

NEŞE VURAL

EFFECTIVE MENTORING FOR BIOLOGY TEACHING: INSIGHTS OF
MENTORS AND SUPERVISORS

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Effective Mentoring for Biology Teaching: Insights of Mentors and Supervisors

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July, 2023

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ABSTRACT**EFFECTIVE MENTORING FOR BIOLOGY TEACHING: INSIGHTS OF
MENTORS AND SUPERVISORS**

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MA in Curriculum and Instruction

Advisor: Asst. Prof. Dr. Armağan Ateşkan

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This study investigated the purposes, perspectives and practices of mentors in mentoring preservice teachers as well as the insights of supervisors regarding effective mentoring for biology teaching by attempting to determine their respective stances on the matter through a mixed method design. The purposes of mentors to work with preservice teachers and the mentoring practices that they found effective were explored through Mentoring Conceptions and Motivations Scale adopted by a research project (TÜBİTAK, 220K086) and follow-up semi-structured interviews with a subset of mentors. Furthermore, Area Specialized Effective Mentoring Opinion Form was used to reveal supervisors' opinions about effective mentoring for biology teaching. The result of the study showed that biology mentors hold developmental conceptions dominant to instrumental conceptions. In addition, it was found that payment and sense of belonging also play a role in motivating mentors to guide preservice teachers for biology teaching besides personal learning and generative outcome motives. Effective biology mentoring practices characterized under five themes by mentors: "Tripartite Cooperation (TRIAD)", "Area-specialized Teaching", "Teaching profession introduction practices", "Pedagogical Knowledge" and "Content Knowledge". Moreover, the analysis of supervisors' responses on effective mentoring in biology teaching yielded "Triad Cooperation in Teaching Practicum (TRIAD)", "Mentoring Practices in Teaching Practicum", and "The Characteristics of the Mentor" themes. This study provides valuable insights into the understanding of effective biology mentoring by shedding light on mentors' purposes, perspectives and practices as well as supervisors' opinions. Therefore, this research can contribute to the improvement of mentoring experiences for biology teaching and professional development of preservice teachers.

Keywords: effective mentoring, effective biology mentoring, teaching practicum, supervisor insights, mentoring motivations, aims of mentoring

ÖZET

Biyoloji Öğretiminde Etkili Mentörlük: Mentörlerin ve Uygulama

Akademisyenlerinin Görüşleri

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Eğitim Programları ve Öğretim Yüksek Lisans Programı

Danışman: Dr. Öğr. Üyesi Armağan Ateşkan

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Bu çalışmanın temel amacı mentörlerin amaç, motivasyon, etkili olarak değerlendirdikleri mentörlük uygulamalarını araştırmakla birlikte öğretmenlik uygulamasının bir diğer paydaşı olan uygulama akademisyenlerinin biyoloji öğretiminde etkili mentörlük üzerine görüşlerini incelemektir. Bu amaçla, karma bir yöntem tasarımı kullanılarak ilgili paydaşların biyoloji öğretiminde etkili mentörlük konusundaki duruşları belirlenmeye çalışılmıştır. Mentörlerin mentörlük yapma amaçları ve etkili olarak değerlendirdikleri mentörlük uygulamaları Mentörlük Anlayış ve Motivasyon Ölçeği kullanılarak incelenmiş ve bu amaçla bazı mentörlerle yarı yapılandırılmış görüşmeler yapılmıştır. Ayrıca, biyoloji öğretimi için etkili mentörlük hakkında uygulama akademisyenlerinin görüşlerini öğrenmek için Etkili Alan Eğitimi Mentörlüğü Görüş Formu kullanılmıştır. Çalışmanın sonuçları, biyoloji mentörlerinin gelişimsel mentörlük anlayışının daha baskın olduğunu göstermektedir. Ayrıca, mentörleri öğretmen adaylarına biyoloji öğretimi konusunda rehberlik etmeye motive eden faktörler arasında kişisel öğrenme ve üretken sonuç güdülerinin yanı sıra ödeme ve aidiyet hissinin de olduğu tespit edilmiştir. Mentörler tarafından belirlenen etkili biyoloji mentörlük uygulamaları "Üçlü İş birliği (TRIAD)", "Alana Özgü Öğretim", "Öğretmenlik Mesleğini Tanıtma Uygulamaları", "Pedagojik Bilgi" ve "Alan Bilgisi" temaları altında toplanmaktadır. Ayrıca, uygulama akademisyenlerinin biyoloji öğretiminde etkili mentörlük hakkındaki görüşlerine dayalı olarak yapılan analizler "Öğretmenlik Uygulamasında Üçlü İş birliği", "Öğretmenlik Uygulamasında Mentörlük Uygulamaları" ve "Mentörün Özellikleri" temalarını ortaya çıkarmıştır. Bu çalışma, mentörlerin amaçları, bakış açıları, uygulamaları ve uygulama akademisyenlerinin görüşleri üzerine değerli bilgiler sunarak etkili biyoloji mentörlüğünün anlaşılmasına katkı sağlamaktadır. Bu nedenle, bu araştırma, biyoloji öğretimi için mentörlük deneyimlerinin ve öğretmen adaylarının mesleki gelişiminin iyileştirilmesine katkıda bulunabilir.

