

Contemporary perspectives on mentoring emphasizes the collaborative construction of knowledge through socio-constructivism and dialogues, challenging the idea of direct transfer of knowledge and encouraging a more interactive learning process (Heikkinen *et al.*, 2012). This collaborative approach is exemplified in the examination of two prominent mentoring models: The Kram Mentoring Model and The MERID Model.

2.2.1. Kram Mentoring Model

Kram (1985) identified two categories of mentorship functions: career function and psychological function. Career functions for mentees include sponsorship, exposure, visibility, mentoring, protection, and demanding tasks to improve their careers. Psychosocial functions include role modeling, acceptance, affirmation, counseling, and friendship shape the mentee's self-image and competence (Kram, 1983).

According to Kram (1983), mentoring "is relational and developmental", (p. 11) has career (instrumental) and psychosocial (relational) functions, and "includes phases and transitions", (p. 11). Kram (1983, 1985) described the mentoring process in four stages. The first stage of mentoring, known as the Initiation phase, is characterized by the mentor and mentee growing to respect each other. The first 6 to 12 months, a positive relationship perception develops, with the mentee valuing the mentor's competence and support. Over time, the mentor's actions reinforce this perception, fostering a supportive atmosphere. If the relationship progresses, it enters a Cultivation phase lasting 2 to 5 years, optimizing mentorship functions, and mentor and mentee engagement peaks (Kram, 1983).

The third phase, Separation, represents a structural and psychological distance between mentor and mentee as the mentor's role diminishes and the mentee becomes more independent (Chao, 1997). This phase, lasting 6 to 24 months (about 2 years), can be emotionally challenging as either or both partners may feel anxious and defiant about the separation (Kram, 1983). During this period, the relationship undergoes significant transformation, with fewer interactions and increased autonomy for the mentee (Mullen and Klimaitis, 2019). The Redefinition phase signifies the conclusion of formal mentorship, transitioning the relationship into one of informal contact and mutual support (Chao, 1997; Kram, 1983).

According to Kram's (1985) research, phases are linked to distinct developmental functions, with psychosocial functions being more significant in the Cultivation phase and career functions more prominent initially. Career and psychological functions become less important when a relationship moves into the Redefinition phase (Chao, 1997).

It is important to mention that other than Kram's interviews with 18 mentor-mentee pairs, there are not a lot of published studies investigating the validity of these phases. Hence, although Kram's approach offers a significant framework, additional research is required to validate and generalize the findings to various mentorship

relationships (Mullen and Klimaitis, 2019; Chao, 1997). To further enhance the understanding of effective mentoring, the MERID model can also be explored, offering a detailed examination of mentor roles and interactions. Unlike the developmental stages emphasized by the Kram model, the MERID model focuses on the specific roles mentors adopt during dialogues, providing a more nuanced understanding of mentoring dynamics in education.

2.2.2. The MERID Model

The MEntor (teacher) Roles in Dialogues (MERID) model developed by Hennissen *et al.* (2008) is a two-dimensional conceptual model that provide a framework for researchers and educators to observe, describe, and analyze the supervisory behavior of mentor teachers during mentoring dialogues. The model aims to integrate and provide a more comprehensive understanding of mentor teachers' roles by connecting two aspects of mentoring dialogues, specifically 'input' and 'directiveness'.

The literature on mentor teachers' supervisory behavior in mentoring dialogues identifies five different research objects: degree of input, degree of directiveness, time aspects, nature of the content, phasing of the dialogue (Hennissen *et al.*, 2008). Regarding degree of input, research indicates that mentor teachers usually take the role of leading discussions and determining the subjects of focus. The degree of directiveness can be classified into two styles: direct (telling and criticizing) and indirect (asking and listening) supervisory styles (Blumberg, 1970). Regarding time aspects, the length of mentoring dialogues varies, and research suggests that mentor teachers tend to use more speaking time than student teachers. According to research by Hawkey (1998), mentor teachers with a directive style may utilize more speaking time than non-directive mentors.

Concerning the nature of the content in mentoring dialogues, research identifies three main categories: instruction and organization, the pupils and the class, subject matter. The topics mostly focus on instructional and organizational settings, with

limited emphasis on individual students, the classroom, or specific subjects. Research indicates that the phasing of dialogues can be divided into two aspects. The first component involves reflecting on what happened in the previous lesson, which is referred to as "deconstructing practice". The second aspect involves planning for future lessons, which is labeled as "constructing practice" (Harrison *et al.*, 2005).

The MERID model contains two independent dimensions. The vertical axis represents the "input" dimension, indicating the degree to which topics are introduced into the dialogue by the mentor teacher. Input dimension is presented as a continuum with two poles: "active" and "reactive". The horizontal axis represents the "directiveness" dimension, signifying the mentor teacher's level of control in steering the dialogue. Directiveness dimension is presented as a continuum with two poles: "directive" and "non-directive". The combination of these dimensions results in the identification of four specific mentor teacher roles: initiator, imperator, advisor, and encourager.

In the 'initiator' role, the mentor teacher takes the initiative by introducing a specific topic for discussion in a non-directive manner. A teacher in the initiator role uses nondirective supervision skills like summarizing content, outlining emotions, and asking open questions after an introduction to the topic. This role emphasizes the mentor's active participation in shaping the conversation and promoting the mentee's reflective thinking. While both 'initiator' and 'imperator' roles involve the mentor teacher initiating topics, the imperator role distinguishes itself by a more directive approach, where the mentor takes the lead in introducing topics and uses directive supervisory skills to guide the dialogue. In the imperator role, the mentor uses directive supervisory skills, such as giving opinions and advice, to guide the dialogue.

Two other roles advisor and encourager. The "advisor" role involves the mentor providing specific guidance and advice to address the mentee's challenges or concerns. The "encourager" role involves the mentor using non-directive supervisory skills to support the mentee's exploration and reflection on their challenges without providing explicit solutions.

While the advisor gives direct advice, the encourager guides the mentee through self-reflection, fostering independent problem-solving and understanding.

By highlighting the varied roles played by mentors in dialogues with their mentees, the understanding of effective mentoring practices, particularly in educational contexts, is enriched by the MERID model. The focus on adaptive and interactive mentoring is crucial for addressing the diverse needs of pre-service teachers. With these specific models examined, attention is now turned to the broader scope of teacher mentoring.

2.3. Teacher Mentoring

The in-school professional experiences serve as a bridge between theoretical studies and actual teaching practices in the classroom, which improves the development of preservice teachers. Mentoring leads to improvements within classrooms and schools, along with better explanations and justifications for the quality of educational practices (Hudson *et al.*, 2009). Moreover, mentoring can serve as a mechanism for guiding advancements and transformations in education by fostering knowledge about curriculum design, teaching methods, and learning processes (Hudson *et al.*, 2009). Teachers, in their collaborative roles as mentors, are an essential component for developing preservice teachers' practices.

Further benefits of professional experiences are associated with the development of reflective practice among preservice teachers. Through this process, they gain valuable insights into their own teaching methods, which contributes to their growth and development as effective teachers (Kuhn *et al.*, 2024). During professional experience, mentors have been found to play an important role in the socialization of teachers by helping them adjust to the norms, standards, and expectations associated with teaching and schooling in general (Hubson *et al.*, 2009).

Expanding on the critical role of mentors in fostering reflective practice and socialization, Orland-Barak and Wang (2021) identified four primary approaches to pre-

service teacher mentoring based on the analysis of theoretical literature on teacher mentoring approaches. These approaches include personal growth, situated learning, core practice, and critical transformative approaches. In the personal growth mentoring approach, mentor teachers take on the role of counselors, empathizing with preservice teachers' personal needs, assisting them in overcoming challenges, and building confidence in their teaching abilities. On the other hand, the situated learning mentoring approach involves mentor teachers utilizing their teaching experiences to immerse preservice teachers in teaching cultures and practices specific to school contexts. They guide preservice teachers in observing and replicating teaching methods, provide feedback focused on technical aspects of teaching, and facilitate learning within the context of real classroom situations.

Mentor teachers following the core practice mentoring approach model essential teaching practices, engage preservice teachers in practicing and deconstructing these practices, collaborate on lesson planning and teaching, and create opportunities for skill development across various teaching environments. The critical transformative mentoring approach, rooted in critical pedagogy principles, encourages active critique and inquiry into teaching practices to promote student learning for social justice purposes. Mentor teachers in this approach challenge preservice teachers to question traditional teaching methods, engage in collaborative problem-solving, and explore alternative teaching approaches to address diverse student needs and advocate for social justice in education.

Empirical studies in the literature provide valuable insights into the practical applications and significance of mentoring approaches. Building on the importance of mentor characteristics, Hudson (2013) gathered insights from 25 experienced mentor teachers to identify essential qualities and practices for preservice teachers. This study highlighted commitment, adaptability, and friendliness as crucial traits, while planning, preparation, behavior management, and instructional strategies were deemed essential practices. Another study, Van Ginkel *et al.* (2018) highlights the critical role of mentor teachers' diagnostic skills in the success of mentoring. The study focuses on how 11

mentor teachers identify similarities and differences among their mentees, finding that personal interactions, defining as a teacher, perfectionism, and confidence were key areas.

Further exploring mentoring dynamics, Graves (2010) examined the relationships between preservice teachers and mentors, emphasizing the significance of clear expectations, continuous communication, and sufficient time for developing supportive relationships. Additionally, the study recommended mentor training to enhance their understanding of roles and effectively support preservice teachers. Focusing on the relational aspects, Hagenauer *et al.* (2021) analyzed the quality of mentor-mentee relationships, particularly the turning points in communication. The study revealed that high-quality feedback positively influenced relationships, whereas a lack of appreciation and low-quality mentoring had negative impacts. This underscores the need for strong professional and interpersonal skills among mentor teachers. Similarly, Hudson (2016a) investigated positive mentor-mentee relationships through written responses and focus group interviews with over 200 teachers. The findings suggested that sharing knowledge, resources, and expectations, along with supportive problem-solving, were critical in building trust and respect. The study also presented a model for fostering positive relationships. Extending the discussion on feedback, Hudson (2016b) explored the variability in written feedback from 24 mentor teachers after observing a preservice teacher via video. Initial feedback was more general, while subsequent feedback, focused on specific teaching activities, provided deeper insights. This research highlighted the importance of detailed and focused feedback in the mentoring process. Having examined various mentoring approaches and their significance, it is essential to explore how these practices are implemented within the context of teacher mentoring in Turkey.

2.3.1. Teacher Mentoring in Turkey

The historical development of teacher training institutions in Turkey traces back to the late Ottoman Empire, with the establishment of 'Darülmuallimin' schools in 1848, serving until 1924. These schools in Istanbul educate teachers for 'modern'

schools (Rüşdiye mektepleri) and offer a more secular, standardized, and Westernized curriculum than traditional primary schools (Akyüz, 2006). Those who had a diploma and ranked the highest were assigned to the role of 'muidlik' (assistant teaching) to develop the necessary habits and skills associated with teaching (Özkan, 2018). However, as stated by Yemez *et al.* (2022), there is no reference in the literature as to whether 'muid' received any mentoring as an assistant teacher.

The establishment of the Turkish Republic in 1923 led to the unification and standardization of the educational system through the 'Law on Unification of Education' (Tevhid-i Tedrisat Kanunu) in 1924, placing all educational systems under the control of the Ministry of Education (Tarman, 2010). The first notable mentoring practices in Turkey emerged with the 'Village Institutes' in the 1940s, responding to regional needs and aiming to provide education to people in Anatolian villages deprived of modern education due to consecutive wars (Çakıroğlu and Çakıroğlu, 2003). Village Institutes provided a unique model of mentoring, integrating an unstructured mentorship approach like a master-apprentice relationship: teachers were in the position of mentors of teacher trainees and teacher trainees were mentoring one another in practical courses (Yemez *et al.*, 2021).

After the closure of Village Institutions in 1954, major reforms were initiated to enhance professional orientation in teacher education. Teacher education initially continued in Teacher Schools, but specific information about mentoring or supervision during this period is not available (Gürşimşek, Kaptan and Erkan, 1997). Criticism of the education quality in these institutions led to a restructuring of teacher education policies in 1973 with the acceptance of the 'Fundamental Law of National Education.' Teacher Education Schools evolved into Teacher High Schools and later Education Institutes, offering a three-year higher education program (Gürşimşek, Kaptan and Erkan, 1997). The mentoring process in teacher training programs was not structured and framed according to specific regulations until the end of the 90s (Yılmaz *et al.*, 2021).

The Ministry of Education trains its own teachers, and teacher candidates could not observe in a real classroom environment and systematically gain teaching experience in Teacher Education Schools.

In 1982, regulations transferred the responsibility of teacher education from the Ministry of National Education (MoNE) to universities through the Higher Education Council (HEC), leading to the transformation of Education Institutes into Education Faculties at universities (Gürşimşek, Kaptan and Erkan, 1997). In the period since the delegation of the function of teacher training to universities, restructurings concerning teacher training undergraduate programs have been undertaken in 1997, 2006, 2009, and 2018.

Between 1994 and 1998, "The Development of National Education Project" was conducted through a collaboration between the Turkish Higher Education Council (YÖK) and the World Bank. This educational policy project started a paradigm shift. As part of this project, the time allocated for teaching practices courses in teacher education programs significantly increased to integrate the knowledge and skills learned at the faculty with the experiences gained in schools in a meaningful way. To regulate collaboration between education faculties and practice schools, a guide defined mutual duties and expectations for the first time (Bulunuz, 2013; YÖK, 1998). The 'Faculty-School Cooperation Booklet' written in 1998 regarding teaching practices in schools was revised in 2018 and 2021.

Teaching practice involves a triad of stakeholders: mentor teacher, student teacher, and supervisor. The mentor teacher, an experienced educator, provides guidance and mentorship to student teachers. Student teachers are pre-service educators who receive hands-on training and practical training in real classroom environments. Supervisors are higher education institution staff who plan teaching practice together with practicing teachers, participate in and evaluate the student teachers teaching practicum. Today, there are two aspects of teaching practice: a two-hour course at university managed by an instructor (supervisor) and twelve-week practicum at a school. Teaching

practice courses at university are extended over two semesters with six lesson hours per week. Each semester, the practicum student is required to instruct not less than 20 lesson hours, under the supervision of the practicum teacher, in at least eight different weeks (Those whose lesson hours are 1-2 hours in the weekly lesson schedule of the relevant course is required to instruct 10 lessons.) The practicum instructor is required to physically attend a minimum of two lessons for each student (MEB, 2021). The Ministry of National Education (MoNE) recorded teaching practices in schools through the National Education Information System (MEBBİS), and courses were organized for practicum teachers. The Practice Student Evaluation Module was created to evaluate the performances of practicum students by both the practicum instructor and the practicum teacher (MEB, 2018).

Undoubtedly, the guidance, feedback and mentoring of mentor teachers within the teaching practicum contribute significantly to the practical and professional development of teacher candidates as they transition from theory to practice in real classroom environments. Due to close and interactive relationships, practicum students often seek cooperating teachers as a primary source of guidance, valuing their extensive teaching experience (Zanting, 2001). Recognizing the evolving landscape of education, there is a great need to transform the traditional role of the practicum teacher into a 'school-based teacher educator' who can serve as role model, mentor and colleague for the development of practicum students in teaching practice (Kiraz and Yıldırım, 2007).

In line with this transformation, in the current system, cooperating (practicum) teachers are required to have the Teaching Practice Consultancy Training Course Certificate provided by the Ministry of National Education. Within the scope of this course, the Clinical Supervision Model is introduced to improve the quality of supervisory skills of practicum teachers. Cooperating teachers undergoing the course are provided with detailed information about the stages of the practicum process, which include the cycles of "pre-interview", "observation and data collection", "data analysis", and "post-interview" (Bulunuz and Gürsoy, 2018).

Clinical Supervision Model: The concept of 'clinical supervision' originated in the late 1950s by Morris Cogan, Robert Goldhammer, and Robert Anderson to improve how they supervised students in Harvard University. Clinical supervision involves collaborative, planned activities focusing on observation, examination, and behavior change. It aims to improve teaching by changing and developing teacher behaviors, relying on the first-hand acquisition of data related to instructional processes (Bulunuz, 2013). The Clinical Supervision Model (CSM) cycle comprises five stages: Pre-conference, Observation and Data Collection, Analysis, Post Conference, and Reflection (Bulunuz, 2013). *1. Pre-conference*; The Teacher Trainee (TT) collaborates with the Supervisor (S) to discuss and refine the detailed lesson plan, addressing crucial aspects such as teaching strategies, classroom management techniques, and material selection. *2.Observation and Data Collection*; Both the Supervisor and CT engage in nonjudgmental and systematic observations of the TT's teaching, capturing valuable insights and gathering data for subsequent analysis. *3. Analysis*; The Supervisor analyzes the collected video data supplemented by observation notes, identifying strengths and areas for improvement in the lesson delivery. *4. Post Conference*; Conducted as a three-way conference involving the S, CT, and TT, serves as a platform for constructive feedback and discussion. The feedback is carefully crafted to provide guidance and support to the TT without veering into overly negative critique, fostering a positive learning environment. *5. Reflection*; TT is encouraged to reflect on the feedback received during the Post Conference, as well as their overall teaching experiences throughout the cycle.

Given this structured approach, it is essential to understand how these practices are perceived and implemented through empirical studies. In the context of mentoring in teacher education in Turkey, several qualitative studies have explored the perspectives and experiences of various stakeholders. Most studies on pre-service teacher mentoring have focused on the perspectives of pre-service teachers themselves (Canaslan-Akyar, 2020; Aydın and Ok, 2020; Hudson, Uşak, and Savran-Gencer, 2010; Sağ, 2008; Kiraz and Yıldırım, 2007; Ekiz, 2006; Kiraz, 2003). Ekiz (2006) also included the views of mentors, and Yılmaz and Bıkmaz (2020) explored mentoring needs from the perspectives of supervisors, mentors, and pre-service teachers.

For instance, Canaslan-Akyar (2020) examined the effectiveness of mentoring processes in practicum courses from the viewpoint of preservice teachers. The study found that cooperating teachers and supervisors often struggled to provide adequate guidance, particularly in classroom management, indicating a critical need for improvement in this area. Similarly, Akpınar *et al.* (2012) focused on mentor teachers' opinions about preservice teachers' competencies. The study identified strengths in using instructional technologies and preparing assessment activities, while also noting weaknesses in method selection, subject knowledge, classroom management, and communication skills. These shortcomings were attributed to the preservice teachers' inexperience and the limited duration of the practicum.

Aydın and Ok (2020) explored the perceptions of prospective teachers, mentor teachers, and supervisors regarding their roles and responsibilities in the mentoring process. The research found consensus on roles such as protection, facilitation, support, observation-feedback, and collegiality, with partial agreement on roles like informing, role modeling, assessment, collaboration, and reflection. Further investigating mentor needs, Yılmaz and Bıkmaz (2020) examined the perspectives of supervisors, mentor teachers, and preservice teachers. The study categorized mentor needs into three main areas: professional knowledge and skills, basic counseling skills, and social competencies, providing a comprehensive understanding of the multifaceted requirements for effective mentoring. In another study, Sarı *et al.* (2020) used metaphors to explore the perceptions of the mentor-mentee relationship among classroom teachers and preservice teachers. The study found that both groups commonly used the "master-apprentice" metaphor. Additionally, preservice teachers frequently used the metaphor of "cooperation", while classroom teachers often referred to "benefiting from experience", highlighting different aspects of the mentoring relationship.

Ekiz (2003) examined how prospective teachers assess the supervisory competence of their supervising teachers. The research involved 690 prospective teachers who had completed practice teaching in their final year of college. The candidates evaluated their supervising teachers in terms of preparation for supervision, instruc-

tional planning and reflection, and collegial supervision and effective mentoring. The results indicated that most prospective teachers rated their supervising teachers as 'poor' or 'partially competent,' with particular weaknesses identified in instructional planning and reflection.

These studies have investigated mentoring within various contexts, such as the Primary School Science Teaching Program (Hudson, Uşak, and Savran-Gencer, 2010), Classroom Teacher Education Programs (Yılmaz and Bıkmaz, 2020), Early Childhood Education (Canaslan-Akyar, 2020), English Language Teaching (Aydın and Ok, 2020), and faculties of education with multiple teaching programs (Kiraz and Yıldırım, 2007; Sağ, 2008; Kiraz, 2003).

In the current mentoring practice implemented in Turkey, although different subjects require different teaching strategies and pedagogical content knowledge, subject specific mentoring such as English, Turkish, and Mathematics is unaddressed (Yavuz, 2011). One of the recent studies addressing this gap is by Güler *et al.* (2023) investigated the impact of e-mentoring on novice middle school mathematics teachers, focusing on enhancing their noticing skills through video-enriched practices. The study involved 17 participants and employed a single-group pre- and post-test design. Teachers' noticing skills were assessed via a whole-class teaching video before and after the intervention, analyzing their responses in terms of attending, interpreting, and decision-making. The results demonstrated significant improvements in all dimensions of the participants' noticing skills.