Anahtar kelimeler: etkili mentörlük, biyoloji öğretiminde etkili mentörlük, öğretmenlik uygulaması, uygulama akademisyeni görüşleri, mentörlük motivasyonları, mentörlük amaçları

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CHAPTER 1: INTRODUCTION

Introduction

Training teachers effectively is one of the main concerns of the vast number of countries because of their undeniable impact on new generations, predicting the countries' future. Therefore, working with more experienced teachers, referred as mentors, is a part of teacher education programs worldwide (Ambrosetti & Dekkers, 2010; Anderson & Stillman, 2013; Musset, 2010; Veenman, 2016; Wideen et al., 1998). In spite of variations in the application of the mentoring process, teachers collaborate with mentors either during their preservice education, when they become practicing teachers, or even during a combination of both. Many researchers demonstrated that the effectiveness of mentoring predicts the success of new teachers in responding to their students' learning needs (Boyd et al., 2012; Rockoff et al., 2008). However, most professional development programs for mentor training are inadequate to prepare mentor teachers to work with preservice teachers (Dağ & Sari, 2017; Hawkey, 1997; Schatz-Oppenheimer, 2016; Wasonga et al., 2015). As teacher learning and adult learning are more prominent in mentoring, differing from the teaching profession, mentor education should be systematic and specific. Further research is needed to create effective mentor training programs to improve mentors' abilities, skills, attitudes, and guidance.

Background

Synthesizing theoretical knowledge with practice is critical for preservice teachers to meet students' learning needs effectively. Therefore, student teaching is

an integral part of teacher education and a condition for gaining a teaching license in many countries worldwide (Darling-Hammond et al., 2002; Lee et al., 2012; Musset, 2010). Through teaching practice in their preservice education, preservice teachers have opportunities to work with practicing teachers, usually referred as mentors, to guide them in their teaching. In the literature, teacher mentors are frequently attributed as experienced practicing teachers who help less experienced or preservice teachers in their professional development (Bigelow, 2002; Kiraz, 2003). Some researchers question this mentor definition in teaching as mentoring differs from the teaching profession in many ways since being a good teacher does not always guarantee being an effective mentor (Tillema et al., 2015).

Diverse descriptions for the roles and identities of mentors exist in the literature. While some researchers emphasize the significance of having a perspective of good teaching and comprehension of teacher learning as features of mentors, others attach different roles to mentors, such as supporter, parent figure, scaffolder, and counselor (Feiman-Nemser, 2001a; Hawkey, 1997; Levy-Feldman, 2018; Schwille, 2008). Beyond the roles and identities, mentors are important figures preparing, supporting, and contributing new teachers or preservice teachers to better adapt to student teaching with maximum efficiency to appeal to learning needs. Even though there is no consensus on the characteristics of a good mentor, studies showed that mentoring preservice or novice in-service teachers have many benefits to mentees, mentors, schools, and the education system when it is done properly (Bianchini et al., 2010; Moor et al., 2005; Yeomans & Sampson, 1994).

Some studies give weight to the willingness of mentees as a critical component for successful mentoring; however, the findings of many research demonstrated that appropriate mentor preparation and support provide a functional

background to employ effective strategies (Crasborn et al., 2008). Despite the essentiality of mentor training, many countries offer it as a professional development program lacking a functional structure and organization, failing to address essential skills mentor teachers should possess for effective communication and helping mentees (Huling-Austin, 1992; Meyer et al., 2013; Schatz-Oppenheimer, 2016). The ineffectiveness of mentor training might be associated with unintended outcomes in mentor-mentee relationships affecting preservice teachers' attitudes towards the teaching profession, even leading to the withdrawal of the profession. One study in Canada revealed that mentors generated a high level of anxiety in preservice teachers by being tough and giving too high workload (Beck & Kosnik, 2000). Maguire (2001) went further by demonstrating that a vast number of teacher trainees reported feeling bullied by their mentors.

Besides the psychological impacts, ineffective mentoring may also negatively influence student teaching as it can be caused due to the lack of discipline-specific pedagogical knowledge (Wang & Odell, 2002). Various strategies and instructional methods are applicable in teaching particular content areas, which their mentors should teach preservice teachers to expand their understanding. Many researchers demonstrated that using subject area-specific strategies by focusing on the content can be associated with positive outcomes for students and teachers (Boyd et al., 2012; Rockoff et al., 2008; Wechsler et al., 2012). However, most mentor training programs worldwide focus only on socio-emotional support and common pedagogical knowledge (Achinstein & Athanases, 2010; Schatz-Oppenheimer, 2016).

In the K-12 context, teachers aim to improve a deep scientific understanding among students, which can be supported by developing science-related pedagogical

knowledge thanks to effective mentoring (Abed & Abd-El-Khalick, 2015). Although it is known that the help of mentors regarding instructional planning, recognition of student difficulties, and addressing the content representation is beneficial for mentees to improve themselves better, little research exists revealing daily science mentor-mentee relationships and their influences (Driel et al., 2002). Secondary science teachers expect the development of scientific inquiry, which students should acquire and use to construct scientific knowledge. For supporting scientific inquiry in high school students, preservice teachers should be skillful in facilitating students' learning. It is found that the success of the improvement of scientific inquiry depends on two significant factors. One of them is students' ability to take ownership of learning, and the second is teachers' direction (Wee et al., 2004). Preservice teachers can gain the necessary skills and knowledge through content-specific mentoring.

Secondary science classes have great importance for students to adapt scientific understanding as many students suffer from misconceptions, leading to failures in the construction of knowledge. Therefore, efficient instructional and pedagogical strategies developed through more sophisticated pedagogical content knowledge (PCK) help students better by making them aware of misconceptions and replacing them with scientific conception. Most biology preservice teachers reported being hesitant due to the lack of content-specific strategies to teach biology and effectively manage practical sessions (Sugiharto & Duran Corebima, 2019). A study done by Barnett & Friedrichsen (2015) demonstrated that biology preservice teachers' topic-specific knowledge of instructional strategies could be enhanced if subject-specific mentoring practices are followed.

Problem

In Türkiye, teachers need to attend a professional development program developed by the Ministry of National Education (MoNE), lasting 40 hours to be mentors (Ministry of National Education Professional Development Support Group Presidency, 2023). As this mentoring program is not subject-specific and systematic, it may cause various problems in communication and transmission of experiences (Dağ & Sarı, 2017).

Teachers who completed this professional development program might not possess the required skills to guide preservice teachers regarding effective instructional and pedagogical strategies particular to subject areas (Bayar, 2014; Yılmaz & Bıkmaz, 2020). As a result of inadequate mentor training, both mentors and preservice teachers might encounter various issues such as not learning the area-specific teaching strategies they need, making them feel less competent when they start teaching, which also threatens school children (Renbarger & Davis, 2019).