2.3.2. Area/Discipline Specified Mentoring

Over the past decade, there has been significant growth in knowledge about generic mentoring methods and practices, outlining essential elements for effective mentoring (Hudson, 2004). However, while generic mentoring provides valuable insights, it may restrict the mentee's experiences for specific teaching practices that covers several key learning areas (Hudson, 2004). Pedagogical knowledge varies across

different subjects, highlighting the necessity for specific mentoring approaches that address content-related issues in subject-specific terms. Peterson and Williams (1998) emphasize the need for unique mentoring processes designed specifically for teachers in specific subject areas. This recognition underscores the importance of aligning mentoring strategies with the subject-specific pedagogy, ensuring that educators receive targeted support and guidance relevant to their teaching contexts.

The transition from generic mentoring to specific mentoring practices can provide a stronger focus for developing preservice primary teachers (mentees) in subject-specific areas. Five Factor Mentoring Model towards specific subject mentoring is proposed as ways to develop mentees' teaching practices.

Five Factor Mentoring Model; Hudson and Skamp (2001, 2003) identified Five-Factor Mentoring Model which focuses on the five factors for effective mentoring in mathematics-Personal Attributes, System Requirements, Pedagogical Knowledge, Modeling, and Feedback.

Factor 1 – Personal Attributes; Mentors need to show several personal attributes to foster the development of mentees' teaching skills. Mentors should be supportive, attentive, and comfortable while discussing teaching practices. Additionally, mentors need to assist their mentees develop positive attitudes toward teaching primary subjects, confidence in their ability to teach primary subjects, and the ability to think more constructively about methods for improving the instruction in specific subject areas.

Factor 2 – System Requirements; System requirements give quality control standards by offering a curriculum that focuses on achieving specific educational objectives. Mentors play a crucial role in providing understanding and guidance to beginning teachers regarding system requirements when they enter the education system. Three key mentoring practices associated with system requirements include focusing on aims for teaching specific subjects, the curriculum, and school policies related to subject areas.

Factor 3 – Pedagogical Knowledge; By offering pedagogical expertise, mentors play a crucial role in directing the teaching practices of their mentees. Providing pedagogical knowledge by mentors is considered a key factor in the mentoring process. The absence of a focus on pedagogical knowledge in mentoring programs is seen as potentially limiting or reducing the quality of experiences that mentees can gain in a school setting. Planning for teaching, timetabling, preparation, teaching strategies, classroom management, questioning skills, help with problem-solving, content knowledge, implementation, assessment, and offering different points of view are some of the mentoring attributes and practices that are related to pedagogical knowledge.

Factor 4 – Modeling; Teaching skills are more effectively acquired by mentees when they observe their mentors demonstrate effective methods of instruction (Carlson and Gooden, 1999). The attributes and practices associated with modeling include enthusiasm (demonstrating a positive and engaging attitude towards teaching), effective teaching, rapport with students, hands-on lessons (providing practical, interactive learning experiences), well-designed lessons, classroom management, syllabus language (using appropriate language when communicating the content and objectives of a syllabus).

Factor 5 – Feedback; Offering feedback enables preservice teachers to engage in reflection and enhance their teaching methods. The attributes and practices linked to Feedback factor: clearly communicate expectations, assess lesson plans, observe teaching sessions, offer verbal feedback, provide written feedback, and support mentees in evaluating their teaching practices.

3. SIGNIFICANCE OF THE STUDY

From the early 1980s to the early 2000s, the landscape of teacher education research underwent a transformative shift, marked by a shift towards a more comprehensive and diverse exploration of learning processes, knowledge development, and contextual influences (Cochran and Smith, 2008). This evolution is crucial in understanding how teachers perceive teaching and learning, a factor that significantly influences their comprehension of mentoring.

The paradigm shift in the global education landscape has had noticeable effects in Turkey as well, leading to a significant increase in the time allocated for teaching practices courses within teacher education programs. This shift aims to integrate the knowledge and skills acquired in academic settings with the practical experiences gained in schools in a more meaningful and effective manner. Recent regulations from the Ministry of National Education (MoNE) and the Council of Higher Education in Turkey have highlighted the importance of mentoring in teacher education. Despite these regulations emphasizing the significance of mentoring, there remains a lack of research on mentoring practices post-regulations, particularly within the unique context of Turkish education.

The significance of this study is highlighted by the growing body of literature on teacher mentoring in Turkey, which examines various dimensions including mentoring processes, roles of mentors, and the challenges they face (Çakmak and Çelik, 2022). Existing research, primarily qualitative, often focuses on the perceptions of pre-service teachers and evaluates teaching practices through feedback from a wide range of stakeholders, pointing to a need for a deeper understanding from the mentors' perspective. Additionally, subject-specific mentoring is recognized as essential for the development of effective mentoring programs in Turkey across all teacher education programs (Ekiz, 2006). Kiraz (2003) emphasizes that mentor teachers need to better understand their roles and responsibilities to improve their supervisory skills, suggesting that mentoring

effectiveness is contingent upon a mentor's self-awareness and adaptability in practice. By investigating mentor teachers' own reports of their mentoring practices this study aims to contribute to the identified gap by examining their understanding of area specialized effective mentoring.

4. PROBLEM STATEMENT

4.1. Research Question

In the context of teaching practicum, the term 'mentoring' refers to the crucial role played by an experienced, in-service teacher from the school in facilitating and providing guidance to new and inexperienced, pre-service teachers (Gordon, 2019; Hudson *et al.*, 2013). While examining individual interviews with mentor teachers, this study considers the variables of branch, years of teaching experience, and years of mentoring experience. The "branch" refers to the specific subject area or specialization of the teachers. This variable helps in understanding how mentorship varies across different areas of teaching. Another variable is "years of teaching experience", which quantifies the number of years that mentor teachers have worked as teachers in schools, reflecting their level of expertise and familiarity with classroom practices. Lastly, "years of mentoring experience" is defined as the number of years that mentor teachers have worked specifically with preservice teachers during their practicum at school. This variable highlights the mentor's experience and proficiency in guiding and mentoring preservice teachers.

This research study aims to understand mathematics and science mentor teachers' motivations and understanding on effective mentoring practices for area specialized teaching.

RQ: What are mathematics and science mentor teachers' understanding on area specialized effective mentoring?

(i) What are the motivations of mentor teachers to take on the role of mentoring?
(ii) How do mathematics and science mentor teachers conceptualize mentoring practices?

5. METHOD

In the context of this research, an in-depth investigation is conducted on the individual interview data obtained from mentor teachers as a component of a comprehensive research project (TÜBİTAK-220K086).

TÜBİTAK-220K086: Developing a Model for Area Specialized Effective Mentoring and Implementing Professional Development for Mentors

This project was conducted in three cities in Turkey: Istanbul, Ankara, and Trabzon. It involved two simultaneous Delphi studies to gather expert opinions for Mathematics and Science separately, and a descriptive study. Expert opinions from local and foreign experts in mathematics education and in science were collected to examine similarities and differences and promote interdisciplinary studies. A mixed method approach was applied in the descriptive study, including quantitative assessments and qualitative interviews with at least 30 mentors per field (secondary school Mathematics, Physics, Chemistry, and Biology education). The study aimed to develop Mentoring for Area Specialized Teaching (MAST Model) by integrating effective mentoring definitions and practices from the Delphi study with insights from mentors and preservice teachers from the descriptive study. For the secondary purpose of developing MT-PD (Mentor Teacher Professional Development), the study was designed in three steps: designing MT-PD based on MAST Model, implementing MT-PD, and evaluating MT-PD.

This research had conducted in the first phase of the TÜBİTAK-220K086 project. In addition to developing the MAST Model, with this thesis study the researcher aimed to reveal how mathematics and science mentor teacher conceptualize effective mentoring. In other words, the qualitative approach is used to obtain a deeper understanding of perception of effective mentoring of mentor teachers who were interviewed individually within the research project's scope.

5.1. Research Design

Quantitative research involves identifying variables, stating a hypothesis, and conducting experiments, resulting in numerical data that can be statistically analyzed (Creswell, 2003). However, qualitative research is the conventional approach used to gain an in-depth understanding of society or human nature. Creswell (1998) states that qualitative research involves creating a comprehensive and holistic representation, analyzing words, describing the perspectives of informants, and conducting investigations in authentic environments. Given the focus of this study on mentor teachers' experiences and views, as opposed to numerical data, a qualitative methodology is found appropriate for the educational research context.

In this study, inductive thematic analysis is employed as the methodological approach to analyze individual interviews. This approach, as described by Braun and Clarke (2006), aims to simplify and organize complex data by identifying meaningful codes, categories, and themes. According to Merriam (2009), the thematic data analysis approach proposes that data collection and preliminary analysis take place concurrently, with the analysis intensifying as the research progresses.

5.2. Sampling and Participants

Within the research project, mentor teachers in high school-level mathematics, physics, chemistry, and biology, employed in both private and public institutions within Istanbul, Ankara, and Trabzon, underwent semi-structured interviews. In accordance with the prevailing practice in Turkey, the Ministry of National Education provides an additional certification for mentors. To qualify for this certification, educators must successfully complete the mentor training program facilitated through MEBBIS. All participating teachers within this study are officially acknowledged as mentors by the Ministry.

The study used purposeful sampling using the following criteria for the selection of participants: (a) In consideration of the forthcoming analysis and the potential for individual interviews with mentor teachers, this study is exclusively incorporated mentor teachers situated in Istanbul. (b) During the individual interviews, teachers who were actively mentoring preservice teachers in their schools were included in the sampling. This criterion was used to ensure that selected mentors were actively engaged in their mentoring roles and could provide valuable insights and experiences regarding mentoring preservice teachers.

Thirteen (13) mentor teachers fit these criteria; 4 mathematics, 4 chemistry, 2 biology, 3 physics high school teachers. Detailed information about the participating mentor teachers is given in Table 5.1.

Table 5.1. Demographics of mentor teachers.

	School		Gender		Age			Years of Teaching Experience		Years of Mentoring Experience			
	Public	Private	Male	Female	30 - 39	40 - 49	50 - 59	10 - 19	20 - 29	1 - 5	6 - 10	11 - 15	16 - 20
Mathematics (n=4)	3	1	3	1	-	2	2	-	4	1	1	2	-
Chemistry (n=4)	2	2	2	2	1	1	2	2	2	1	1	1	1
Biology (n=2)	1	1	1	1	1	1	-	2	-	2	-	-	-
Physics (n=3)	1	2	2	1	1	1	1	1	2	1	1	-	1

The sample of this research is from Istanbul where there are two universities with secondary school mathematics, physics, chemistry and biology teaching programs. These two universities often work with the prestigious high schools for teaching practicum. Thus, for this study the public schools where the mentor teachers work represent some of Turkey's most prestigious educational institutions. These schools

admit students who are among the top approximately 0.1 percentile in the national placement exam. This highly selective criterion ensures that these institutions are populated by students with exceptional academic capabilities. The curriculum is intensive, particularly in STEM disciplines, aimed at preparing students for significant roles in scientific, technological, and medical fields.

The private schools involve prestigious private high schools that combine rigorous academic programs with extensive co-curricular activities. These schools are known for their competitive admissions processes, requiring students to score highly on national standardized exams. They offer a bilingual curriculum, with the majority of classes conducted in English, aiming to prepare students for both national and international higher education opportunities. The schools are accredited by international bodies and offer a mix of Turkish Ministry of Education approved curricula and international programs such as the International Baccalaureate (IB) and Advanced Placement (AP) courses.

Detailed demographic information for each participant is presented in the table below.

Table 5.2. Demographics of each participant.

ID	**Branch**	**Age**	**Gender**	**School**	**Years on Teaching Experience**	**Years on Mentoring Experience**	**Number of Mentees**
MT1	Mathematics	50	Female	Private	25	15	2
MT2	Mathematics	42	Male	Public	21	12	3
MT3	Mathematics	50	Male	Public	25	10	6
MT4	Mathematics	49	Male	Public	28	4	6
BT1	Biology	41	Female	Private	18	3	2
BT2	Biology	35	Male	Public	11	5	3
PT1	Physics	37	Female	Private	12	2	3
PT2	Physics	49	Male	Private	25	20	2
PT3	Physics	52	Male	Public	25	12	1
CT1	Chemistry	39	Female	Private	15	5	2
CT2	Chemistry	50	Male	Private	26	15	1
CT3	Chemistry	58	Female	Public	29	20	5
CT4	Chemistry	42	Male	Public	18	6	4

5.3. Data Collection and Analysis

Within the TÜBİTAK-220K086 project's scope, data was collected from area specialized teacher educators, preservice teachers and mentor teachers. Semi-structured individual interviews were held with a small group selected from among the participating mentor teachers to describe their perception of effective area specialized mentoring. Each semi-structured interview was carried out by an expert specialized in the relevant field. For instance, interviews with mathematics teachers were conducted by an expert specialized in mathematics education. During the semi-structured interviews, mentor teachers were asked a series of questions to gain insights into their motivations, effective practices, experiences, and subject-specific differences in mentoring. These questions included:

- Why do you serve as a mentor? (What is your motivation? How many years have you been mentoring? How many preservice teachers do you mentor?)
- In your opinion, what constitutes effective mentoring for Mathematics/ Physics/ Chemistry/Biology?
- Can you share an example from your experiences of effective mentoring? (What is the most memorable experience you have had during your mentoring?)
- How do you evaluate your mentoring experiences in recent years?
- What are the differences between mentoring in Physics/Chemistry/Biology and mentoring in other subjects?

The interviews were video recorded and later transcribed. Demographic data were gathered to gather information such as teachers' age, gender, subject area, and years of experience in teaching and mentoring.

Following Peel's (2020) methodological framework, a six-stage data collection and analysis process are employed. Peel (2020) contributes to methodological knowledge by presenting a comprehensive six-stage data collection and analysis process includes: (1) collecting, (2) engaging with data, (3) coding, (4) generating code categories, (5)

conceptualizing themes, and (6) contextualizing findings. This adaptable qualitative data analysis method simplifies the complex process of moving from concrete descriptions to abstract interpretations based on the existing literature (Meriam, 2009). The recursive nature of data analysis, as emphasized by Braun and Clarke (2006), involves iterative movement back and forth between phases as necessary to derive meaningful insights from the data.

First, open coding was performed by reading the data line by line. Codes were created by using the same labels for open codes with similar meanings. Each code was assigned a label that successfully described the essence of the data segment it represented. Codes were then compared and grouped into broader categories, reflecting patterns and connections in the data.

To ensure a comprehensive analysis, the codes were reviewed multiple times, and new codes were added as necessary to capture all relevant aspects of the data. This iterative coding process involved constant comparison, where newly identified codes were continuously checked against existing codes to refine the categories and ensure consistency.

Once the coding was completed, the next step was to generate code categories. This involved organizing the codes into higher-order categories that encapsulated related codes. These categories were then used to conceptualize themes, which represented the overarching patterns and insights derived from the data. The themes were carefully defined and named to accurately reflect their content and significance.

Four distinct themes emerged from the inductive analysis of the data: (1) Mentoring Motivations, (2) Conception of Knowledge for Teaching, (3) Mentoring Practices, and (4) Mentoring Perceptions. The data was then re-examined multiple times, which allowed for the emergence of sub-themes within these main categories. Detailed codebook table for each theme is in the Appendix.

5.3.1. Mentoring Motivations Theme

The theme of 'Mentoring Motivations' explores the reasons why mentor teachers engage in mentoring roles. This theme is subdivided into three sub-themes: personal outcome motivations, generative outcome motivations and professional responsibility. The researcher employed inductive thematic analysis yet for naming the sub-themes, the terminology from the literature was used. In order to maintain consistency with literature, other-focused motivations are named as 'generative outcome' (G. van Ginkel *et al.*, 2015). Likewise, self-focused motivations, labeled 'personal learning motives' in the study by G. van Ginkel *et al.* (2015), are renamed 'personal outcome' in current study due to the incorporation of emotional aspects within this category as identified through in current data analysis. Personal outcome motivations refer to the self-oriented incentives where mentor teachers engage in mentoring to pursue their own intellectual, professional, and emotional benefits. Generative outcome motivations refer to the mentor teachers' other-oriented desires to create positive and lasting impacts within the educational landscape. Professional responsibility motivations involve the sense of duty or obligation mentor teachers feel towards mentoring, often influenced by the school administration.

5.3.2. Conception of Knowledge for Teaching Theme

The theme of 'Conception of Knowledge for Teaching' explores the type of knowledge and skills that mentor teachers believe prospective teachers should possess or develop. Four sub-themes have been identified for both mathematics and science teachers: Subject Matter Knowledge, Pedagogical Content Knowledge, Pedagogical Knowledge, and Teaching Mathematics/Science Beliefs. Subject Matter Knowledge specifically refers to the depth and breadth of understanding that teachers have in the content areas they teach. Pedagogical Content Knowledge refers to the specialized knowledge that teachers possess in integrating subject matter with pedagogy. The Pedagogical Knowledge sub-theme encompasses a wide range of general teaching principles and strategies that mentor teachers emphasize, focusing on thorough lesson preparation,

effective classroom management, and fostering student engagement and discipline. The Teaching Math/Science Beliefs sub-theme focuses on their perceptions and attitudes towards teaching math/science.

These beliefs are distinct from content knowledge and pedagogical methods, emphasizing the cultural and attitudinal aspects of teaching.

5.3.3. Mentoring Conceptions Theme

The theme of "Mentoring Conceptions" explores how the concept of mentoring is perceived, focusing on various aspects of the mentoring relationship. In the study by G. van Ginkel *et al.*, 2015, a mentoring conception is described as a consistent set of beliefs regarding the objectives, origins, and essence of mentored learning in teaching. This theme is divided into five main sub-themes: The position of prospective teacher, the position of mentor teacher, the characteristics of mentor, the purpose of mentoring and mentor – mentee relationship. The position of the prospective teacher sub-theme examines the role, position and expectations of the prospective teacher in the mentoring process according to the mentor teachers. The position of the mentor teacher sub-theme explores the role, responsibilities, and guidance provided by the mentor in the mentoring process. The characteristics of mentor sub-theme define the qualities and skills that make an effective mentor. The Purpose of Mentoring sub-theme investigates the ultimate goals and objectives of the mentoring process. The Mentor – Mentee Relationship sub-theme focuses on the dynamics and interaction between the mentor teacher and the prospective teacher.

5.3.4. Mentoring Practices Theme

Mentoring practices were explored through four distinct sub-themes: (1) Instructional activities, (2) Observation, (3) Competency Co-Creation via Discussion, and (4) Other activities. The Instructional Activities sub-theme encompasses the active teaching and learning experiences that mentors provide to prospective teachers, em-

phasizing hands-on learning and collaborative teaching opportunities. The Observation sub-theme involves student teachers observing lessons or student behaviors. The Competency Co-Creation via Discussion sub-theme focuses on the meaningful dialogues between student teachers and mentors. Any practices that did not fit neatly into other categories were grouped under The Other Activities sub-theme, reflecting the diverse range of supportive actions in mentoring.

5.4. Ethical Considerations

Ethical approval and written permission were obtained from the the Trabzon University Social and Human Sciences Scientific Research and Publication Ethics Committee on December 11, 2020. Informed consent was obtained from all participants to use their data from the semi-structured interviews.

5.4.1. The Role of the Researcher

In this study, the researcher did not participate in the collection of the data. The data was collected by experts in the field as part of a larger project. This ensures that the data collection process was conducted by individuals with the appropriate expertise and training, adhering to the highest standards of research ethics. As the analyst of the data, the researcher's primary role was to objectively examine and interpret the data. To maintain objectivity, the researcher consciously set aside any personal biases or preconceived notions about the data. Efforts were made to ensure that the analysis was conducted impartially and that the findings accurately reflected the data.

Although the researcher did not collect the data, it is essential to note that informed consent was obtained from all participants by the original data collectors. Participants were fully informed about the purpose of the study, the procedures involved, and their right to withdraw from the study at any time without any negative consequences.

The data was anonymized before it was analyzed to protect the identities of the participants. Any identifying information was removed to ensure that the participants' privacy was maintained throughout the research process. Maintaining data integrity was a priority throughout the analysis. The data was handled with care, ensuring that it was not altered or manipulated in any way that could bias the findings. The analysis process was documented in detail to provide transparency and allow for the replication of the study if necessary.

6. FINDINGS

Although four common themes emerge in the perspectives of Mathematics and Science teachers, the findings are presented separately for each group. This separation allows for a deeper and more nuanced analysis, revealing unique patterns and insights specific to each subject.

6.1. Mathematics Teachers

Four main themes emerged from the inductive thematic analysis of semi-structured interviews with high school mathematics teachers: (1) Mentoring Motivations, (2) Teacher Knowledge, (3) Mentoring Conception, and (4) Mentoring Practices.

6.1.1. Mentoring Motivations

Within the theme of 'Mentoring Motivations,' which explores the reasons the mentor teachers engage in the mentor role, two sub-themes emerged. These include *personal outcome motivations and generative outcome motivations.*

6.1.1.1. Personal Outcome Motivations. Personal outcome motivations, another sub-theme under the broader theme of mentoring motivations, refers to the incentives where mentor teachers engage in mentoring to pursue their own intellectual, professional, and emotional benefits.

This sub-theme encompasses not only mutual learning and professional development but also the emotional benefits that mentors derive from mentoring, such as developing good relationships, enjoying the mentoring process, and increasing their professional motivation.

Table 6.1. The frequency table for personal outcome motivations of MT's.

Sub-theme	**Codes**	**Frequency**
Personal Outcome Motivations	Mutual Learning	2
	Self-improvement	1
	Dynamic Group	1
	Professional Motivation	1

MT1 expresses her motivation for mentoring by stating that she enjoys working with young people not only for her own learning but also for sharing knowledge with them (*I love working with young people, sharing new learning for both me and them*). Here, "loving working with young people" refers to expressing their dynamism, which is why the codes 'dynamic group' and 'mutual learning' are used. Additionally, MT2 emphasizes mutual learning as a motivation within mentoring relationships. He highlights the contributions received from mentees, stating, *There were things they contributed to me.* Similarly, MT4 underscores the importance of self-improvement, expressing a continuous desire to enhance skills and knowledge with the statement, *I always want to improve and go further.*

The sub-theme of personal outcome also underscores mentors' emphasis on cultivating a confident relationship with mentees to facilitate effective mentorship. This aspect is specifically articulated by MT4, who emphasizes the importance of establishing good communication with student teachers as a means to boost motivation. He states, *Establishing good communication with the prospective teacher increases my motivation.*

6.1.1.2. Generative Outcome Motivations. The 'Generative Outcome' sub-theme underscores mentor teachers' underlying desire to create enduring and positive impacts within the educational landscape.

Table 6.2. The frequency table for generative outcome motivations of MT's.

Sub-theme	**Codes**	**Frequency**
Generative Outcome Motivations	Motivation Beyond Money	2
	Providing Benefit	2
	Broader Social Benefits	2
	Fostering Love for the Profession	1
	Knowledge Transfer	1
	Inspiring Pursuit for Teaching	1

MT3, who does not mention any personal outcome motivation, emphasizes the broader societal benefits that come from knowledge acquisition, highlighting the transformative power of education (*If every teacher made a change in a student's life every year, this effect would continue like a chain*). This vision is shared by MT2 who believes that mentor teachers have a crucial role to play in the progress of the nation, as represented by the idea of 'contributing advantages to the country.' This discourse reflects a profound interest in guiding the next generation (Teacher MT2 says: *They will educate our children*).

One of the codes within the 'Generative Outcome' sub-theme is 'motivation beyond money.' Both MT2 and MT3 stressed that their motivations for mentoring extend far beyond monetary rewards. A distinct code under this sub-theme is 'providing benefit.' MT4 remarked, *The more helpful I can be, the better* and similarly, MT3 expressed, *"I strive to contribute in any way I can* highlighting their motivation to aid in the professional development of novice teachers. Both MT4 and MT3 are driven by the desire to benefit student teachers, albeit approaching it from different perspectives. MT4 addresses this from an emotional standpoint, emphasizing his goal of fostering a love for the profession among student teachers by saying *Since I am passionate about teaching, it would bring me joy to see them inspire others like me.* On the other hand, MT3 approaches this in an academic standpoint, emphasizing his motivation to transfer all the knowledge he possesses to support the professional growth of student teachers by saying *I am committed to sharing as much knowledge as possible.*

6.1.2. Conceptions of Knowledge for Teaching

Mentor teachers discuss the teacher knowledge when articulating their perspectives on effective mentoring practices. In the context of this theme the type of knowledge and skills that mentor teachers believe prospective teachers should possess or develop is examined. Four sub-themes have been identified: (1) Subject Matter Knowledge, (2) Pedagogical Content Knowledge, (3) Pedagogical Knowledge, and (4) Teaching Mathematics Beliefs.

6.1.2.1. Subject Matter Knowledge (SMK). All four teachers emphasized the significance of subject matter knowledge during their interviews, despite not being explicitly asked about the specific knowledge they believe a mathematics teacher should possess.

Table 6.3. The frequency table for SMK of MT's.

Sub-theme	**Code**	**Frequency**
Subject Matter Knowledge	Comprehensive Subject Matter Knowledge	4
	Horizon Content Knowledge	1

It's important to note that all of them teach in high achieving high schools in Istanbul, underscoring the importance they place on having a comprehensive and deep subject matter knowledge. For instance, MT1 remarked, *If the teacher has a solid understanding of mathematics, it makes a big difference.* This highlights the critical role of subject matter knowledge in their teaching context. Similarly, teacher MT3 pointed out, *The teacher explains what s/he knows well but cannot explain what s/he does not know well.* This emphasizes how important it is for teachers to have an advanced understanding of the subject in order to effectively teach and clarify concepts to students.

MT2 shared an example during his lectures, noting, *There is a concept known as an asymptote. Although it's not explicitly covered in the curriculum, it exists.* This illustrates his readiness to explore topics outside the standard curriculum when required,

underscoring the comprehensive horizon content knowledge expected of a mathematics teacher. MT4 mentioned, *The information at the university is not very fresh anymore. The knowledge of the prospective teachers is fresher because they are still at the university.* In the subsequent parts of the interview, he emphasized his desire for prospective teachers to engage in mathematical proofs using these competencies. This underscores his recognition of the importance of possessing comprehensive and advanced mathematical knowledge.

MT2 remarked, *Students think that a mathematics teacher knows everything* and similarly, MT3 stated *The mathematics teacher must first acknowledge that s/he doesn't know everything. Moreover, s/he must be willing to admit this to his students.* Their emphasis lies in the notion that mathematical knowledge is boundless while the knowledge possessed by teachers is finite, that reminded of Socrates' concept of knowledge.

6.1.2.2. Pedagogical Content Knowledge (PCK). PCK refers to the specialized knowledge that teachers possess in integrating subject matter with pedagogy.

Table 6.4. The frequency table for PCK of MT's.

Sub-theme	**Code**	**Frequency**
Pedagogical Content Knowledge	Academic Contingency	2
	Multiple Representation	1
	Proximal Development Zone	1

MT1 states, *There are some things that students always ask about academic issues. The teacher should be able to catch contingencies academically.* She highlighted the importance of being prepared and responsive to unexpected academic questions or situations that may arise from students. MT2 emphasizes the significance of multiple representation knowledge in mathematics, stating that when explaining inequalities, *we draw a function graph as well as making a table.* He advocates for student-centered instruction, asserting that *Mathematics should be explained in a way that the other person can understand.* Additionally, when he mentions *neither too far ahead nor too*

far behind, he is emphasizing the importance of keeping students within the zone of proximal development.

MT3 underlines the dynamic essence of teaching, stating, *You enter two classes, and that subject cannot be explained in the same way.* He emphasizes the interactive and student-centered nature of teaching and academic contingencies. MT3 also stated, *I've taught the lesson here, but I'm not done with it; I'll come across other questions while teaching it in the next class.* Contrasting mathematics with history teaching, he notes, *If I were a history teacher, I would always give the same example. There is no such thing in mathematics.* According to him, the concepts and problems faced by students can vary significantly, necessitating varied and flexible teaching methods.

MT4's insights did not include any explicit references or discussions related to Pedagogical Content Knowledge (PCK) codes or concepts.

6.1.2.3. Pedagogical Knowledge (PK). This subtheme covers a wider range of pedagogical principles and teaching strategies that mentor teachers discuss, distinct from the specific Pedagogical Content Knowledge (PCK) codes. Notably, opinions pertaining to the pedagogical knowledge sub-theme are exclusively voiced by MT2. He stresses the importance of thorough 'preparations before teaching' *(f=1)*, stating, *When I teach a lesson, I make preparations. I know what to say.* Additionally, he emphasizes the value of respecting students' time and engagement, noting, *When I enter the classroom, I do not waste students' time. I try to give everything I know without boring the students.* These insights highlight MT2's commitment to delivering effective and engaging lessons while 'maintaining student interest and participation' *(f=1)*.

6.1.2.4. Teaching Math Beliefs. The sub-theme of Teaching Math Beliefs refers to the fundamental beliefs that teachers have about how they perceive mathematics. These beliefs are not directly related to content knowledge or the knowledge of how to teach. Teaching Math Beliefs focuses on the beliefs that teachers hold in math instruction,

while PCK, PK, and SMK are more concerned with the knowledge-based aspects of teaching. MT3 suggests that mathematics teachers often exhibit a 'sense of superiority' *(f=1)* or confidence that can create tension with students by stating, *There is a conflict between the mathematics teacher and the students. Mathematics is aa department with a very high ego.* MT4 underscores the 'elevated status of mathematics'*(f=1)* by saying, *Courses are divided into two: mathematics and others. Since mathematics is the most important subject in such schools, children value mathematics more.*

6.1.3. Mentoring Conceptions

In examining the perceptions of mentoring among the four teachers, a notable distinction arises in how they define the roles of both the prospective teacher (their expectations throughout the mentoring process) and the mentor (the attitude the mentor teacher should display). The terms "position" is used to describe these roles because they encompassed more than mentoring practices. Consequently, the theme of mentoring conception is explored under four sub-themes: *The position of the prospective teacher, the position of the mentor, characteristics of mentor, purpose of mentoring.* The third sub-themes emerged from MT3 and MT4. They emphasized specific characteristics that a mentor should possess within the theme of mentoring perception, leading to the examination of a sub-theme focusing on mentor characteristics for these two teachers. Furthermore, as for the fourth sub-theme MT3's emphasis on the purpose of mentoring, unlike the other teachers, led to the examination of a separate sub-theme focusing on the purpose of the mentor's role in mentoring relationships.

6.1.3.1. Position of the Prospective Teacher. All four mentor teachers provide insights into the position they believe the prospective teacher should assume during the mentoring process. However, there are notable variations in how each teacher perceives this role.

Table 6.5. The frequency table for the position of teacher candidate of MT's.

Subtheme	**Code**	**Frequency**
The Position of Teacher Candidate	Comparator-Observer	3
	Discipline and Adherence	2
	Alignment with Preferences	1

MT2 emphasizes that during the teacher mentoring process, the prospective teacher should, in his own words, *Take what they need from everyone, like a bee.* He emphasizes the importance of making connections between exemplary and less preferred teaching practices by observing different teaching styles. This positioning of student teachers as comparators-observers underscores MT2's belief in learning by observation in the context of teacher education. MT3 places emphasis on discipline, stating that the prospective teacher should adhere strictly to necessary tasks, expressing, *They will do exactly what they need to do.* Similar to MT2, MT3 stresses the importance of observation, noting that student teachers learn from both successes and mistakes, enabling them to determine their preferred teaching methods. (*They also see our mistakes, let them choose how they should be a teacher.* However, MT3 also adds an additional layer by highlighting the significance of observing preparation before, during, and after lessons by saying *I believe that one should experience the before and after the lesson.... S/he should see how to solve a problem when there is a problem while teaching...This way, we can teach that pre-lesson preparation is also important.* He believes that experiencing the entire teaching process is crucial for understanding the nuances of effective teaching and problem-solving during instruction.

MT1 emphasizes the importance of aligning teacher mentoring practices with the preferences of the prospective teacher, stating, *Some may want to observe, some may want to learn about the class; it should be in line with the prospective teacher's preferences.* Contrastingly, teacher MT4's focus is on discipline alone, underscoring its importance in mentoring practice without elaborating on specific aspects of the teacher candidate's role or actions during the mentoring process.

These variations reflect diverse approaches to mentoring, each offering unique insights into effective mentorship practices.

6.1.3.2. Position of the Mentor Teacher. The positioning of the four teachers throughout the mentoring exercise reveals significant differences in their approaches.

Table 6.6. The frequency table for the position of mentor teacher for MT's.

Subtheme	**Code**	**Frequency**
The Position of Mentor Teacher	Adaptive	1
	Model	3
	Provide Field Experience	2
	Guide	1
	Motivative	1
	Negative Internship Exp.	2

Teacher MT1, who advocates adapting to the preferences of student teachers in mentoring practices, defines her role as providing guidance and creating a supportive environment rather than pushing them into difficult situations. She emphasizes, *Not telling the students in advance what will happen if they ask, giving them a cushion and showing them instead of throwing them into a storm.* Additionally, she highlights, *The observation period should not be around 3-5 weeks, I think we should start taking classes together immediately*, pointing to the structured mentoring experience she aims to offer. Teacher MT2, who advocates for student teachers to gather insights like bees collecting nectar from each observed teacher, positions himself as a "model" in the mentoring process (*Effective mentoring is being a model*). He emphasizes motivating pre-service teachers to observe different teaching styles by attending classes from various teachers. However, it is noteworthy that he focuses on observation without explicitly mentioning reflective practices, which distinguishes his approach. On the other hand, Teacher MT3 positions himself as a 'model' throughout the mentoring process, stating, *'I want the prospective mathematics teacher to fully absorb everything I have.* In contrast to Teacher MT2, MT3's approach includes a reflective attitude, highlight-

ing the importance of experiencing pre-lesson, in-class, and post-lesson moments with the prospective teacher to promote a more interactive mentoring style. Teacher MT4 emphasizes the practical nature of learning mathematics in the field. However, there is a lack of clarity regarding how the student teacher positions himself/herself academically as a mentor while 'in the field'. MT4 states, *Maybe you can't learn anything just by listening; mathematics is learned in the field.*

As a result, Teachers MT1 and MT4 position themselves as providers of experiential learning opportunities to pre-service teachers, with MT1 emphasizing a 'structured' experience. On the other hand, Teachers MT2 and MT3 position themselves as models; MT2 emphasizes passive observation, while MT3 integrates reflective practices into the mentoring process.

There is another common feature that draws attention in the individual interviews of teacher MT2 and teacher MT4, who described themselves as a 'model' in the mentoring process. While reflecting on their mentoring experiences and motivations for becoming mentors, they both recount negative mentoring experiences at the beginning of their careers. Teacher MT3 shares, *The teacher at the school where I did my internship didn't pay attention to me... I had to learn everything out on my own... I think the first five years of my job were very challenging... It took a great deal of work....* This experience significantly influenced his perception of mentoring and his motivation, thus falling under the theme of 'mentoring conceptions'. Similarly, Teacher MT2 stated, *I only saw my internship supervisor once...He said the class is yours... I taught for a semester.* This experience also contributed to shaping his understanding of mentoring (in terms of how it shouldn't be) and is explored further under the same theme.

6.1.3.3. Mentor Teacher Characteristics. Teacher MT4 and Teacher MT3 stand out from the other two teachers by placing emphasis on the characteristics of a mentor teacher. In describing an ideal mentoring experience, Teacher MT4 articulated, *Establishing necessary communication and closeness is pivotal... Teacher candidates to feel*

comfortable with me, and that stems from my warmth. These insights from Teacher MT4 shed light on what he believes constitutes an effective mentor: someone who is 'warm-hearted' (f=1), communicative, and sincere. It's noteworthy that Teacher MT4 is the only one among the four who explicitly emphasizes the importance of building strong relationships as a key motivation in mentoring. When discussing an effective mentoring experience, Teacher MT3 emphasized, *An effective mentor should have at least 15, maybe 20 years of experience*, stressing the importance of sharing expertise and 'being experienced in the profession' *(f=1)*. This viewpoint underscores his belief that mentorship is more efficient when based on extensive experience and a willingness to share knowledge, reflecting his view on the characteristics of a mentor teacher.

6.1.3.4. Purpose of Mentoring. In terms of mentoring conceptions, Teacher MT3 uniquely discusses the purpose of mentoring. He states, *We aim to expedite someone's teaching journey by sharing our knowledge and experiences with them... Our goal is to enable them to achieve a level of teaching expertise that might typically take 8 years, perhaps in just 6 years, or even 3 years.* MT3 emphasizes that the primary objective of mentoring is to 'transfer experiences' *(f=1)* to the prospective teacher and 'accelerate their professional development' *(f=1)*.

6.1.4. Mentoring Practices

Mentoring practices were explored through four distinct sub-themes: (1) Instructional activities, (2) Observation, (3) Competency Co-Creation via Discussion, and (4) Other activities.

Table 6.7. The frequency table for instructional activities of MT's.

Sub-theme	**Code**	**Frequency**
Instructional Activities	Lecture Preparation	2
	Assessment and Evaluation	1
	Question Solving	2
	Co-Teaching	2
	Curriculum- Annual Plan Review	1
	Mathematical Proof	1

6.1.4.1. Instructional Activities. Teacher MT1 positioned herself as providing structured experience throughout the mentoring process, in light of this position she focuses on instructional activities that offer comprehensive learning experiences. Her detailed explanation covers various aspects, including curriculum review to ensuring that prospective teachers have a clear understanding of the content they will be teaching. She incorporates hands-on learning experiences by involving student teachers in solving worksheets, which helps them gain practical insights into classroom dynamics. Additionally, she advocates for collaborative teaching practices, where student teachers actively participate in co-teaching. Notably, she encourages prospective teachers to read quizzes to understand student perspectives, engage in interactive problem-solving sessions, and provide individualized student feedback. To enhance instructional skills, she adopts a progressive teaching approach, starting with guided practice under her supervision, followed by collaborative lesson planning and eventually independent teaching by the candidates. This indicates Teacher MT1's commitment to the role of a teacher educator, guiding candidates through a structured learning journey in their teaching profession.

When discussing effective mentoring practices, Teacher MT2 advocates collaborative lesson preparation and co-teaching by stating *It could be preparing for the lesson together and teaching the lesson together.* Additionally, MT2 suggests that student teachers actively seek teaching opportunities, such as covering classes for absent teachers, to gain practical teaching experience. This approach reflects a more spontaneous and hands-on learning experience for student teachers. While Teacher MT2 considers facilitating student teachers' engagement in lecturing and problem-solving with students as effective mentoring practices, he states practical challenges due to constraints such as curriculum limitations.

While explaining effective mentoring practices, Teacher MT4 states that student teachers can solve questions rather than lecturing. He emphasizes that student teachers should not just be observers by saying *In the second or third week, teacher candidates need to interact with students.* Teacher MT4 states that he encourages student teachers

to solve students' questions. He also points out a hands-on approach in his teaching practices by saying, *I try to give teacher candidates tasks in the classroom.* Teacher MT4 states that he often assigns student teachers the task of making mathematical proofs and preparing questions in order to enrich their teaching skills and benefit from their new knowledge.

Teacher MT3's approach to effective mentoring practices primarily revolves around the observation aspect. He emphasizes the importance of student teachers delivering lectures as part of instructional activities. Teacher MT3 informs the students in the class in which the prospective teacher will teach to establish trust and confidence between the candidates and the students.

Table 6.8. The frequency table for observation of MT's.

Subtheme	**Code**	**Frequency**
Observation	Active Lesson Observation	2
	Comprehensive Observation	1
	Diverse Teaching Insights	3

6.1.4.2. Observation. Teacher MT3 stands out by describing active lesson observation as an effective mentoring practice, highlighting something unique compared to other teachers. He says, *I would like to simulate the lesson with the teacher candidates* as an effective mentoring practice. He explains what he means by lesson simulation as follows: *The prospective teacher will have my lecture notes... They will observe how closely I adhere to the lecture notes and where I diverge... They will see how much the class advances me in teaching and how much it leaves me behind... This way, we can show that lesson is something that alive.* This practice allows prospective teachers to see firsthand how classroom dynamics influence teaching and learning. Teacher MT3's emphasis on active lesson observation through simulation demonstrates instilling an understanding of the student-centered nature of lessons.

Another teacher who touched on lesson observation is MT2. Unlike Teacher MT3, he does not describe an active lesson observation in which the students have lecture notes in their hands, and he also states that he directs the prospective teachers to observe the lessons of different teachers. We can note that teacher MT2's approach to lesson observation appears more superficial compared to MT3's. This inference is supported by MT2's statement, *Teacher candidates may have thought that the lesson could be taught this way while I was lecturing.* Teacher MT2 emphasizes not only observing lessons but also encouraging prospective teachers to interact directly with students to understand their thinking. He underscores that student teachers should spend extended periods at school to gain a comprehensive understanding of the school environment, integrate into the school community and develop a realistic perspective on teaching demands.

Teacher MT1 highlights that mentor teachers can provide opportunities for student teachers to observe, but it's vital to keep these observations brief and swiftly move towards practical classroom experiences. Similar to Teacher MT2, MT1 stresses the significance of direct interaction with student teachers to comprehend students' thought processes. Teacher MT4 doesn't explicitly specify lesson observation, he emphasizes the value of direct student interaction for student teachers, aligning with the principles advocated by Teacher MT2 and Teacher MT1. MT4 notes that by intentionally seating pre-service teachers next to students, he fosters situations where they can directly respond to student queries.

6.1.4.3. Competency Co-Creation via Discussion. Meaningful conversations between student teachers and mentor teachers were explored within the ' Competency Co-Creation via Discussion ' sub-theme, focusing on the collaborative learning-to-teach experience between them.

Table 6.9. The frequency table for competency co-creation via discussion of MT's.