Although mentor training programs aim to support preservice teachers in improving professional identities, they also need content area-related pedagogical strategies. Especially in biology, preservice teachers need to learn how to manage practical sessions such as lab experiments and assessment methods of practical work besides science instruction and pedagogy while working with mentors (Barnett & Friedrichsen, 2015). However, the current mentor training professional development program does not provide the necessary knowledge and skills specific to disciplines (Yılmaz & Bıkmaz, 2020). In order to respond to the learning needs of biology preservice teachers, mentor teachers need systematic and subject-specific training.

Purpose

This study attempts to explore biology mentors' perceptions of effective mentoring practices and purposes of mentoring. These mentors are practicing teachers in private and public schools placed in İstanbul, Ankara, and Trabzon. Through a questionnaire, biology teachers' insights regarding their experiences were revealed. Mentors also described their aims and motivations for working with preservice teachers. Some of the mentors were interviewed to understand their opinions, perceptions, experiences, and subject-specific pedagogical knowledge and strategies better.

Moreover, the current study also investigates the university supervisors' opinions regarding effective biology mentoring that supports the professional development of preservice teachers. These university supervisors are experienced in biology teaching and offer or previously offered biology teaching practicum courses in Türkiye and the UK. An open-ended questionnaire was applied to explore the views of university supervisors on the dynamics of effective mentoring.

Furthermore, both parties explained the ways to prepare biology teachers better to work with students in the first year of their profession. The result of the study revealed the learning needs of biology mentors, which might help the development of biology mentor training programs. A key outcome is to identify promising practices that teachers and university supervisors have found effective for their professional development and support preservice teachers that might be used while developing a professional development program for mentors.

Research Questions

The following research questions are the focus of this study's investigation:

1. What are the perceptions of biology mentors regarding the purpose of mentoring?
 - a. What are the aims of mentoring preservice teachers?
 - b. What are the motivations of mentors regarding working with preservice teachers?
2. What are the mentoring practices regarded as effective by biology mentors?
3. What are the insights of university supervisors regarding effective biology mentoring?

Significance

The current study's findings revealed the needs of biology mentors to guide preservice teachers effectively, which can be utilized to improve and restructure the professional development programs for mentors or create a more effective training program. Determination of facilitators and obstacles may provide feedback for stakeholders regarding how to enhance the mentoring process. In addition, practical subject-specific instructional and pedagogical knowledge were identified, contributing to preservice and practicing teachers' professional development. In addition, revealing the perspectives of mentors and university supervisors may help identify teacher mentoring dynamics. Moreover, when better-trained preservice teachers through content-specific, more influential mentoring become practicing teachers, students may benefit by experiencing more effective strategies for gaining a deeper understanding of biology.

Definition of Key Terms

Mentor: Experienced teachers guiding practicing novice or preservice teachers (Bigelow, 2002).

Motivation: Sets of reasons given by mentors engaged in mentor role (Van Ginkel et al., 2015).

University supervisor: Faculty members who are specialists in guiding preservice teachers during the teaching practicum by overseeing their progress and providing feedbacks (Steadman & Brown, 2011).

Preservice teacher: Teacher candidates who are the students of teacher education programs trained to become fully certified teachers (Cohen et al., 2013; Gay et al., 2003; Koehler, 1985).



CHAPTER 2: REVIEW OF RELATED LITERATURE

Introduction

This chapter includes a review of the literature regarding teacher education by emphasizing preservice teacher education and mentoring teachers. It also includes various aspects of mentoring, including its objectives, conceptions, motivations, and mentoring models like the Five-Factor Mentoring Model. Furthermore, it investigates effective mentoring practices, with a focus on their application in biology education.

Teacher Education

The changing needs of people as a result of new developments in technology, population growth, and the increase in competition on the global market triggered innovations in various fields including education. Since the 1980s, numerous countries made considerable structural changes in education and policy to cope with the challenges posed by the critical changes which have a global impact on citizens (Alexander & Bourke, 2021; Darling-Hammond, 2000; Zajda, 2016). In 1990, the Education for All policy introducing a universal commitment to quality basic education for children, young people, and adults has been launched at World Conference with the agreement of more than 150 governments (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2000). As teaching is accepted as the most contributing school-related factor for student success, teacher effectiveness reached the top of the education policy agendas (Organization for Economic Co-operation and Development [OECD], 2014). Since qualified teachers were regarded as a key to educational quality and reformation, the attention paid to teacher education has increased dramatically (Colby, 2000).