Subtheme	**Code**	**Frequency**
Competency Co-Creation via Discussion	Pre-Conference	2
	Post-Conference	1
	Feedback	2
	Academic Support	1
	Emotional Support	1

Among the teachers, MT3 teacher particularly emphasizes discussion as an effective mentoring practice. He mentions providing academic and emotional support to student teachers, boosting their self-confidence by stating, *Your knowledge is fresh... If I can teach, so can you.* Teacher MT3 also states pre-conference by talking to prospective teachers about what may happen during the lesson in advance and gives directive feedback such as *It would be useful if such a question was added here.“ By stating 'meeting before and after each lesson.* Teacher MT3 provides a reflective approach to the teaching experience of student teachers through pre-conference and post-conference discussions.

Teacher MT1, similar to Teacher MT3, mentions engaging in pre-conference discussions with student teachers about the topic they will teach in the lesson. As an effective mentoring practice, she suggests having a *Self-reflection time can be beneficial, revisiting what we've done...* approach, pointing out a reflect-revise cycle. Teachers MT1 and Teacher MT3's emphasis on 'learning to teach' discussions with student teachers provide valuable insight into their roles as teacher educators. Teacher MT4 and Teacher MT2 do not provide insights into effective mentoring practices that fall under the Competency Co-Creation via Discussion sub-theme.

6.1.4.4. Other Activities. This sub-theme encompasses additional mentoring practices that do not fall neatly into the categories of instructional activities, discussion, or observation. MT2 emphasized the importance of prospective teachers actively 'participating in projects' (f=1) with students, as he stated, *They supported the student who partici-*

pated in the Tübitak project. MT4 states, *I am trying to include prospective teachers in class communication groups. I want them to communicate with students.* emphasizing the necessity of direct interaction between prospective teachers and students (*coded as 'communication groups', f=1*).

6.2. Science Teachers

Four main themes emerged from the thematic analysis of semi-structured interviews with high school science teachers: (1) Mentoring Motivations, (2) Teacher Knowledge, (3) Mentoring Conception, and (4) Mentoring Practices.

6.2.1. Mentoring Motivations

Within the theme of 'Mentoring Motivations,' which explores the reasons why mentor teachers engage in the mentor role, three sub-themes emerged: *Personal learning motivations, generative outcome motivations, and professional responsibility.* While personal learning and generative outcome motivations were similar among mathematics teachers, a distinct sub-theme of professional responsibility was observed among science teachers.

6.2.1.1. Generative Outcome Motivations. Among teachers, the predominant motivation for engaging in mentor role is categorized under the sub-theme of generative outcome motivations, identified by eight out of nine participants.

Table 6.10. The frequency table for generative outcome motivations of ST's.

Sub-theme	**Codes**	**Frequency**
Generative Outcome Motivations	Past Experiences	5
	Providing Benefit	4
	Inspiring Pursuit to Teaching	3
	Knowledge Transfer	2
	Responsibility Driven by Respect	2

When asked about their motivations for assuming the mentor role, five teachers referenced their own experiences as mentees. Four of them highlighted negative experiences. For example, BT1 stated, *I went through those stages too, it was really challenging... it was not easy at all.* BT1 also states that she feels close to prospective teachers. Similarly, BT2 stated, *During my internship, I was not given much guidance.* PT1 reflected, *The early years of my career were very painful; there were limited opportunities... one feels the need for development.* CT3 repeated these sentiments, noting, *We were interns but had very few examples to follow... it was really tough.* In contrast, one teacher, CT1, stated a positive experience, *Internship played a significant role in my teaching career. I began teaching at the school where I completed my internship.* This points out the significant impact of prior mentorship experiences on teachers' motivations to become mentors themselves, with both positive and negative experiences shaping their motivations to be a mentor.

PT1, reflecting on her own insufficient internship experience during the early years of her career, recounts how she later worked at a private school that provided numerous development opportunities. She states, *The school was very supportive at that time. I think the same thing should be done for newly graduated teacher candidates.* This underscores her belief in reciprocating the support she received by aiding new teachers.

Similarly, PT3 expresses a comparable sense of gratitude, stating, *If the state has educated me, I think I should somehow transfer this to them as a debt.* These statements illustrate a "giving back" motivation, where both teachers feel a duty to repay the support and education they received by mentoring and supporting the next generation of educators.

Another motivation identified within this theme is the desire to provide benefit to the professional growth of others. For instance, BT1 articulated this motivation by stating, *It's nice to be able to help people.* Similarly, BT2 emphasized his commitment to mentorship with, *I act as a mentor to help as much as I can.* CT3 also expressed

similar motivation, noting, *Knowing the steps that may be simple in advance will make it easier for our teacher candidates.* CT1 also expresses her motivation to support, expressing, *It brings me joy not only to impart knowledge but also to provide support in the heart of the work.* These statements reflect an altruistic motivation among mentor teachers to support and ease the transition of prospective teachers into the profession by providing guidance and sharing practical knowledge.

Similar to the motivations of helping and facilitating, some teachers are also driven by the desire to guide and support the professional development of their mentees to provide benefit. CT3 articulates this sentiment by stating, *It is beneficial for valuable individuals to receive some support and guidance in order to grow. I would like to support and guide them.* This underscores her commitment to mentorship as a means of fostering growth and development in others. Similarly, BT2 expresses his motivation by saying, *They also come here to enhance themselves. I look at how I can improve them, how I can position them better. It should shed light on their development.* These statements reflect the motivation of mentor teachers to not only provide assistance but also to actively contribute to the professional and personal development of their mentees.

Some teachers express motivations that go beyond mere career development, emphasizing the importance of inspiring prospective teachers to pursue the teaching profession-a code notably absent among the mathematics teachers. For example, CT1 highlights the critical role of internships in shaping career decisions: *Internships are important when deciding whether to pursue a teaching career after graduation.* Similarly, BT2 underscores the necessity of motivation in the teaching profession, especially for newcomers: *There is a great need for motivation in teaching; we need to motivate new teachers.* CT2 also stresses the importance of sustaining the professional motivation of prospective teachers, stating, *I want the professional motivation of prospective teachers to continue.* These insights reveal a distinct focus on the motivational aspects of mentoring, emphasizing the importance of not only acquiring necessary skills but also fostering a deeper, long-term dedication to the teaching profession.

PT1 articulates her motivation to share her knowledge and experiences by stating, *Every day we gain a new experience, we add something new to ourselves... I want to share my own experiences.* Similarly, PT3 expresses his motivation with, *I think I cannot take my knowledge to the grave; I feel the need to transfer all my knowledge and experience to them.* MT3, a mathematics teacher, also shares this motivation to impart his knowledge. While PT1, MT3, and PT3 all exhibit a desire to transfer knowledge and experience, PT3 stands out by advocating for a more holistic approach. PT3 further provides a holistic perspective on sharing knowledge and experience, emphasizing that *Our new teacher friends are missing many things. Manners, culture, speech, communication with students-these are not taught at the university.* This highlights the importance of a comprehensive approach to mentorship, guiding preservice teachers into developing a teacher identity.

CT3, emphasizes her motivation to contribute to the nation by stating, *Raising good generations is important for the country.* She further elaborates on her unique perspective, asserting that *... to show teaching is not just about instruction; education is also a part of it.* This highlights her holistic approach to mentoring, where she aims to cultivate well-rounded individuals who can positively impact society. CT2 emphasizes the value of role modeling in the teaching profession by saying, *The responsibility of being an exemplary model excites me.* CT4 introduces a distinctive motivation, stating, *There is a feeling of responsibility because you feel that the other person respects you.* This motivation is categorized under the sub-theme of generative outcome because it emphasizes the creation of a positive, reciprocal relationship between mentor and mentee. These motivations reflect a broader vision among mentor teachers to not only enhance the professional competencies of new educators but also to instill values and attitudes that contribute to the betterment of society.

6.2.1.2. Personal Outcome Motivations. Personal outcome motivations, another sub-theme under the broader theme of mentoring motivations, refers to the motivation where mentor teachers engage in mentoring to pursue their own intellectual, professional, and emotional benefits. This sub-theme encompasses not only mutual learning

and professional development but also the emotional benefits that mentors get from mentoring, such as enjoying the mentoring process and increasing their professional motivation.

Table 6.11. The frequency table for personal outcome motivations of ST's.

Sub-theme	**Codes**	**Frequency**
Personal Outcome Motivations	Mutual Learning	3
	Emotional Benefits	1
	Dynamic Group	1
	Professional Motivation	1

BT1 states, *We are learning something too; I got some ideas from them too*, highlighting her motivation for reciprocal learning. Similarly, CT2 underscores the concept of mutual learning with, *I am constantly motivated to learn new things.* CT4 also supports this idea, noting, *We see that it contributes to personal development*, indicating that mentoring fosters his own benefits as well.

Examining the emotional aspects of personal outcome motivation, BT1, for instance, expressed her enjoyment of the mentoring process, stating, *It was a great pleasure for me.* This indicates that the act of mentoring itself provides her with a sense of joy and fulfillment. Similarly, CT4 highlighted the motivational aspect of mentoring by noting, *Mentoring is one of the things that motivates me.* CT2 also underscored the emotional and motivational benefits of mentoring, stating that it brings professional satisfaction and helps sustain his motivation: *Mentoring provides professional satisfaction and ensures there is no loss of motivation.* In addition, CT2, similar to MT1, one of the mathematics teachers, pointed out the encouraging influence of working with young prospective teachers. He stated, *Being together with new teacher candidates, their dynamism, and sharing that energy....* This highlights how the fresh perspectives and enthusiasm of new entrants into the profession can motivate experienced teachers.

6.2.1.3. Professional Responsibility. When asked about their motivation for mentoring, four of the science teachers emphasized a sense of 'professional responsibility given by the school administration' *(f=4)*, a motivation not observed among the mathematics teachers. CT1 initially highlighted the obligatory nature of mentoring by stating, *Teacher candidates already coming; we don't have the chance to say we won't do mentoring.* However, she mainly elaborated on other generative motivations. Similarly, CT4, who teaches at a well-established public high school in Istanbul (same as B2 and M3), noted, *Mentoring was a mission assigned to us by the school administration. We were doing it as a task given by the ministry, without interpreting it as a different task from other duties.* Although BT2 and MT3 taught at the same school, they did not perceive their motivation for mentoring as a responsibility imposed by the school administration. CT2 also underscored the notion of mentoring as a professional responsibility, emphasizing its procedural aspect. Notably, PT2, a physics teacher, cited professional responsibility as his sole motivation, stating, *The department head asks you to act as a mentor; you accept it as an order.* No personal or generative motivation codes were identified for this mentor teacher, indicating that he served as a mentor solely out of obligation.

6.2.2. Conception of Knowledge for Teaching

Mentor teachers discuss the teacher knowledge when articulating their perspectives on effective mentoring practices. In the context of this theme the type of knowledge and skills that mentor teachers believe prospective teachers should possess or develop is examined. Four sub-themes have been identified: (1) Subject Matter Knowledge, (2) Pedagogical Content Knowledge, (3) Pedagogical Knowledge, and (4) Teaching Science Beliefs.

6.2.2.1. Subject Matter Knowledge (SMK). This sub-theme focuses on the perspectives of mentor teachers regarding subject matter knowledge.

Table 6.12. The frequency table for SMK of ST's.

Sub-theme	**Code**	**Description**
Subject Matter Knowledge	Comprehensive Subject Matter Knowledge	3
	Up-To-Date Subject Matter Knowledge	1
	Doing Science	2

PT2 stated, *I think the more flowers the teacher smells, the more successful our students become.* This metaphor suggests that the more diverse and extensive the teacher's knowledge (kind to gathering fragrances from many flowers), the more successful the students become. It implies that a teacher's broad and deep understanding of the subject matter, enriched by varied experiences and learning, directly contributes to students' success. PT3 stated, *That's why we learn mathematics, then we learn physics. Physics is a different thing, it is a different branch, so physics is a different thing, mentoring is a different thing, teaching is also a different thing.* He underscores the importance of subject matter knowledge by emphasizing the necessity of a strong foundation in mathematics to effectively learn and teach physics. BT1 stated *Teacher candidates come to teaching practice after a certain degree of university education*, indicating the strength of their subject matter knowledge. She highlights that prospective teachers have already built a solid foundation in their field during their academic journey. PT3 also indirectly emphasizes the importance of up-to-date subject matter knowledge, stating, *Unless you renew human relations, unless you renew field knowledge, unless you renew your computer knowledge...* suggesting that effective teaching requires the continuous updating of knowledge.

The code of 'doing science' was observed in the insights shared by PT2 and CT2, who both provided perspectives on the practical aspects and epistemological nature of scientific inquiry. PT2 reflects on the balance or disparity between theory and practice, remarking, *We acknowledge the divergence between real-world scenarios and theoretical ideals...* as he discusses the practice of science. Similarly, CT2 emphasizes the importance of practical experimentation, advising, *You should always try experiments firsthand, as there may be discrepancies with theoretical expectations.*

6.2.2.2. Pedagogical Content Knowledge (PCK). This sub-theme focuses on the specialized knowledge that teachers possess in integrating subject matter with pedagogy.

Table 6.13. The frequency table for PCK of ST's.

Sub-theme	**Code**	**Frequency**
Pedagogical Content Knowledge	Laboratory Experience	5
	Questioning	3
	Misconceptions	1
	Assessment and Evaluation	1
	Technology Integration	5
	Curriculum Knowledge	1
	Instructional Approaches	5

Five of the nine science teachers emphasize the importance of 'laboratory experience' in their views on pedagogical content knowledge. BT1 remarks, *(For IB) our laboratory is very different from others. Our difference is that we do dissection, and our lab report format is different compared to physics and chemistry*, highlighting the distinctions between biology, chemistry, and physics labs. BT1 also highlighted the teacher's role as a guide in the laboratory, stating, *Teachers have significant roles in guiding students. We refrain from overwhelming children with too much information and aim to foster their ability to manage their own learning processes.* BT2 underscores the significance of hands-on experience, stating, *Let them discover, break, spill, destroy.* PT2 emphasizes, *Experimental design is very important for us. They should focus on the fact that physics can be taught with simple tools and how much practice can produce it.* CT2 notes, *The enjoyable part of the job is the experiments in the lab. Children need to develop the ability to use tools. We always preserve the experimental side of classical chemistry and try to convey it to prospective teachers.* Similarly, CT4 asserts, *Chemistry has a laboratory component. It is one of the duties of today's teachers to respond appropriately to this laboratory aspect, and we are trying to make that happen.*

Another code that is not seen in mathematics teachers but is prominent among science teachers is 'technology integration.' CT1 states, *Lessons using online inter-*

active tools are given priority. The teacher needs to be knowledgeable about technology. This emphasizes the importance of technological proficiency in modern teaching practices. CT3 adds, *Web 2 tools can be used in the evaluation processes... Teacher candidates come here finding very different simulations, perhaps because they know the language, and they use some Web 2 tools to motivate the students*, indicating her commitment to teaching technology integration in instructional design. CT2 highlights the continuous advancements in technology, stating, *There are developments in technology every day, teacher candidates see it and they grow up to be more prone and competent in technology.* CT4 reinforces this by saying, *As you know, we are in the age of technology. There are simulations, there are animations.* PT3 also indirectly emphasizes the importance of technological skills, stating, *Unless you renew human relations, unless you renew your field knowledge, unless you renew your computer knowledge*, suggesting that effective teaching requires constant updating of technological knowledge and skills.

Another code seen under pedagogical content knowledge is 'instructional approaches'. CT1 states, *Flip classroom is a method we use a lot now.* She elaborates on this teaching method, saying, *It's not like before, let me just open a PowerPoint, explain, and give you a piece of paper. First, they dive into something themselves, research it, and apply it. We do our before and after checks.* This highlights the importance of offering students a structured learning experience under the guidance of the teacher. She also notes, *In recent years, I have been teaching in the classroom without knowing how many parts I was divided into. In other words, lessons are no longer possible with a single lesson plan. You need to go to class with plenty of materials*, pointing out the need for a student-centered and content-rich education. BT2 emphasizes the need for students to think critically and creatively by saying, *Students should find an F option rather than marking the ABCDE options* encouraging students to go beyond the provided choices and come up with their own answers or solutions. CT3 underscores the importance of instructional approaches without detailing specific methods. She states, *Perhaps one of the most important factors of teaching is the method of transferring knowledge beyond the knowledge.*

PT2 states 'questioning' by highlighting the importance of student inquiries, saying, *Through discussion, how do we respond when a student asks a question?* He highlights the prompting questions, noting, *Posing questions that encourage students to ask further questions.* PT2 also discusses the significance of addressing misconceptions, affirming that *Understanding misconceptions is crucial for educators*, distinguishing him as the sole mentor teacher to address misconceptions among all teachers. BT1 mentions the significance of a teacher's prior knowledge, stating, *Having prior knowledge is highly beneficial.* CT1 draws attention to the critical role of assessments, mentioning, *Assessments are pivotal, including pre-assessment, post-assessment, and available strategies for these.* She also emphasizes the necessity of understanding the curriculum, stating, *One should not begin teaching without a solid grasp of the curriculum.*

6.2.2.3. Pedagogical Knowledge (PK). This sub-theme encompasses broader pedagogical principles. BT2 stresses, "Our students are very insecure. I want the children to maintain internal discipline". He emphasizes the necessity for students to 'uphold internal discipline' *(f=1).* CT1 emphasizes, *Classroom management is important*, underlining the crucial role of effective 'classroom management' *(f=1).* CT4 asserts, *The attitude of the teacher candidate towards the good student is also important.* CT4's insight highlights the significance of the prospective teacher's 'attitude towards high-performing students' *(f=1).*

6.2.2.4. Teaching Science Beliefs . The "Teaching Science Beliefs" sub-theme refers to the beliefs and values that teachers hold regarding the teaching and learning of science. BT2 states, *The perception of a good teacher in Turkey is if s/he explains the subjects of the university exam, solves all the questions from the students completely, and assigns homework ... This should not be the case.* This reflects a belief that effective science teaching should 'extend beyond mere exam preparation' (f=1).

His later remarks such as, *Let them explore, let them break, let them spill, let them break...* underscore a broader teaching philosophy that emphasizes the importance of

developing students' scientific understanding and skills. This approach moves beyond rote learning, focusing instead on deeper, more meaningful educational experiences.

6.2.3. Mentoring Conceptions

The theme of mentoring conceptions is examined under 5 sub-themes: *(1) The position of the prospective teacher, (2) the position of the mentor, (3) the mentor teacher characteristics, (4) the purpose of mentoring and (5) mentor- mentee relationship.* The fifth sub-theme, "mentor-mentee relationship," is not observed among mathematics teachers. This subtheme examines the interactions between mentors and mentees and provides insights into the dynamics of their relationship.

6.2.3.1. The Position of Prospective Teachers. The roles and responsibilities that mentor teachers expect prospective teachers to undertake are examined under the subtheme of the position of the prospective teachers.

Table 6.14. The frequency table for the position of prospective teachers of ST's.

Subtheme	**Code**	**Frequency**
The Position of Prospective Teachers	Active Participation	5
	Field Experience	3
	Conducting Experiments	2
	Willingness and Curiosity	4
	Discipline (Attendance)	3
	Mentor as Role Model	2
	Developing Unique Identity	1

Almost all mentor teachers have emphasized the importance of the prospective teacher's 'active participation' in the mentoring process. BT1, emphasizing, *It should go beyond just helping; complete involvement makes it more beautiful* and BT2, noting, *In biology, the prospective teacher must experience the laboratory environment during the mentoring process* have underscored the significance of active involvement of prospective teachers in teaching practice for their professional development. Similarly,

PT3 highlights that prospective teachers understand the necessity of field experience, stating, *They realize that without getting into the field, this won't work.* CT2 expresses that prospective teachers should actively conduct experiments with students, stating, *I think that during the experiment, they both become familiar with that experiment and get a significant contribution by implementing the experiment.* Finally, CT3 and CT4 also emphasize that teaching can be learned through experience, and they strive to involve prospective teachers in the process.

The importance of prospective teachers' willingness in the mentoring process was highlighted by several mentor teachers. PT1 underscored, *Alongside the mentor teacher, the willingness of the candidate teacher also holds significance* emphasizing the voluntary aspect of the prospective teacher's involvement in this process. CT1 explained further, stating, *However, some prospective teachers express curiosity, asking questions like, 'Is there a quiz to review? Let me assist you. How do you handle it?'.* She indicated that certain candidates desire to extend their engagement beyond mandatory requirements. PT1 expressed similar sentiments, noting, *Mentoring results in better outcomes with learners who are eager to learn, exhibit curiosity, and ask questions* underscoring the importance of prospective teachers' willingness and active approach. PT2 emphasized that regardless of the mentor, an active student can find substantial benefits in the mentoring process. He stated, *No matter how bad the mentor is, when the student is good, he finds a lot to benefit from.* PT2 highlighted that prospective teachers should view the mentoring process as an opportunity and emphasized the importance of being receptive during this time.

PT3 stated, *I will make attendance on a daily basis, they will come at the right time.* emphasizing the necessity of discipline during the mentoring process. Similarly, CT2 underscored the importance of maintaining discipline, particularly in terms of attendance.

CT3 expressed that prospective teachers should take the mentoring process seriously: *Prospective teachers need to take this system very seriously, not just as a lesson*

but as an opportunity to make observations, gain understanding, and make the right choices. This highlights the expectation that prospective teachers should view the mentoring process as a significant responsibility and a crucial part of their professional development.

PT3 emphasized, *I think the prospective teacher who is doing his internship should take me as a role model* highlighting the importance of prospective teachers having a mentor as a role model. On the contrary, CT4 offered a different perspective, stating, *I don't want him to take his/her mentor as a role model; instead, I want him/her to differentiate himself in some way.* This perspective encourages student teachers to develop their unique identities rather than simply imitating their mentors.

CT4 underscored the significance of critical thinking in the mentoring process, saying, *What we expect is not for them to take us as a role model, but for them to draw their own conclusions and recognize our shortcomings here.* He believes that pre-service teachers should cultivate metacognition, think critically, remain perceptive, and also nurture their originality.

CT4 elaborated on this idea by mentioning, *We all have different capacities, characteristics, behaviors, and approaches to dialogue. Let the student observe me, learn from me, and teach what he has learned. Having such expectations seems contrary to the essence of teaching.*

6.2.3.2. The Position of Mentor Teachers. Mentor teachers' views on their roles, responsibilities, expectations and guidance styles in the mentoring process were examined under this sub-theme. It is concerned with what the mentor teacher does, their functions, and their placement within the mentoring relationship.

Table 6.15. The frequency table for the position of mentor teacher of ST's.

Subtheme	**Code**	**Frequency**
The Position of Mentor Teacher	Adaptive	2
	Guide	5
	Motivative	1
	Guide in Professional Identity	1
	Open Communication	2
	Negative Internship Exp.	2
	Knowledge Transfer	1
	Associating with Students	1
	Constructivist	1

BT1 and PT1 assert that mentor teachers should not delegate their responsibilities to prospective teachers. BT1 articulates this by stating, *What we do is not to put the work on him.* She emphasizes that mentor teachers should not impose their own duties and responsibilities on the prospective teachers but should instead provide opportunities for them to learn through their own experiences. Similarly, PT1 highlights this perspective by stating, *We should not think, 'Okay, let them come and take care of our work.'.* She further explains, *The person who volunteers should act as a mentor, and the primary aim of the mentor should be to genuinely impart knowledge and skills.*

BT1 underscores the importance of providing opportunities and support to prospective teachers, conceptualizing the mentor's role in the mentoring process as a 'guide.' She articulates, *I show them a way; if they still can't do it, then they can't.* Similarly, PT3 states that mentor teachers should offer extensive guidance to prospective teachers, saying, *The mentor must guide them in everything.* He further elaborates, *It is essential to continually explain to prospective teachers how to access available resources and the importance of maintaining open communication.* He notes a selective approach in his support, offering more guidance to those displaying interest and aptitude in teaching: *In my mentorship, I have focused more on those who show interest and a tendency towards teaching, providing them with increased support. I have concentrated more on those who exhibit the greatest need and eagerness.* Similarly, CT3 states, *I*

would like to support and guide the prospective teacher perceiving her role as both supportive and guiding.

BT2 stated, *I offer them the options and leave them to their own choices. I'm not forcing it.* CT1 also highlighted the adaptability of the mentoring process, saying, *What I give seems to change depending on the incoming student's request from the mentor and their attitude.* Both of them underscore a mentoring process that is responsive to the preferences and attitudes of the prospective teachers. CT1, expressing a nuanced view regarding the mentor's role in the mentoring process, mentioned *I believe I act as an effective mentor when I ensure their expectations are realistic.* She emphasizes the mentor's responsibility in ensuring that prospective teachers have realistic expectations as they transition theoretical knowledge into practical application in the real-world.

BT2 elaborates, *I always try to arouse a sense of curiosity in them.* He connects his mentoring approach with his classroom teaching experience, where he strives to engage students through curiosity. He likens mentoring to *Teaching students by doing and experiencing, showing them in an experimental environment.* PT1 shares a similar perspective, asserting, *The process goes faster or more efficiently if we capture it from a place that might interest them.* She further explains, *I'm trying to establish some similarities with the student in the class*, establishing a link between her relationship with mentees and her interactions with students in the classroom.

BT1 emphasizes the necessity of maintaining a disciplined attitude for the well-being and development of prospective teachers, stating, *I should be stricter for his well-being and development.* She believes that a mentor's disciplined approach will support the professional growth of prospective teachers. Similarly, BT2 underscores the significance of discipline through an anecdote where initially being intolerant towards a prospective teacher due to irresponsibility in the mentoring process ultimately led to positive outcomes. CT3 also highlights the role of discipline, stating, *I aim to serve as an example for our incoming teacher candidates, encouraging them to embrace a sense of responsibility and to act in accordance with structured planning.*

She views herself as a role model, demonstrating the importance of responsibility and structured planning.

BT2, who defines the mentoring process as 'learning by doing and experiencing,' also states, *I try to motivate them*, indicating his motivational role in the mentoring process. Similarly, CT2 stressed the importance of motivation, stating, 'the priority is always to motivate them, focusing on their positive aspects, with improvement occurring over time.' He underscores the role of motivation in mentoring. CT2, who offers a very limited view on the roles that the mentor should undertake in the mentoring process, emphasizes the importance of sharing within the mentor's role. He states, *'We are not limited to post-lesson feedback; our sharing of real-life experiences about the school's functioning and the profession continues throughout the semester*'. This highlights his belief in the mentor as a facilitator of knowledge sharing and acquisition.

PT2 and PT3 talk about their insufficient internship experiences as mentees. PT3 stated, *I went to the internship with great excitement, but my mentor said there was no need to come. All my dreams were dashed. Maybe the teacher was inadequate, or he just saw the role as a chore. As a result, I try not to make any of the mistakes I have experienced in my own experience.* He underscores that mentor teachers should not be indifferent towards prospective teachers. As previously mentioned, he argues that mentors should guide and support prospective teachers in every aspect. PT2 shared a similar sentiment: *I was unlucky; I went to the internship school once. They only asked me to teach a lesson for one day, and I taught that lesson. I felt so worthless during my internship.* He highlights the negative impact that an indifferent mentor can have on a prospective teacher. Despite expressing a limited view on the mentor's role in the mentoring process, PT2 stated, *I think the mentor should broaden horizons* and *I conclude that a mentor is not only a person who imparts information but also someone who continues the process of acquiring knowledge.* Despite expressing a limited view on the mentor's role in the mentoring process, PT2, after his inadequate internship experience, stated, *'I think the mentor should broaden horizons.' and, 'I conclude that a mentor is not only a person who gives information but also one who continues*

the process of receiving information'. This perspective underscores the importance of mentors being active learners themselves and engaging in a reciprocal exchange of knowledge with their mentees.

CT4 offers a different perspective from other teachers. He begins by stating, *We act according to a directive given to us by the Ministry of National Education. The general framework is already our main axis.* He explains that his mentorship is shaped according to this directive. In addition to mandatory tasks, he notes, *There are things we need to give extra in terms of the attitude that the teacher should show.* CT4 asserts, *The mentor should teach the prospective teachers how to understand the student*, emphasizing that the mentor should guide the prospective teacher in establishing dialogue with students. He elaborates, *First of all, we try to get teacher candidates to accept themselves as teachers* that highlights his focus on supporting prospective teachers in building a professional identity. During the mentoring process, CT4 emphasizes the importance of the teacher being natural, stating, *First of all, it is necessary to ensure that the teacher remains in his own nature.* He stresses the need for open communication by saying, *Let's say clearly what is right for us.* He believes that both the prospective teacher and the mentor should establish an environment where they can freely criticize each other. CT4 asserts that a mentor should be a good guide rather than just a good teacher. He describes his role as a mentor by saying, *We encourage each candidate teacher to understand themselves and the process; that's actually what we do.* He defines the mentoring process as *more constructivist, more research-based, and questioning-based.*

6.2.3.3. Mentor Teacher Characteristics. This sub-theme focuses on the personal and professional qualities and attributes of the mentor teacher. It examines what makes an effective mentor teacher in terms of their traits and competencies. PT2 emphasizes the importance of extensive knowledge in teaching (*coded as knowledgeable, f=1*), stating, *A person with a lot of knowledge is always inspiring because their knowledge increases the more, they share it.* PT1 highlighted that a mentor should 'inherently be a sharing individual' *(f=1).* PT3 added, *A teacher who becomes a mentor must be open to*

innovations. Unless you renew your human relations, your fields of expertise, and your computer knowledge, you cannot be a good teacher or mentor. He asserted that a mentor teacher should be someone who continually renews themselves (*coded as 'open to innovations, f=1*).

He emphasizes that mentor teachers '*must have a great passion for their job*' and should view prospective teachers as 'the future of our country'.

6.2.3.4. The Purpose of Mentoring. This sub-theme pertains to the overarching goals and objectives of the mentoring process. BT2's mentoring goal is to *teach them how to behave with students*, acknowledging that *they already learn to solve problems somehow.* He further expresses the purpose of mentoring as ensuring that the prospective teacher can 'go beyond what is presented' (f=1) to them by saying, *How can we best develop new teacher candidates... Teaching them to find an alternative option F, beyond just marking options ABCDE...* CT4's mentoring goal is to ensure that prospective teachers become teachers who can *accept that students are human too.*

This highlights his focus on 'fostering empathy' (f=1) and self-awareness in teacher candidates as they grow into their professional roles. CT3 states, *I think making them love chemistry should be one of the most important goals* emphasizing that one of the goals of mentoring is to instill a 'passion for the subject' *(f=1)* in teacher candidates.

6.2.3.5. The Mentor - Mentee Relationship. This sub-theme focuses on the dynamics and interaction between the mentor teacher and the prospective teacher. Here, mentor teachers expressed views about the 'mentoring relationship,' which differ from the roles they and the prospective teachers assume in the mentoring process or the goals of mentoring. Notably, no views were found among mathematics teachers regarding the nature of this reciprocal relationship.

Table 6.16. The frequency table for mentor-mentee relationship of ST's.

Subtheme	**Code**	**Frequency**
Mentor – Mentee Relationship	Long-term Relationship	4
	Mutual Learning	3
	Dual Nature	1
	Individuality and Flexibility	1
	Talent Acquisition	1

Four of the science teachers expressed that mentoring should extend beyond the confines of school practice, emphasizing the importance of establishing a long-term mentoring relationship. PT3 remarked, *I believe that we should maintain ongoing communication; this is about continuity.* PT1 and BT2 mentioned that they continued to keep in touch with the prospective teachers they mentored even after their school application period. CT1 remarked, *Teacher candidates can maintain contact with the mentor teacher afterward. There may also be a network for this purpose. Therefore, even after starting their careers, we can remain in touch.* She added that she saw herself as an effective mentor when prospective teachers contacted her after the practice at school.

PT3 stated, *I think I have a lot to share with them, just like they shared with me. I think we learned to teach together* highlighting the mutual learning relationship in the mentoring process. Similarly, PT2 emphasized, *This is a mutual relationship. I would like to work with a quality teacher candidate; I think it will strengthen me* underlining the importance of mutual development. CT3 added, *We can think of this as a mutual interaction. We learn a lot from our incoming teacher candidates* reinforcing the idea of reciprocal learning. The mutual learning these teachers emphasize in the mentoring process differs from the code of mutual learning used in mentoring motivation. Their motivation for mentoring is not rooted in mutual learning, but rather, they acknowledge the mutual learning aspect inherent in the mentor-mentee relationship during the process.

BT1 states, *There are two aspects to this mentoring, both academic and emotional. They make good progress academically. They also enjoy teaching emotionally.* This view emphasizes the dual nature of mentoring, highlighting the importance of both professional development and emotional satisfaction.

CT4 underscores the value of individuality and flexibility in the mentoring relationship by stating, *I do not find it very appropriate to have a standard stereotyping process; I think standardization is an intervention into the nature of mentoring.* PT2, who teaches at a prestigious private school, remarks on the mentoring process: *It was an incredibly valuable gain for human resources. You can't get to know a candidate better than that. Our students recognized them, their parents recognized them, the staff recognized them, and they were approved by all.*

This highlights a practical approach where mentoring serves as a means of talent acquisition and employee development. Additionally, PT2 notes, *Teachers working in private schools may perceive prospective teachers as their competitors.* This insight reveals a potential challenge in private school settings, where competition can impact the dynamics between mentors and mentees.

6.2.4. Mentoring Practices

Mentoring practices were explored through four distinct sub-themes: (1) Instructional activities, (2) Observation, (3) Competency Co-Creation via Discussion, and (4) Other activities.

6.2.4.1. Instructional Activities. Instructional activities encompass the active teaching and learning experiences that mentors provide to prospective teachers, emphasizing hands-on learning and collaborative teaching opportunities.

Table 6.17. The frequency table for instructional activities of ST's.

Sub-theme	**Code**	**Frequency**
Instructional Activities	Lecture Preparation	3
	Material Preparation	3
	Assessment and Evaluation	3
	Laboratory Work	4
	Question Solving	2
	Curriculum- Annual Plan Review	2

The most common instructional activity among mentor teachers is lesson preparation and teaching. BT1 said, *If they were going to teach a lesson, we expected them to prepare a lesson plan.* CT2 added, *Preparing the plans, sending them, and after reviewing those plans, giving our suggestions and finalizing them before entering the lesson.* CT1 also noted, *They were sending me the lesson plans.* These comments highlight that prospective teachers are required to prepare lesson plans. BT1 emphasizes the importance of integrating technology into teaching by asking candidates to experience *How to present an online course* and manage it effectively. She also highlights the necessity of practicing pronunciation, especially for teachers working within an international curriculum. CT1 encourages the preparation of enriched course content, stating, *I wanted him to integrate group work into the lessons, if possible. I generally want them to do different things. He was interested in drama, and I specifically suggested that he should definitely include it.* She mentions providing opportunities for prospective teachers to practice teaching. Similarly, CT4, BT2, and PT2 mention that prospective teachers give lectures. However, PT2, who teaches at a prestigious private school, says, *We try to keep the time required for the prospective teacher to teach to a minimum. There is also pressure from parents at school.*

BT1 discusses a unique approach to teaching practice. For prospective teachers with weak field knowledge, she says, *We work together. We teach him, and he then teaches the students.* This approach involves providing necessary guidance and reinforcement to candidates before they teach the material to students.

Science teachers often highlight laboratory work as a crucial instructional activity. BT2 explains, *I encouraged them to conduct experiments. It not only streamlined my own laboratory work but also provided valuable experiential learning opportunities for them.* Similarly, PT3 notes, *I assigned laboratory experiments to prospective teachers and noticed areas where they needed improvement.* PT2 also shares his experience with laboratory work alongside a prospective teacher. *We decided to utilize a free video analysis program for our lab work. It was a mutual learning experience where I'm not sure who mentored whom; it was a bilateral learning situation*, he reflects. CT4 emphasizes the importance of incorporating technology into laboratory studies, saying, *I assigned various tasks in the lab to my interns, leveraging technological tools like simulations and animations. I encouraged them to integrate these tools into their teaching.* Likewise, BT1 mentions her shift from paper-based test reports. *I ask them to write and assess reports online, I also incorporate simulations* she explains. She offers guidance and sharing opportunities for these technological advancements, stating, *We can assist with these tools and perhaps share them with prospective teachers.*

Some mentor teachers prioritize measurement and evaluation among instructional activities. BT1 stated, *I encourage prospective teachers to grade students' lab reports.* BT2 emphasizes support in tasks like exam paper preparation. PT3 elaborates, *Teacher candidates assist in preparing school exam questions. They draft written answers and evaluate them independently.* His perspective highlights the active involvement of prospective teachers in exam preparation and evaluation processes.

Another aspect of teaching is material preparation. BT1 notes, '*Teacher candidates are actively involved in creating visually engaging online activities*'. BT2 emphasizes, '*I request teacher candidates to prepare slides before lectures*'. CT1 highlights the significance of creating diverse worksheets for the same subject. She mentions, '*I encourage them to develop materials that can be used interactively*', highlighting her approach to incorporating technology.

PT1 and PT3 discuss the instructional activity of problem-solving. PT3 notes, '*Pre-service teachers gain confidence in themselves when they solve student questions*'. PT1 says, *They solved the problem in the class. I think it is an important point that they see the types of questions rather than the explanation of the subject. It was useful for them to have information about the exam structure.* It is worth noting that PT1 solely touched on the development of prospective teachers' problem-solving skills for the university exam within the scope of the theme of mentoring practices. This singular focus reflects a highly exam-focused approach, emphasizing the importance of equipping prospective teachers to master the university examination structure and specific question types.

CT1 suggests, *Let's review annual plans together. We can compare different curricula such as AP, IB, and MEB.* She discusses curriculum and annual plan reviews with prospective teachers. CT1 also mentions, *We covered various practices, including lab preparation, curriculum design, weekly planning, homework creation, quiz development, and organizing departmental meetings. There are countless other tasks I may have overlooked.* She not only covers laboratory study and material preparation, as well as annual plan review but also emphasizes extracurricular practices geared towards shaping the teacher's identity, including departmental meeting preparation.

6.2.4.2. Observation. This sub-theme focuses on the various situations in which both the mentor observes the prospective teacher, and the prospective teacher observes the mentor.

Table 6.18. The frequency table for observation of ST's.

Subtheme	**Code**	**Frequency**
Observation	Active Lesson Observation	6
	Comprehensive Observation	4
	Exam Process Observation	2
	Laboratory Management	2
	Diverse Teaching Insights	4

All teachers, except PT1 (who offers very limited insight into mentoring practices), emphasize the importance of lesson observation. BT2 states, *First of all, I want them to observe. They should be able to immerse themselves in the classroom atmosphere. I want them to take the notes like I do in class.* He emphasizes the need for prospective teachers to actively observe and take notes during lessons. PT2 mentions, *They were participating in our lesson observations. When a problem arises in the classroom, the teacher should observe how it is solved.* CT3 adds, *You may actually experience some negativities in the classroom environment, but it is also very important to see examples of how to intervene in these situations.* Like PT2, she emphasizes observing classroom management. Similarly, PT3 says, *When I encounter questions that I cannot answer, they see how I manage things* underscoring the observing problem-solving and management in real-time. CT3 also notes, *They try to follow all of our lessons according to the program. Let them see different perspectives and understand various teacher attitudes.* CT2 affirms this view, stating, *They observe classes with all the teachers.“ Similarly, CT4 emphasizes, “We want them to attend lessons from 9th, 10th, 11th, and 12th graders.* Both stress the importance of observing lessons at different grade levels and with different teachers to gain diverse insights. BT1 and MT1 also mentioned that prospective teachers observed their classroom sessions.

Some teachers discuss out-of-class observation. PT2 emphasizes, *We need to spend time together, not only in-class but also observing out-of-class relationships, interactions with employees, and parents. It's important to observe the appropriate style for conveying a problem to parents.* He believes that understanding and observing the broader social and professional interactions within the school environment is crucial. CT1 adds, *We arrive a little before the lesson to see what the teacher does in preparation, such as setting up for laboratory activities. We also use a system called ManageBac* (ManageBac is a management system designed specifically for International Baccalaureate schools) -*understanding how it works is part of the observation. It's like a shadowing experience, spending a day at school.* She highlights the importance of observing preparatory activities and administrative tasks to get a comprehensive view of a teacher's responsibilities. CT2 discusses the importance of academic development

in chemistry, stating, *We have a chemistry department room at our school, a laboratory preparation room where everything is centered around chemistry. Achievements, curriculum, and university exam processes are discussed there. Spending time in this environment allows them to be constantly immersed in chemistry.* He emphasizes the value of being immersed in a specialized academic environment to understand the depth of subject-specific professional practices. BT1 highlights that prospective teachers can observe extracurricular activities outside of regular classes, such as club activities at school.

BT2 emphasizes the importance of observing the exam process by stating, *I want them to be with us during exams, observing how to interpret written papers.* Similarly, PT3 mentions, *We may believe we've explained everything, but true understanding is tested during exams. That's where reality hits.*

CT3 emphasizes laboratory observation, stating, *It's essential to demonstrate how to manage the laboratory environment.* Likewise, CT2 expresses, *I particularly want prospective teachers to witness these experiments. Prior to the experiment, they should learn how to use the tools effectively... Group work involves delegating responsibilities to a team and observing their progress*, aiming to equip prospective teachers with practical skills and teamwork dynamics essential for effective teaching.

CT4, as a mentor, emphasizes observing prospective teachers. He mentions, *It's crucial for us to assess their self-confidence and motivation levels during lessons, and how they engage students.* CT4 is the sole mentor teacher who discusses observing prospective teachers.

6.2.4.3. Competency Co-Creation via Discussion. Meaningful conversations between student teachers and mentor teachers were explored within the 'discussion' sub-theme, focusing on the collaborative learning-to-teach experience between them.

Table 6.19. The frequency table for competency co-creation via discussion of ST's.

Subtheme	**Code**	**Frequency**
Competency Co-Creation via Discussion	Pre-Conference	3
	Post-Conference	3
	Feedback	4
	İmprove Communication	3
	Academic Support	2
	Professional Identity	4
	Emotional Support	1
	Reciprocal Feedback	1

Many mentor teachers emphasize the importance of holding a 'pre-conference' with prospective teachers prior to their teaching sessions to facilitate a smoother transition into the teaching environment. BT1 notes, "There may be a preliminary meeting. *Some things should not come as a surprise to the prospective teacher by reviewing what they will do in advance.* Similarly, PT2 states, *I try to introduce my colleagues to the lesson by providing tips about class dynamics, what they should do, the characteristics of that age group, and by sharing my own experiences before they join the class.* CT1 adds, *They receive information about the course from me. There may be a preliminary meeting before the lesson where not only the subject to be taught but also the overall structure will be discussed.*

Another significant code of the discussion involves holding a post-conference after the prospective teacher or the mentor teacher has taught the class. BT1 highlights the usefulness of these meetings, stating, *It's important to discuss what went well, what can be improved, and to get the prospective teacher's ideas after the lesson, including the questions they will ask.* BT2 adds, *After leaving the class or at the end of the week, I ask, 'Do you think there was something missing?' We evaluate these aspects in general terms.* PT3 also notes the importance of self-reflection, saying, *After the prospective teachers observe my lesson, I ask them, 'What do you see missing in me?'.*

In terms of materials and lesson plans prepared by the prospective teachers, mentors provide feedback. BT2 mentions, *They send their materials to me first; I review them. My approach is often to suggest reducing the content. I tell them what aspects are positive or need improvement in the presentation they prepared.* CT2 underscores the importance of timing, noting, *I provide feedback on making the lesson plan suitable for a 40-minute session.* CT3 adds, *Feedback can be given regarding the subject content and the evaluation process applied by the prospective teacher to the students.* BT1 emphasizes a broader approach to feedback, stating, *Finally, we send an overall reflection. It's important to provide feedback in a way that is constructive. It is hard for me to avoid any hard feelings in giving feedback.*

Improving communication with students is another focus for some mentor teachers. PT3 says, *There are deficiencies in communication with the student. I advise prospective teachers to be authentic and present with the student.* CT3 shares, *We talked with the prospective teacher that when we make a mistake as a teacher, instead of covering it up, telling the student that it is a mistake will not show that we have less knowledge.* CT4 suggests that to facilitate direct communication between prospective teachers and students, he encourages them by saying, *Let's ask general questions to the students, let's chat with them.*

Regarding academic support, BT1 highlights the importance of sharing successful strategies, stating, *I also shared effective practices with new prospective teachers, which helps them understand different generational expectations and approaches.* CT2 reinforces this point by adding, *Some prospective teachers have reported that they applied what they learned here in other settings* illustrating the practical and academic supports he makes to the development of prospective teachers.

PT3: *I always start by meeting the first group of prospective teachers that arrive. I tell them, 'Your appearance should befit a teacher-consider your clothing, hair, and beard. You are teachers now, so feel comfortable in the teachers' room'* He emphasizes his support for teachers in developing their professional identity, believing that a pro-

fessional appearance instills respect and confidence. Similarly, CT3 states, *Ensuring that teachers have a diverse cultural life outside the classroom helps them impart these experiences to their students. I believe it's beneficial to provide feedback to prospective teachers regarding their general behavior and attitude* underscoring the importance of cultural richness in their professional identity. CT2 says, "Throughout the semester, we continue sharing our work, our profession, and our life experiences. We are preparing them with insights into the teaching profession for the years ahead". CT4 says, *I told them that a teacher should never try to prove themselves to others. It's crucial to understand that teaching is, above all, about understanding others.* He emphasizes fostering a professional attitude in prospective teachers, stressing the importance of empathy and self-assurance in their roles.

CT4 mentions receiving feedback from mentee by saying, *I'm trying to get a lot of feedback here. I say, friends, just criticize us because we are also open to new information. If prospective teachers sense sincerity in you, they express it very easily. If I say, 'You can criticize me easily,' I will criticize them openly.* He emphasizes the importance of reciprocal feedback and creating an open, sincere environment for mutual growth. PT3 emphasizes the emotional support he provides to prospective teachers by saying, *Relax, be confident, you already know more than you students. I motivate you.* CT3 does not provide any insights related to the discussion sub-theme in her mentoring practices.

6.2.4.4. Other Activities. BT1 says, *They can be with us on duty...* and discusses spending time with mentor teachers during 'duty shifts' (f=1). She also mentions, *They might attend ceremonies* highlighting their participation in 'school ceremonies' *(f=1)* on special occasions. Additionally, she notes, *They can participate in club activities and offer ideas* encouraging involvement in 'extracurricular activities' *(f=1). We can go on school trips together* she suggests, as an opportunity for prospective teachers to observe 'out-of-classroom experiences' *(f=1).* She also mentions, *Sometimes there are library classes. Let them get an idea of how this works* emphasizing diverse learning environments. CT4 includes, *We also provide Olympic training to students, they can*

join us indicating specialized training opportunities for Science Olympiads *(f=2)*. BT2 adds, *I say spend time with friends who are training for the Olympics.* In addition, he states, *There are TÜBİTAK projects in our school. I want them to organize students in their project work* promoting involvement in scientific research projects.

7. DISCUSSION

7.1. Mentoring Practices of Mathematics and Science Teachers

This study explored the mentoring practices of mentor teachers, categorizing them into four distinct sub-themes: instructional activities, discussions, observations, and other practices. In examining the instructional activity aspect of mathematics and science teachers mentoring practices, distinct patterns emerge that shed light on the approaches and emphases within each discipline. Mathematics mentor teachers demonstrate a commitment to providing guided learning experiences for prospective teachers, focusing on comprehensive instructional activities that foster understanding and practical application of mathematical concepts. Through hands-on learning experiences and guided teaching practices, these mentor teachers aim to ensure that prospective teachers have an advanced understanding of mathematical concepts. Emphasis is placed on mathematical proof, problem-solving skills, and curriculum review to ensure that prospective teachers possess a clear understanding of the content they will be teaching. Their descriptions align with the concept of Advanced Mathematical Knowledge as defined by Zazkis and Leikin (2010). According to their definition, AMK involves a deep understanding of mathematics acquired at the university level, which is essential for effectively teaching complex mathematical concepts. The specific mention of emphasizing mathematical proof, problem-solving skills, and curriculum review aligns with using AMK to foster a deep understanding of mathematical concepts among prospective teachers.

A unique characteristic of science mentor teachers is to prioritize experiential learning opportunities through laboratory work and hands-on activities as crucial components of instructional practices. They emphasize material preparation and the integration of technology to creating visually stimulating online activities and preparing instructional materials for effective learning experiences.

While mathematics and science teachers share commonalities in their commitment to hands-on learning experiences, lesson preparation practices, and assessment and evaluation processes, notable differences emerge in their emphasis. Mathematics educators prioritize mathematical proof and problem-solving skills with a knowledge-based perspective. On the other hand, science educators emphasize laboratory studies, technology-integrated material preparation and measurement and evaluation periods.

Upon closer examination of mentor teachers' discussion and observation practices, no meaningful differences were found across branches. However, delving into other themes from this study may unveil how these practices vary. When the themes are examined, it is seen that the mentor teachers' understanding of teacher knowledge that mentor teachers believe prospective teachers should have and mentoring conceptions affect mentoring practices.

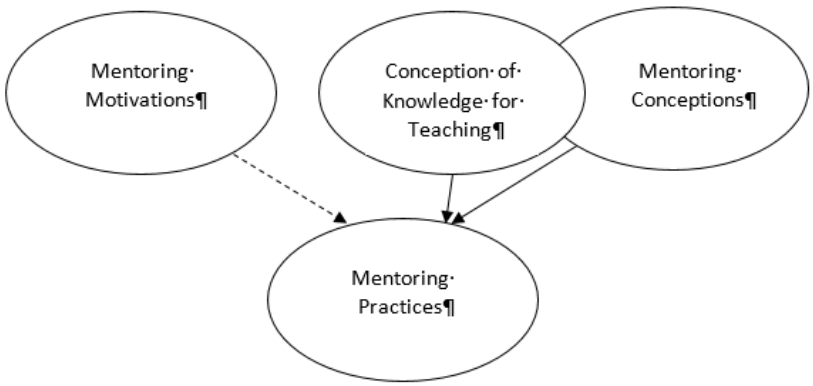


Figure 7.1. Visualization of themes.

7.2. Mentor Teachers' Conception of Knowledge for Teaching

All mentor teachers discuss teacher knowledge as they express their perspectives on effective mentoring practices. What is meant by teacher knowledge here is not the teacher knowledge that mentor teachers themselves have, but the teacher knowledge that mentors believe prospective teachers should have / develop. Both science teachers and mathematics teachers refer to subject matter knowledge, pedagogical content knowledge and pedagogical knowledge.

The subthemes that emerged as teacher knowledge are compatible with the existing literature.

Both mathematics and science mentor teachers highlighted the significance of subject matter knowledge in their respective fields, although their discussions showcased variances in the supplementary factors they prioritized. All mathematics teachers strongly emphasized the significance of subject matter knowledge (SMK), underscoring its critical role in effective teaching practices. Their discussions reflected a shared belief in the importance of an advanced understanding of mathematics to clarify concepts and guide students in their learning processes, demonstrating a strong commitment to enhancing instructional practices through comprehensive subject matter knowledge in their high-achieving high school contexts. Science teachers also emphasized the importance of subject matter knowledge in their field, highlighting a shared belief in the necessity of a broad understanding of the subject matter enriched by varied experiences and continuous learning to support student success. In addition to subject matter knowledge, the teachers discussed practical aspects and the epistemological nature of scientific inquiry. Their emphasis on practical experimentation and the need for continuous learning and updating of knowledge in the dynamic field of science suggests an approach to teaching that goes beyond solely focusing on subject matter knowledge.

While both mathematics and science teachers prioritize subject matter knowledge in their instructional activities, the specific activities undertaken by each group reflect the unique characteristics and demands of their respective subjects. In mathematics teaching, mentor teachers often focus on activities that deepen candidates' understanding of mathematical concepts and teaching methodologies. They frequently engage prospective teachers in solving mathematical problems, creating mathematical proofs, and preparing questions, all of which contribute to enhancing their SMK and teaching skills within the domain of mathematics. On the other hand, science teachers' instructional activities apart from emphasizing SMK through lesson preparation and teaching, science mentor teachers often integrate practical experiences such as laboratory work, experiments, and hands-on activities.

The findings from mentor teachers' opinions on Pedagogical Content Knowledge (PCK) in science teachers demonstrated a consistent emphasis on integrating subject matter with pedagogical strategies, with a notable focus on laboratory experiences and hands-on learning. Mentor teachers highlighted the importance of inquiry by guiding students in laboratory settings to foster curiosity and practical experimentation. Additionally, the role of technology integration emerged prominently among science teachers, highlighting the necessity of technological proficiency in modern teaching practices. Given the tangible and practical nature of science, these teachers emphasize technology integration in both their pedagogical content knowledge (PCK) and instructional activities. They frequently incorporate visualization tools to enhance understanding and engagement in the learning process.

The integration of subject matter with pedagogical strategies as practiced by science mentor teachers can be understood within the framework of the Pedagogical Content Knowledge (PCK) model as described by Magnusson *et al.* (1999). In this model, PCK emerges not merely from possessing subject matter knowledge (SMK) and pedagogical knowledge but transforming these foundational sources into effective teaching practices. Mentor teachers' emphasis on laboratory experiences, hands-on learning, and inquiry-driven education aligns closely with key components of the PCK model, particularly the knowledge of instructional strategies and students' understanding of science. These components facilitate the creation of learning environments that actively engage students and enhance their comprehension and curiosity.

On the other hand, mathematics mentor teachers emphasized the importance of being well-prepared to handle spontaneous academic questions and scenarios. They stressed the significance of understanding students' thinking patterns and employing multiple representations to deepen their comprehension. This approach is consistent with the literature on teacher noticing, which identifies mathematics instruction as a critical pedagogical opportunity to constructively engage with student thinking (Kilic, 2018).

Additionally, one teacher highlighted the focus on facilitating learning within the zone of proximal development and the importance of using adaptable teaching methods to meet individual student needs effectively.

The analysis of teachers' engagement with Pedagogical Content Knowledge (PCK) reveals a nuanced picture. While teachers demonstrate an awareness of various PCK components such as laboratory experiences, technology integration, and diverse instructional approaches, the depth and extent of their application appear somewhat limited. For instance, only one teacher mentions the use of multiple representations-a crucial aspect of effective mathematics instruction that aids students in understanding complex concepts from different perspectives. Similarly, critical elements like addressing student misconceptions and fostering inquiry through questioning, which are essential for deep learning and comprehension, are each highlighted by only one teacher. This suggests that although teachers are cognizant of these important educational principles, their practical implementation may be more superficial. Consequently, it becomes necessary to examine mentoring conceptions to understand the differences in the practices of mentor teachers.

7.3. Mentoring Conceptions and Practices

Mentor teachers in mathematics present varied perspectives on the role of prospective teachers during the mentoring process. One perspective emphasizes the importance of prospective teachers observing and comparing different teaching styles to identify both exemplary and less preferred practices. This approach suggests that learning by observation is crucial for developing effective teaching methods. Another perspective highlights the need for strict adherence to tasks and the importance of experiencing all phases of teaching, including preparation, in-class problem-solving, and reflection. This comprehensive approach underscores the belief that understanding the entire teaching process is essential for effective instruction.

Some mentors advocate for tailoring mentoring practices to align with the prospective teacher's preferences, whether they prefer to observe or engage directly, while others focus more narrowly on the importance of discipline without detailing specific actions.

In the science domain, mentor teachers largely emphasize the necessity of active participation for prospective teachers. They stress that candidates should go beyond mere assistance to fully immerse themselves in teaching practices, including laboratory work and field experience. This hands-on involvement is seen as vital for professional development and gaining practical teaching experience. Several mentors also highlight the significance of the prospective teacher's willingness and curiosity, noting that an eager and active approach leads to better outcomes in the mentoring process. Despite these variations, there is no significant branch-based change in how mentor teachers position prospective teachers.

When the data of mentor teachers in the context of the position of mentor teacher is examined, there is no meaningful branch-based difference in approaches among mentor teachers. The synthesis of findings highlights two distinct categories of mentor teachers: those who take on the role of teacher educator in the mentoring perception they offer and those who do not explicitly adopt this role. The first category comprises mentor teachers who actively embrace the role of teacher educator in their mentoring practices. These mentor teachers focus on adaptive mentorship, which means they adjust their guidance to suit each prospective teacher's unique needs. They use modeling approaches, where they demonstrate effective teaching practices for their candidates to observe and learn from. They engage in reflective mentoring, encouraging candidates to analyze their teaching experiences critically. They provide guided mentorship by offering structured guidance and feedback throughout the mentoring process without delegating responsibilities. On the other hand, the second category includes mentor teachers who do not explicitly see themselves as teacher educators. These mentors generally focus on the emotional dimension of mentorship, providing personal support, encouragement, and guidance. However, they do not offer a detailed perspective on how

they will contribute to the specific professional growth and development of prospective teachers.

There are notable variations in mentoring practices between teachers who embraced the role of teacher educator and those who did not. For instance, MT3, embodying the teacher educator role, advocates for active lesson observation through simulation. His emphasis on firsthand experience with classroom dynamics and comprehension of student-centered teaching methods underscores a strong commitment to offering immersive learning experiences for prospective teachers. Conversely, MT2, who does not adopt the role of teacher educator, takes a more surface-level approach to lesson observation. His focus lies in encouraging prospective teachers to directly engage with students and develop a practical understanding of teaching demands. While this method encourages direct interaction and hands-on experience, it may lack the depth and structured learning opportunities inherent in MT3's active lesson observation strategy.

In the context of discussion practices, a notable difference emerges between two groups based on their self-perception as teacher educators. Those who identify themselves as teacher educators prioritize discussions focused on 'learning to teach,' engage in pre- and post-conference discussions to prepare and reflect on teaching experiences and provide constructive feedback on materials and lesson plans. On the other hand, teachers who do not primarily see themselves as teacher educators have a different focus in their discussion practices. These educators emphasize improving communication with students, providing emotional support, and fostering a sense of cultural richness. While they may still engage in discussions and offer feedback, their approach to structured discussions and reflective practices may vary. This group may not provide as much detail regarding their discussion-based mentoring practices compared to those who explicitly identify as teacher educators. What they offer as discussion practice is not academic topics but rather emotional aspects.

In the literature, Butler (2012) elaborates on three distinctive roles that mentors may adopt to support the development of preservice teachers: as Instructional Coaches, Emotional Support Systems, and Socializing Agents. Mentors acting as Instructional Coaches focus on enhancing preservice teachers' pedagogical, technical, and organizational skills. They spend considerable time providing feedback and fostering professional growth through reflective practices, helping preservice teachers identify and develop their strengths and weaknesses in alignment with their personal attributes. This role is pivotal in ensuring that preservice teachers can navigate the complexities of teaching and develop a robust set of teaching strategies tailored to their unique capacities.

In the roles of Emotional Support Systems and Socializing Agents, mentors provide crucial emotional backing and aid in the socialization of preservice teachers into the teaching profession. Emotional support is essential for building trust and helping new teachers overcome the initial uncertainties and emotional challenges of the profession. As Socializing Agents, mentors guide preservice teachers in understanding the non-instructional and cultural aspects of schools, such as community interactions and administrative duties. However, this role can sometimes perpetuate traditional norms and practices that may not align with the progressive goals taught in educational programs, potentially leading to conflicts between the theoretical ideals and practical realities encountered in schools. These mentorship roles underscore the multifaceted responsibilities mentors have in preparing preservice teachers to meet both the pedagogical and personal demands of the teaching profession.

The findings from this study align closely with Butler's (2012) conceptualization of mentor roles, reinforcing the significance of how mentors perceive their responsibilities in shaping their mentoring practices. Teachers identified as 'teacher educators' in this study closely resemble the 'instructional coaches' in Butler's framework. A key observation from the research is that these teacher educators distinguish themselves through their commitment to reflective practices, which are essential for the development of preservice teachers' pedagogical skills. Similarly, the study corroborates

Butler's findings that mentors not adopting the instructional coach role tend to emphasize emotional support and social integration roles. This distinction highlights the compatibility between the theoretical models and practical implementations observed in this study, underlining the pivotal role of mentor self-perception in determining the focus and efficacy of their mentoring approaches.

8. LIMITATIONS AND FURTHER RESEARCH

This study operates within certain constraints that should be noted. One limitation relates to the methodology of data collection; the data was gathered by field experts rather than directly by the researcher. While this approach benefits from the experts' specialized knowledge and potentially enhances the data's reliability, it may also limit the researcher's ability to directly engage with the data collection process. This could affect the depth of interpretation as the researcher might not have firsthand insights into the contextual factors influencing the data. However, these limitations are balanced by the rigor of the analytical methods employed and the expertise of those collecting the data.

Future studies could benefit from incorporating interviews with prospective teachers mentored by the study's participants. This approach would provide a broader perspective on the mentoring process, enriching the understanding of mentor teachers' perceptions and effectiveness from the mentees' viewpoint. Such triangulation could balance the insights into the mentoring dynamics and offer a more comprehensive analysis of the outcomes.

Another valuable area of research would involve a detailed analysis of the dialogues between mentor teachers and their mentees. This research could focus on the qualitative aspects of these interactions, examining how communication styles, discussion topics, and interpersonal dynamics influence the professional development of prospective teachers. This approach would offer deeper insights into the mentoring process's communicative and relational aspects.

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APPENDIX A: MENTORING MOTIVATIONS CODES AND DESCRIPTIONS

The codebooks of Mentoring Motivations sub-themes, detailing descriptions and example quotations for each code are included.

Table A.1. The codebook for personal outcome motivations.

Sub-theme	**Code**	**Description**	**Example**
Personal Outcome Motivations	Dynamic Group	Enjoying the energy and dynamism brought by working with young people.	MT1: "I love working with young people, sharing new learning for both me and them".
	Mutual Learning	The reciprocal nature of learning is where both mentor and mentee gain knowledge.	MT2: "There were things they contributed to me".
	Self-improvement	The continuous desire to enhance one's own skills and knowledge.	MT4: "I always want to improve and go further".
	Emotional Benefits	Deriving joy and satisfaction from the mentoring process.	BT1: "It was a great pleasure for me".
	Professional Motivation	Increased motivation to perform better professionally through mentoring.	MT4: "Establishing good communication with the teacher candidate increases my motivation".

Table A.2. The codebook for generative outcome motivations.

Sub-theme	**Code**	**Description**	**Example**
Generative Outcome Motivations	Broader Societal Benefits	The desire to contribute to societal progress through education.	MT3: "If every teacher made a change in a student's life every year, this effect would continue like a chain".

Table A.2 The codebook for generative outcome motivations. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Contributing Advantages to the Country	Helping to improve the nation's educational standards.	MT2: "They will educate our children".
	Motivation Beyond Money	Mentoring driven by factors other than financial incentives.	MT2: "It's not about the money, it's about making a difference".
	Providing Benefit	The drive to be helpful and support the professional growth of mentees.	MT4: "The more helpful I can be, the better".
	Fostering Love for the Profession	Inspiring mentees to develop a passion for teaching.	MT4: "Since I am passionate about teaching, it would bring me joy to see them inspire others like me".
	Knowledge Transfer	Committed to sharing all the knowledge to aid mentees' growth.	MT3: "I am committed to sharing as much knowledge as possible".
	Past Experiences	Motivations rooted in mentors' own experiences as mentees, both positive and negative.	BT1: "I went through those stages too; it was really challenging... it was not easy at all".
	Inspiring Pursuit for Teaching	The motivation to inspire mentees to pursue teaching as a career, emphasizing the impact of mentorship on career choice.	CT1: "Internships are important when deciding whether to pursue a teaching career after graduation".

APPENDIX B: CONCEPTION OF KNOWLEDGE FOR TEACHING CODES AND DESCRIPTIONS

The codebooks of Conception of Knowledge for Teaching Sub-themes, detailing descriptions and example quotations for each code are included.

Table B.1. The codebook for professional responsibility motivations.

Sub-theme	**Code**	**Description**	**Example**
Professional Responsibility	Assigned Responsibility	Mentoring as a task assigned by school administration or other authorities.	CT1: "Teacher candidates already coming; we don't have the chance to say we won't do mentoring".
	Institutional Duty	Viewing mentoring as a part of professional duties mandated by the institution.	CT4: "Mentoring was a mission assigned to us by the school administration".
	Procedural Aspect	Following procedural requirements to act as a mentor.	CT2: "The department head asks you to act as a mentor; you accept it as an order".

Table B.2. The codebook for subject matter knowledge (SMK).

Sub-theme	**Code**	**Description**	**Example**
Subject Matter Knowledge	Comprehensive Subject Matter Knowledge	Emphasizes a deep and extensive understanding of the subject matter, covering a wide range of topics.	MT1: "If the teacher has a solid understanding of mathematics, it makes a big difference".

Table B.2 The codebook for subject matter knowledge (SMK). (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Horizon Content Knowledge	Refers to subject matter that extends beyond the curriculum boundaries.	MT2: "There is a concept known as an asymptote. Although it's not explicitly covered in the curriculum, it exists".
	Up-To-Date Subject Matter Knowledge	Stresses the importance of current and updated knowledge in the subject area, including recent developments and advancements.	PT3: "Unless you renew human relations, unless you renew field knowledge, unless you renew your computer knowledge...".
	Doing Science	Focuses on the practical application of scientific principles and methodologies and nature of science	PT2: "We acknowledge the divergence between real-world scenarios and theoretical ideals...".

APPENDIX C: MENTORING CONCEPTIONS CODES AND DESCRIPTIONS

The codebooks of Mentoring Conceptions sub-themes, detailing descriptions and example quotations for each code are included.

Table C.1. The codebook for pedagogical content knowledge (PCK).

Sub-theme	**Code**	**Description**	**Example**
Pedagogical Content Knowledge	Laboratory Experience	Emphasis on hands-on experiences, experimentation, and practical learning in laboratory settings	PT2: "Experimental design is very important for us. They should focus on the fact that physics can be taught with simple tools and how much practice can produce it."
	Questioning	Use of questioning techniques to encourage student inquiries, critical thinking, and deeper understanding of concepts.	PT2: "Posing questions that encourage students to ask further questions".
	Misconceptions	Addressing and understanding student misconceptions	PT2: "Understanding misconceptions is crucial for educators".
	Assessment and Evaluation	Application of various assessment strategies, including pre-assessment, post-assessment, and	CT1: "Assessments are pivotal, including pre-assessment, post-assessment, and available

Table C.1 The codebook for pedagogical content knowledge (PCK). (cont.)

Sub-theme	**Code**	**Description**	**Example**
		ongoing evaluation, to monitor student progress and guide instructional planning	strategies for these".
	Technology Integration	Incorporation of technological tools and resources such as online interactive tools, simulations, and animations	CT1: "Lessons using online interactive tools are given priority. The teacher needs to be knowledgeable about technology".
	Curriculum Knowledge	Possession of a solid grasp of the curriculum to effectively plan and deliver instruction aligned with learning objectives and standards	CT1: "One should not begin teaching without a solid grasp of the curriculum".
	Academic Contingency	Ability to respond effectively to unexpected academic questions or situations from students, ensuring preparedness and adaptability in teaching.	MT1: "The teacher should be able to catch contingencies academically".
	Multiple Representation	Use of various representations to explain concepts	MT2: "We draw a function graph as well as making a table".

Table C.1 The codebook for pedagogical content knowledge (PCK). (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Proximal Development Zone	Understanding and implementation of teaching methods that keep students within the zone of proximal development	MT2: "Neither too far ahead nor too far behind".
	Instructional Approaches	Methods and strategies that mentor teachers recommend or utilize to enhance the teaching and learning experience.	CT1: "Flip classroom is a method we use a lot now. It's not like before, let me just open a PowerPoint, explain, and give you a piece of paper. First, they dive into something themselves, research it, and apply it".

Table C.2. The codebook for pedagogical knowledge (PK).

Sub-theme	**Code**	**Description**	**Example**
Pedagogical Knowledge	Lesson Preparation	Refers to the preparations before teaching	MT2 "When I teach a lesson, I make preparations. I know what to say".
	Internal Discipline	Stressing the need for students to maintain internal discipline within the classroom.	BT2: "Our students are very insecure. I want the children to maintain internal discipline".

Table C.2 The codebook for pedagogical knowledge (PK). (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Classroom Management	Highlighting the role of effective classroom management in ensuring a conducive learning environment.	CT1: "Classroom management is important".
	Attitude towards Students	Recognizing the significance of the teacher candidate's attitude towards students.	CT4: "The attitude of the teacher candidate towards the good student is also important".

APPENDIX D: MENTORING PRACTICES CODES AND DESCRIPTIONS

The codebooks of Mentoring Practices sub-themes, detailing descriptions and example quotations for each code are included.

Table D.1. The codebook for teaching math/science beliefs.

Sub-theme	**Code**	**Description**	**Example Quote**
Teaching Math / Science Beliefs	Sense of Superiority	Belief that math teachers exhibit high confidence or superiority, potentially creating tension with students.	MT3: "There is a conflict between the mathematics teacher and the students. Mathematics is a group with a very high ego".
	Elevated Status of Math	Belief in the paramount importance of mathematics compared to other subjects.	MT4: "Courses are divided into two: mathematics and others. Since mathematics is the most important subject in such schools, children value mathematics more".
	Beyond Exam Preparation	Belief that effective science teaching extends beyond just preparing students for exams.	BT2: "The perception of a good teacher in Turkey is if s/he explains the subjects of the university exam, solves all the questions from

Table D.1 The codebook for teaching math/science beliefs. (cont.)

Sub-theme	**Code**	**Description**	**Example**
			the students completely, and assigns homework ... This should not be the case".

Table D.2. The codebook for the position of prospective teachers.

Subtheme	**Code**	**Description**	**Example Quotes**
The Position of Teacher Candidate	Comparator-Observer	Teacher candidates should observe and compare different teaching practices.	MT2: "Take what they need from everyone, like a bee".
	Discipline and Adherence	Emphasis on strict adherence to tasks and observing all aspects of teaching, including preparation.	MT3: "They will do exactly what they need to do"; "Experience the before and after the lesson...".
	Alignment with Preferences	Mentoring practices should align with the teacher candidate's preferences.	MT1: "Some may want to observe, some may want to learn about the class; it should be in line with their preferences".
	Active Participation	Teacher candidates should be actively involved in the teaching process.	BT1: "Complete involvement makes it more beautiful". BT2: "They must experience the laboratory environment".

Table D.2 The codebook for the position of prospective teachers. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Field Experience	Importance of hands-on field experience in professional development.	PT3: "Without getting into the field, this won't work".
	Conducting Experiments	Teacher candidates should actively conduct experiments with students.	CT2: "During the experiment, they become familiar with it and gain significant contributions".
	Willingness and Curiosity	Teacher candidates' willingness and curiosity are crucial for effective mentoring.	PT1: "The willingness of the candidate teacher holds significance"; BT1: "Certain candidates desire to extend their engagement".
	Discipline (Attendance)	Importance of maintaining discipline, particularly attendance.	PT3: "They will come at the right time"; CT2: "Maintaining discipline, particularly in terms of attendance".
	Mentor as Role Model	Teacher candidates should see the mentor as a role model.	PT3: "The teacher candidate should take me as a role model".

Table D.2 The codebook for the position of prospective teachers. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Developing Unique Identity	Teacher candidates should develop their unique identities and think critically.	CT4: "I want him/her to differentiate himself in some way".

Table D.3. The codebook for the position of mentor teacher.

Subtheme	**Code**	**Description**	**Example**
The Position of Mentor Teacher	Adaptive	Adapting mentoring practices to match student preferences.	BT2 "I offer them the options and leave them to their own choices. I'm not forcing it".
	Model	Emphasizing the mentor's role as a model for teacher candidates.	MT2: "Effective mentoring is being a model".
	Provide Field Experience	Providing opportunities for hands-on, practical learning experiences.	MT4: "Maybe you can't learn anything just by listening; mathematics is learned in the field".
	Guide	Providing guidance and support without delegating responsibilities.	BT1: "What we do is not to put the work on him".

Table D.3 The codebook for the position of mentor teacher. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Motivative	Encouraging and motivating teacher candidates throughout the mentoring process.	BT2: "I try to motivate them; mentoring should increase the motivation of the teacher candidates".
	Guide in Professional Identity	Guiding teacher candidates in establishing their professional identity.	CT4: "First of all, we try to get teacher candidates to accept themselves as teachers".
	Open Communication	Encouraging open communication and dialogue between mentors and teacher candidates.	CT4 "Let's say clearly what is right for us".
	Negative Internship Exp.	Reflecting on negative internship experiences to improve mentoring practices.	PT2: "I was unlucky; I went to the internship school once. They only asked me to teach a lesson for one day, and I taught that lesson. I felt so worthless during my internship".

Table D.3 The codebook for the position of mentor teacher. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Knowledge Transfer	Facilitating the transfer of knowledge and skills from mentor to mentee.	MT3: "I want prospective mathematics teachers to be able to absorb everything I have".
	Associating with Students	Building a connection and understanding with students in the mentoring process.	PT1: "I'm trying to establish some similarities with the student in the class".
	Constructivist	Adopting a constructivist approach to mentoring, focusing on inquiry and critical thinking.	CT4: "Mentoring should be more constructivist, more research-based and questioning-based...".

Table D.4. The codebook for characteristics of mentor teachers.

Sub-theme	**Code**	**Description**	**Sample Quotations**
The Characteristics of Mentor Teachers	Knowledgeable	Possesses extensive knowledge in teaching and mentoring.	PT2: "A mentor with a lot of knowledge is always inspiring because her knowledge increases as she gives more".

Table D.4 The codebook for characteristics of mentor teachers. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Open to Innovation	Receptive to new ideas and approaches in mentoring.	PT3: "A teacher who is a mentor should be open to innovations".
	Loving Job	Demonstrates passion and enthusiasm for teaching.	PT3: "First of all, mentor must love their job very much".
	Sharing	Mentors willing to share knowledge and experiences.	MT3: "I believe that mentorship is more efficient when based on extensive experience and a willingness to share knowledge".
	Warm-blooded	Fosters a supportive and positive learning environment.	MT4: "Establishing necessary communication and closeness is pivotal... Teacher candidates to feel comfortable with me, and that stems from my warmth".
	Professional Experience	Mentor has significant professional experience.	MT3: "An effective mentor should have at least 15, maybe 20 years of Experience",

Table D.5. The codebook for purpose of mentoring.

Subtheme	**Code**	**Description**	**Example**
The Purpose of Mentoring	Knowledge Transfer	The mentor aims to share knowledge and experiences with the teacher candidate to accelerate their	MT3: "We aim to expedite someone's teaching journey by sharing our knowledge and experiences with
		professional development.	them... Our goal is to enable them to achieve a level of teaching expertise that might typically take 8 years, perhaps in just 6 years, or even 3 years".
	Teaching Behavior	Guide the teacher candidate in developing appropriate behavior and interaction with students.	BT2: "teach them how to behave with students".
	Exploring Alternatives	Emphasizes going beyond presented options and encourages creativity in problem-solving	BT2: "How can we best develop new teacher candidates... Teaching them to find an alternative option F, beyond just marking options ABCDE..."

Table D.5 The codebook for purpose of mentoring. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Empathy Development	Nurturing empathy and self-awareness in teacher candidates, emphasizing	CT4: "ensure that prospective teachers become teachers who can accept that students are human too".
		the human aspect of teaching.	
	Passion for Subject	Instill a passion for the subject in teacher candidates, fostering a love for the content they will teach.	CT3: "I think making them love chemistry should be one of the most important goals".

Table D.6. The codebook for mentor-mentee relationship.

Subtheme	**Code**	**Description**	**Example**
Mentor – Mentee Relationship	Long-term Relationship	Mentoring extends beyond school practice, emphasizing ongoing communication	PT3 "I believe that we should maintain ongoing communication; this is about continuity".
	Mutual Learning	Emphasis on reciprocal learning and mutual development in the mentoring	PT2: "This is a mutual relationship. I would like to work with a quality teacher candidate;

Table D.6 The codebook for mentor-mentee relationship. (cont.)

Sub-theme	**Code**	**Description**	**Example**
		process	I think it will strengthen me".
	Dual Nature	Acknowledges the academic and emotional aspects of mentoring	BT1: "There are two aspects to this mentoring, both academic and emotional. They make good progress academically. They also enjoy teaching emotionally".
	Individuality and Flexibility	Values individuality and rejects standardization in the mentoring process	CT4: "I do not find it very appropriate to have a standard stereotyping process; I think standardization is an intervention into the nature of mentoring".
	Talent Acquisition	Views mentoring as a means of talent acquisition and employee development	PT2: "It was an incredibly valuable gain for human resources. You can't get to know a candidate better than that".

Table D.7. The codebook for instructional activities.

Sub-theme	**Code**	**Description**	**Example**
Instructional Activities	Lecture Preparation	Tasks related to creating lesson plans and incorporating diverse teaching methods	BT1: "If they were going to teach a lesson, we expected them to prepare a lesson plan."
	Material Preparation	Developing teaching materials such as worksheets, slides, and online activities	BT1: "Teacher candidates are actively involved in creating visually engaging online activities".
	Assessment and Evaluation	Activities involving grading, creating quizzes, and preparing exam questions	BT1: "I encourage teacher candidates to grade students' lab reports."
	Laboratory Work	Engaging student teachers in conducting and managing laboratory experiments	PT3: "I assigned laboratory experiments to teacher candidates and noticed areas where they needed improvement".
	Question Solving	Providing opportunities for student teachers to solve problems and questions posed by students	MT4: "They can solve questions rather than lecturing".

Table D.7 The codebook for instructional activities. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Co-Teaching	Involving student teachers in co-teaching or team teaching alongside experienced teachers	MT1: " The more classroom sharing we get, the better. Like co-teaching".
	Curriculum-Annual Plan Review	Reviewing and discussing curricula and yearly teaching plans	CT1: "We covered various practices, including lab preparation, curriculum design, weekly planning...".
	Mathematical Proof	Assigning tasks related to proving mathematical concepts and creating related questions	MT4: "I try to give teacher candidates tasks in the classroom... often assigns student teachers the task of making mathematical proofs".

Table D.8. The codebook for observation.

Subtheme	**Code**	**Description**	**Example Quotation**
Observation	Active Lesson Observation	Emphasizes active participation and simulation in lesson observation	MT3: "I would like to simulate the lesson with the teacher candidates".
	Comprehensive Observation	Advocates for observing various aspects of teaching beyond classroom lessons	PT2: "We need to spend time together, not only in-class but also observing out-of-class relationships, interactions with employees, and parents".
	Exam Process Observation	Highlights the importance of observing exam processes to understand student assessment	BT2: "I want them to be with us during exams, observing how to interpret written papers".
	Laboratory Management	Emphasizes observing and managing laboratory environments and experiments	CT3: "It's essential to demonstrate how to manage the laboratory environment".
	Diverse Teaching Insights	Emphasizes observing lessons at different grade levels and with different teachers	CT4: "We want them to attend lessons from 9th, 10th, 11th, and 12th Graders".

Table D.8 The codebook for observation. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Subject-Specific Immersion	Advocates for immersion in subject-specific environments to understand professional practices	CT2: "Spending time in this environment allows them to be constantly immersed in chemistry."

Table D.9. The codebook for competency co-creation via discussion.

Subtheme	**Code**	**Description**	**Example**
Competency Co-Creation via Discussion	Pre-Conference	Holding pre-lesson discussions to prepare prospective teachers for teaching sessions.	BT1: "There may be a preliminary meeting. Some things should not come as a surprise to the teacher candidate by reviewing what they will do in advance".
	Post-Conference	Conducting post-lesson discussions to reflect on teaching experiences and provide feedback.	BT1: "It's important to discuss what went well, what can be improved, and to get the teacher candidate's ideas after the lesson".
	Feedback	Providing feedback on materials, lesson plans, and teaching strategies prepared by prospective teachers.	BT2: "They send their materials to me first; I review them. My approach is often to suggest reducing the content".

Table D.9 The codebook for competency co-creation via discussion. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	İmprove Communication	Offering advice and guidance on improving communication with students.	PT3: "There are deficiencies in communication with the student. I advise prospective teachers to be authentic and present with the student".
	Academic Support	Sharing successful strategies and academic insights with teacher candidates.	BT1: "I also shared effective practices with new teacher candidates".
	Professional Identity	Supporting the development of a professional identity among teacher candidates.	PT3: "Your appearance should befit a teacher-consider your clothing, hair, and beard".
	Emotional Support	Providing emotional encouragement and support to teacher candidates.	PT3:"Relax, be confident, you already know more than your students. I motivate you".

Table D.9 The codebook for competency co-creation via discussion. (cont.)

Sub-theme	**Code**	**Description**	**Example**
	Reciprocal Feedback	Encouraging reciprocal feedback and creating an open, sincere environment for mutual growth.	CT4: "I say, friends, just criticize us because we are also open to new information".

Table D.10. The codebook for other activities.

Sub-theme	**Code**	**Description**	**Example**
Other Activities	Projects	Encouraging prospective teachers to actively participate in projects with students.	MT2: "They supported the student who participated in the Tübitak project".
	Communication	Emphasizing the necessity of direct interaction between prospective teachers and students through communication channels.	MT4 "I am trying to include prospective teachers in class communication groups. I want them to communicate with students".
	Extracurricular Activities	Encouraging involvement in extracurricular activities such as club activities and offering ideas.	BT1:"They can participate in club activities and offer ideas"; "They can be with us on duty..."; "They might attend ceremonies"; "We can go on school trips together".

APPENDIX E: ETHICAL CONSIDERATIONS

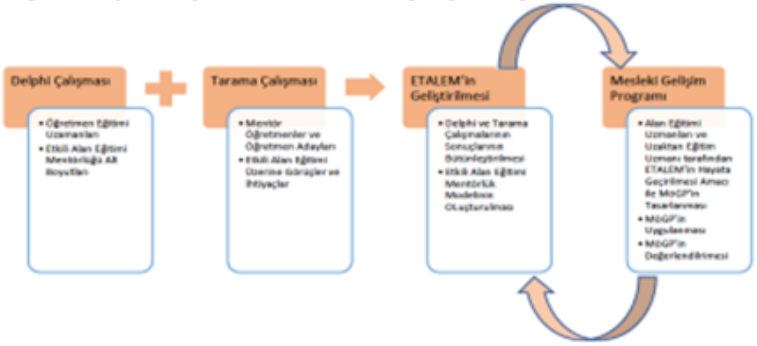
Ethical committee approval obtained from the Trabzon University social and human sciences scientific research and publication ethics committee has been provided.

T. C.
TRABZON ÜNİVERSİTESİ
SOSYAL VE BEŞERİ BİLİMLER BİLİMSEL ARAŞTIRMA ve YAYIN ETİK KURULU
ONAY FORMU

TARİH	**11.12.2020**	
YER	**Fatih Eğitim Fakültesi Dekanlık Toplantı Salonu**	
KATILIMCILAR	Prof. Dr. Haluk ÖZMEN Prof. Dr. Suat UNGAN Prof. Dr. Bülent GÜVEN Prof. Dr. M. Kayhan KURTULDU Prof. Dr. Rahmi ÇİÇEK Prof. Dr. Hasan KARAL Prof. Dr. Erdem TAŞDEMİR	Başkan Üye Üye Üye Üye Üye Üye
ARAŞTIRMA ÖNERİSİNİN İÇERİĞİNE YÖNELİK BİLGİLER		
Araştırmanın Adı	Alan Eğitiminde Etkili Alan Eğitimi Mentörlük Modeli Oluşturulması ve Mentörlük Mesleki Gelişim Programının Geliştirilerek Uygulanması	
Araştırmanın Türü	☐ Yüksek Lisans Tezi ☐ Doktora Tezi ☐ BAP Projesi ■ **TÜBİTAK Projesi** ☐ Diğer (Belirtiniz)	
Araştırmada Görev Alan Kişiler	Doç. Dr. Fatma ASLAN TUTAK (Proje Yürütücüsü - Boğaziçi Üniversitesi) Doç. Dr. Sevil AKAYGÜN (Araştırmacı-Boğaziçi Üniversitesi) Doç. Dr. Armağan ATEŞ (Araştırmacı-Bilkent Üniversitesi) Doç. Dr. Derya ÇELİK (Araştırmacı-Trabzon Üniversitesi) Doç. Dr. Faik Özgür KARATAŞ (Araştırmacı- Trabzon Üniversitesi) Doç. Dr. Fatih Çağlayan MERCAN (Araştırmacı - Boğaziçi Üniversitesi) Dr. Öğr. Üyesi Mutlu ŞEN-AKBULUT (Araştırmacı- Boğaziçi Üniversitesi) Dr. Mustafa GÜLER (Araştırmacı- Trabzon Üniversitesi) Bursiyerler (2)	
Araştırma Yürütücüsünün İletişim Bilgileri	Doç. Dr. Fatma ASLAN TUTAK Boğaziçi Üniversitesi, Kuzey Kampus, Eğitim Fakültesi No:510, 34342 Bebek İstanbul Tel: 0212-359-4610, Cep Tel: 0533-462-5956	
Araştırmanın Amacı	Projenin ilk hedefi Matematik-Fizik-Kimya ve Biyoloji öğretimi için etkili alan eğitimi mentörlük modelinin geliştirilmesidir. Bu modelin uygulanabilirliğinin test edilmesi ve ülkemizde mentör öğretmen eğitimi konusunda yol gösterici olabilecek bir mesleki gelişim programının tasarlanması da projenin ikinci hedefidir. Bu proje ülkemizdeki öğretmen eğitiminde önemli bir ihtiyaca bilimsel alt yapıyı oluşturmak üzere önerilmektedir.	
Araştırmanın Gerekçesi	Ülkemizde öğretmen yetiştirme anlamında olumlu gelişmeler gözlenmektedir. Öğretmen öğrenmesi alan yazını incelendiği zaman hizmet öncesi öğretmen yetiştirmede kuramsal bilgi ve donanımın sahada işe koşularak öğretmenlerin gelişiminin güçlendirilmesinde önemli rol oynayan öğretmenlik uygulaması stajında en önemli etmenlerden birinin mentör öğretmenlerin uygulamaları olduğu görülmektedir. Ancak mentör öğretmenlik uygulamaları genel pedagoji uygulamaları ile sınırlı kalmakla beraber kullanılan modellerde pedagojik alan bilgisine işaret eden boyutlarda alan eğitimi sınırlandırılmıştır. Alan eğitiminde etkili mentörlüğün uzmanlar tarafından kararlaştırılan bir tanımına ihtiyaç duyulduğu ortadadır. Bu bağlamda, önerilmekte olan projenin ilk hedefi Matematik-Fizik-Kimya ve Biyoloji öğretimi için etkili alan eğitimi mentörlük modelinin geliştirilmesidir. Bu modelin uygulanabilirliğinin test edilmesi ve ülkemizde mentör öğretmen eğitimi	

Figure E.1. Form 1

	konusunda yol gösterici olabilecek bir mesleki gelişim programının tasarlanması da projenin ikinci hedefidir. Bu proje ülkemizdeki öğretmen eğitiminde önemli bir ihtiyaca bilimsel alt yapıyı oluşturmak üzere önerilmektedir.
Araştırmanın Yöntem ve Örneklemi	Çalışmanın İstanbul, Ankara ve Trabzon olmak üzere üç ilde yürütülecektir. ETALEM'in geliştirilmesi ve ardından MöGP'in tasarlanarak uygulanmasına yoğunlaşan bu araştırmanın yöntemi Şekil 1'deki her bir adım için açıklanmıştır.



Şekil 1: Çalışmanın akışı

ETALEM'in Geliştirilmesi (Delphi Çalışması ve Tarama Çalışması)

Türkiye'de Matematik ve Fen Bilimleri alanlarında mentör öğretmen uygulamalarına yol gösterici nitelikte bir model olacağı öngörülen ETALEM'in geliştirilmesi sürecini, Matematik ve Fen Bilimleri (Fizik-Kimya-Biyoloji) alanları için ayrı ayrı uzman görüşleri alınarak yürütülecek iki eş-zamanlı Delphi çalışması ve mentör öğretmen ile öğretmen adayları ile yapılacak bir tarama çalışması oluşturmaktır. Matematik eğitimi alanından 30, Fen Bilimleri alanlarından 45 yerli ve yabancı uzmanların görüşleri alınarak yürütülmesi planlanan Delphi çalışmaları sonucunda alanlar arasındaki benzerlik ve farklılıkların da incelenerek disiplinlerarası çalışmalara olanak sağlanacağı düşünülmektedir. Delphi çalışmasından elde edilecek etkili alan eğitimi mentörlük tanımı ve uygulamaları ile tarama çalışmasından elde edilecek mentörlerin ve öğretmen adaylarının etkili mentörlük görüşleri birleştirilerek ETALEM'in oluşturulması hedeflenmektedir. Tarama çalışması kapsamında ise üç ildeki Matematik ve Fen Bilimleri branşlarından mentör öğretmenlerin motivasyonları, anlayışları, uygulamaları ve etkili mentörlük tanımları ile katılımcı mentörlerin öğretmenlik uygulaması süresince birlikte çalıştıkları öğretmen adaylarının mentörlük deneyimleri ve ihtiyaçları incelenecektir. Karma yöntemin uygulanacağı tarama çalışmasında, nicel verilerin toplanması sürecinde hem mentör öğretmenlere hem de öğretmen adaylarına Etkili Matematik/Fizik/Kimya/Biyoloji Öğretiminde Mentörlük Ölçeği, mentör öğretmenlere ayrıca Mentörlük Motivasyonu ve Mentörlük Anlayışı Ölçekleri (Van Ginkel, Verloop, & Denessen, 2016) uygulanacaktır. Etkili alan eğitimi mentörlük modelinin geliştirilmesi bağlamında, nitel çalışma için her branştan en az 30 mentör öğretmenin belirlenmesi ve belirlenecek mentör öğretmenlerle yarı-yapılandırılmış bireysel görüşmelerin yapılması hedeflenmektedir.

Delphi Çalışması Katılımcıları: Matematik veya fen bilimleri eğitimi alanında en az doktora derecesine sahip ve öğretmen eğitimi araştırmaları ile uygulamaları üzerine deneyimleri olan uzmanlar sürece dâhil edilecektir. Öğretmenlik uygulaması derslerini en az bir kere yürütmüş olmak katılımcılarda aranan ön şartlardan bir diğeridir. Ayrıca, mentörlük alanında çalışma yapmış olmak katılımcıların belirlenmesinde dikkate alınacak bir diğer ölçüttür.

Mentör Öğretmen ve Öğretmen Adayı Katılımcıları: Bu çalışmanın hedef evrenini İstanbul, Ankara ve Trabzon'daki lise matematik, fizik, kimya, biyoloji öğretmenlik uygulaması kapsamında mentörlük yapan öğretmenler ve bu illerdeki öğretmenlik stajını yapmakta olan öğretmen adaylarıdır. İl Milli Eğitim Müdürlüklerinden öğretmen isim bilgileri

2

Figure E.2. Form 2

alınamayacak olsa da bu öğretmenlerin çalıştıkları okulların bilgisine ulaşılarak belirlenen okullardaki mentör öğretmenlerin çalışmada katılımcı olması için şu koşullara bakılacaktır:

- Ortaöğretimde matematik, fizik, kimya veya biyoloji derslerinde öğretmen olma
- Milli Eğitim Mentör Öğretmen sertifikasına sahip olma
- Son 5 sene içerisinde en az bir kere öğretmen adaylarına öğretmenlik uygulaması mentörlük yapmış olma
- Mentörlük deneyiminin Formasyon öğrencileri veya Eğitim Fakültesi öğrencileri ile olması

Araştırmanın bir diğer örneklemini de öğretmenlik uygulaması stajını yapmakta olan öğretmen adayları oluşturmaktadır. Hedef evrendeki öğretmen adaylarına okumakta oldukları üniversitelerde ulaşılarak çalışmaya davet edilmeleri planlanmaktadır. Öğretmen adaylarına üç ildeki öğretmenlik lisans programlarındaki staj dersleri (Formasyon veya Eğitim Fakültesi) kapsamında ulaşılacaktır.

Nicel verilerin toplanması sürecinde hem öğretmen adaylarına hem de mentör öğretmenlere Etkili Matematik/Fizik/Kimya/Biyoloji Öğretiminde Mentörlük Ölçeği, mentör öğretmenlere ayrıca Mentörlük Motivasyonu ve Mentörlük Anlayışı Ölçekleri (Van Ginkel, Verloop, & Denessen, 2016) uygulanacaktır.

Veri Toplama

Delphi Çalışması Anketi:

ETALEM'e yönelik uzman görüşlerinin alınması sürecine Delphi çalışmasının ilk turu için uzman görüş formunun geliştirilmesi ve uzmanların belirlenmesiyle başlanacaktır. Uzman görüş formu EK-1'deki gibi alanyazında ifade edildiği üzere açık uçlu sorulardan oluşabilir. Ardından form uzmanlara e-posta ile gönderilecek ve 2 hafta süre verilecektir. Uzmanlardan gelen cevaplar analiz edildikten sonra, ikinci turda analiz sonuçları ile birlikte görüş formu da bir kez daha gönderilerek yine 2 haftada görüşlerini bildirmeleri istenecektir. İkinci turdaki görüşlerin analiz edilmesinin ardından görüş formu ve analiz sonuçları üçüncü ve son kez uzmanlara gönderilerek tekrar görüşleri istenecektir. Analizlerin tamamlanmasının ardından görüş birliğine varılan kısımlar belirlenecektir.

Etkili Matematik/Fizik/Kimya/Biyoloji Öğretiminde Mentörlük Ölçeği: Hudson, Skamp ve Brooks (2005) tarafından 5 Faktörlü Mentörlük Modeli'ne dayanarak geliştirilmiş olan Etkili Fen Bilgisi Öğretiminde Mentörlük Ölçeği, fen bilgisi öğretmen adaylarının uygulama okullarındaki mentörlerinin uygulamaları hakkındaki algılarını ortaya koymayı amaçlamaktadır. Ardından, Etkili Fen Bilgisi Öğretiminde Mentörlük Ölçeği, Hudson ve Peard (2006) tarafından matematik öğretmen adaylarının uygulama okullarındaki mentörlerinin uygulamaları hakkındaki algılarını incelemek için tekrar tasarlanarak Etkili Matematik Öğretiminde Mentörlük Ölçeği oluşturulmuştur. Daha sonra Hudson (2010) mentör matematik öğretmenlerinin kendi mentörlük uygulamaları hakkındaki algılarını incelemek için ölçekteki maddelerin özne ve yüklemini değiştirerek aynı ölçeği mentör öğretmenler için tekrar tasarlamıştır. Bu ölçeklerin Türkçeye uyarlamaları, yürütücünün devam etmekte olan Boğaziçi Üniversitesi BAP tarafından desteklenen Matematik Öğretiminde Etkin Mentörlük (BU-BAP-20D03P1) projesi kapsamında tamamlanmıştır (EK-2).

Mentörlük Motivasyonu Ölçeği: Van Ginkel, Verloop ve Denessen (2016) tarafından geliştirilmiş olan Mentörlük Motivasyonu Ölçeği, öğretmenlerin mentörlük yapmak için motivasyonlarını inceleyen 7'li Likert tipi maddelerden oluşmaktadır. Mentörlük motivasyonları 2 iki öğe altında incelenmiştir ve toplam 19 maddeden oluşmaktadır; Üretme Güdüsü (Generative Outcome Motives) (8 madde) ve Kişisel Öğrenme Güdüsü (Personal Learning Outcome Motives) (11 madde). Bu ölçeğin Flemenkçe'den Türkçeye

Figure E.3. Form 3

uyarlaması, devam etmekte olan Boğaziçi Üniversitesi, Bilimsel Araştırmalar (BAP) projesi kapsamında yapılmış olup bu araştırma başvurusu sırasında uygulanmaktadır **(EK-3).**

Mentörlük Anlayışı Ölçeği: Van Ginkel, Verloop ve Denessen (2016) tarafından geliştirilmiş olan Mentörlük Anlayışı Ölçeği, toplam 48 tane 7'li Likert tipi maddeden oluşmaktadır. Ölçeğin amacı; (1) mentörlük amaçlarını ve niyetlerini, (2) öğretmeyi öğretme kaynakları hakkındaki inanışlarını, (3) öğretmen bilgi ve öğreniminin doğası ve süreci hakkındaki inanışlarını incelemektir. Bu ölçeğin Flemenkçe'den Türkçeye uyarlaması, yine devam etmekte olan Boğaziçi Üniversitesi, Bilimsel Araştırmalar (BAP) projesi kapsamında yapılmış olup bu araştırma başvurusu sırasında uygulanmaktadır **(EK-4).**

Mülakat: Bahsi geçen üç nicel ölçeğin yanı sıra nitel veri toplama ve analizi de gerçekleştirilecektir. Nitel çalışma için belirlenecek mentör öğretmenler ile etkili alan eğitimi mentörlüğü modeli geliştirilmesi bağlamında yarı-yapılandırılmış bireysel görüşmeler de yapılacaktır **(EK-5)**. Bu görüşmelerde aşağıdaki soruların yönetilecektir:

- Bu dönemki mentörlük deneyiminizden bahseder misiniz? Genel bir değerlendirmesini yapabilir misiniz?
- Neden mentörlük yapıyorsunuz? Motivasyonunuz nedir?
- Sizce iyi bir matematik/fizik/kimya/biyoloji öğretmeni nasıl olmalı?
- Sizce iyi bir matematik/fizik/kimya/biyoloji mentör öğretmen nasıl olmalı?
- Sizce matematik/fizik/kimya/biyoloji için etkili mentörlük uygulaması nasıl olmalı?
- Etkili mentörlük için sizin deneyimlerinizden bir örnek paylaşır mısınız?
- Mentörlük yaptığınız süre içinde aklınızda en çok kalan deneyiminiz neydi?
- Son yıllardaki mentörlük deneyimlerinizi nasıl değerlendirirsiniz
- Son yıllardaki mentörlük deneyimlerinizi düşündüğünüzde ideal mentörlük için neler aynı kalmalı neler değişmeli?
- Mentörlük yaptığınız ilk yıllarla son yılları kıyaslarsanız, neler aynıydı, neler değişti?

MöGP'nin Geliştirilmesi ve Uygulanması

Milli Eğitim Bakanlığı yetkilileri ve mentör öğretmenlerin katılımı ile bir çalıştay düzenlenecektir. Çalıştayda her bir alan eğitimi branşı için ayrı ayrı geri bildirimler alınarak sunulmuş olan MÖGP revize edilecektir.

MöGP katılımcıları: Çalışma kapsamında hazırlanan alan eğitiminde mentör öğretmenlik mesleki gelişim programın çalışmanın yürütüleceği üç ilden gönüllü katılımcılar ile uygulanması planlanmaktadır. Çalışmanın model oluşturma safhasında katılımcı olan mentör öğretmenlere ulaşılarak MÖGP'in uygulanması aşamasında katılımcı olmaları için çağrıda bulunulacak ve gönüllü öğretmenler arasından tabakalandırılarak rastgele seçilecek öğretmenler ile uygulama çalışması yapılacaktır. MÖGP uygulama aşamasında katılımcı sayılarının her branş için 9'ar katılımcı olması planlanmıştır. Üç ilden uygulamanın yapılacağı yıl öğretmenlik uygulaması stajı kapsamında en az bir öğretmen adayına mentörlük eden 9 Matematik, 9 Fizik, 9 Kimya ve 9 Biyoloji (toplam 36) gönüllü mentör öğretmen ile çalışılması planlanmakta olup her branş için katılımcıların seçilmesinde aşağıdaki maddeler gözetilerek tabakalandırma yapılacaktır:

1. Mentörlük deneyim süresi
2. Öğretmenlik deneyim süreleri
3. Cinsiyet
4. Öğretmenin çalıştığı okul türü (özel lise, fen lisesi, anadolu lisesi, vb.)

Bu tabakalandırma maddeleri gözetilerek her branş içinde bir dağılım oluşturulacak ve içlerinden 9'ar kişi seçilecektir.

4

Figure E.4. Form 4

Araştırmada Kullanılacak Veri Toplama Araçları	**Veri Toplama** MöGP'in odağında etkili mentörlük uygulamalarının geliştirilmesi olması nedeni ile, o dönemde yapılan öğretmenlik uygulaması kapsamında MöGP'e katılan mentör öğretmenlerin ve onlarla çalışan öğretmen adayları ile üniversite süpervizörleri ile değerlendirme görüşmeleri çalışmaları yapılacaktır: Süpervizörler: Yarı yapılandırılmış bireysel görüşmeler ile süpervizörlerin MÖGP süresince mentör öğretmenlerin uygulamaları üzerine görüşleri ve deneyimleri incelenecektir. Görüşmelerde ETALEM'in alt boyutlarına üzerine sorular yöneltilecektir. ETALEM alt boyutları çalışmanın önceki aşamalarından oluşturulacağı için bu görüşme soruları daha sonra hazırlanacaktır. Öğretmen adayları: Yarı yapılandırılmış bireysel görüşmeler ile öğretmen adaylarının MÖGP süresince mentörlük uygulamaları üzerine deneyimleri incelenecektir. Görüşmelerde ETALEM'in alt boyutlarına üzerine sorular yöneltilecektir. ETALEM alt boyutları çalışmanın önceki aşamalarından oluşturulacağı için bu görüşme soruları daha sonra hazırlanacaktır. Mentör öğretmenler: • Çalışmanın model geliştirme aşamasında kullanılan nicel ölçekler (EK-2, EK-3, EK-4) kullanılarak mentör öğretmenlerin mentörlük motivasyonları, anlayışları ve uygulamaları incelenecektir. • Mentör öğretmenlerin uygulamalarındaki değişimi gözlemleyebilmek ve ETALEM'in alt boyutlarını işe koşup koşmadıklarını, işe koşulan alt boyutların nasıl gerçekleştiği incelenecektir. Bahsi geçen amaçlar doğrultusunda şu nitel veri toplama süreçlerine başvurulacaktır: a. Yarı-yapılandırılmış bireysel görüşmeler: katılımcıların MÖGP süresince mentörlük uygulamaları üzerine deneyimlerini incelemek amacı ile süreçte üç tane bireysel görüşme yapılacaktır - Açılış Çalıştayı, Ara Dönem Çalıştayı ve Kapanış Çalıştayı. b. Katılımcılardan aylık olarak mentörlük ettikleri öğretmen adayları ile yaptıkları, örnek çalışmalarını (ses veya görüntü kaydı alınarak) oluşturulacak uzaktan eğitim platformuna yüklemeleri istenecektir. Bu örnekler daha sonra ETALEM'in alt boyutları bağlamında incelenecektir. c. Katılımcıların haftalık mentörlük raporları doldurmaları istenecek, o hafta yapmış oldukları mentörlük uygulamalarını betimsel anlamda raporlamaları istenecektir. Bu raporlardaki deneyimleri de ETALEM'in alt boyutları bağlamında incelenecektir • Mentör öğretmenler ile yapılacak son değerlendirme etkinliği ise takip çalışması olacaktır. MÖGP'e katılan öğretmenler ile, program tamamlandıktan sonraki akademik dönem içerisinde, mentörlük uygulamaları üzerine yarı-yapılandırılmış bireysel görüşmeler yapılacaktır.
Kullanılacak biyolojik, eğitimsel, psikolojik, teknik vb. tüm yöntemleri açıklayan etik ile ilgili özet	Çalışma kapsamında ülkemizde kullanılmak üzere etkili mentörlük modeli gelişrtilmesi ve ardından bu modele uygun mesleki gelişim programı geliştirilerek uygulanması planlanmaktadır. Çalışma kapsamında kullanılacak nitel veri araçları araştırmacılar tarafından geliştirilecek olup, nicel veri araçlarından Türkçeye uyarlaması gerekenler de yürütücünün başka bir projesi kapsamında tamamlanmıştır. Çalışmada katılımcıların zarar görme riski yok denecek kadar azdır. Onlara verilecek Onam Formlarında da belirtileceği üzere çalışmadan herhangi bir aşamada çekilme hakları gizli olup, toplanan veri araştırmacılar tarafından güvenli şekilde muhafaza edilecektir. Çalışma sonucunda ortaya çıkacak sonuçlarda, akademik sunum veya yazılı ürünlerde kişilerin veya kurumların isimleri kullanılmayacak, kimliklerini açığa çıkaracak açıklamalardan kaçınılacaktır.

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Figure E.5. Form 5