Although many countries acknowledge the value of raising qualified teachers, a controversy exists on who can be a teacher since lots of people believe that knowing the subject is enough to teach it well, as stated by Darling-Hammond (2000). However, numerous studies demonstrated that teachers who were involved in any preparation program such as certification and licensing have higher success in teaching and better with students than those who didn't get any preparation to teach (Ashton & Crocker, 1986; Evertson et al., 1985; Greenberg, 1983). Therefore, teacher preparation programs became a part of education policies, which are conceptualized as a system then, all around the world (Darling-Hammond, 1994; Day, 1999; Fullan & Hargreaves, 1992). These systems encompass the development and support of teachers as well as school leaders, the recruitment process enabling hiring qualified individuals to the profession, professional development, and retention besides teacher preparation and induction (Darling-Hammond, 2017). Two purposes of a meaningful teacher education program are to help preservice teachers to learn about teaching through an active construction process and gain a perspective that teaching is a complex profession involving various interconnected factors (Hoban, 2005).

Preservice Teacher Education

With the increasing need for qualified individuals joining into the profession, preservice teacher education also gained significant importance. For instance, in the US, many reform movements were held in the aforementioned area, resulting in four traditions defined by Liston and Zeichner (1991): an academic tradition, a social efficiency tradition, a developmentalist tradition, and a social reconstructionist tradition. Preservice teacher education programs involve general education, specialization in subject matter, and pedagogy components; however, the time and

credits devoted to each component may vary. When the history of preservice education in the US was examined closely, it is possible to the numerous types of preservice teacher education program formats such as 4-year programs, 5th-year graduate programs, 5-year integrated programs, and alternative programs, including teaching experience as an internship (Morey et al., 1997). The formats and focuses of preservice education programs were subject to change due to the varying purposes arising from the current needs. Despite the diversity across preservice teacher education programs all around the world, they are designed to prepare graduates to become high-quality teachers equipped with pedagogical knowledge and practices that meet the growing demands of the teaching profession (Singh, 2016).

In teacher education, "learning to teach" is the process where prospective teachers acquire necessary pedagogical theories, knowledge, and skills to become effective educators. It involves passing on professional skills, fostering theoretical learning, and supporting the study of child psychology and social issues to improve classroom content and instructional strategies. The main goal is to train instructors who can provide their students with equal educational opportunities and cultivate a positive learning environment (Grossman, 2010; Krichevsky, 2023). In her study, Darling-Hammond (2006) pointed out three main issues regarding learning to teach: Apprenticeship of observation, enactment, and complexity. The problem of apprenticeship of observation stems from the necessity of new teachers to understand the teaching in terms of ways different than their previous experiences as a student. Furthermore, new teachers not just need to think like a teacher but also need to act like one, which leads to the enactment problem. In addition, the complexity is another problem of learning to teach, requiring new teachers need to understand the nature of the classroom in terms of multidimensionality and density (Cohen et al.,

2013). In order to deal with these problems of teacher training, long-term teaching experience in partner schools called as teaching practicum was involved in preservice teacher education programs.

Cohen et al. (2013) conducted a literature review focusing on the studies published between 1996 and 2009 regarding the teaching practicum. The results of their study determined the “goals and rationales”, “activities and relation of participants”, and the “outcomes of the events in the practicum”. Learning the teaching profession deeply and supporting preservice teachers’ professional development in terms of knowledge, skills, and identity are the goals of the teaching practicum (Abbate-Vaughn, 2006; Blasi, 2002; Ma et al., 2008). Two rationales for teaching practicum, preservice teachers’ application of skills related to instruction into real classroom settings under supervision and filling the gap between theory and practice, were mentioned mostly. Preservice teachers, mentors, and supervisors, as participants of teaching practicum, have different roles in terms of activities. For instance, planning and teaching particular topics and reflecting on the aspects of teaching practicum made up the activities of preservice teachers, while mentors’ roles are usually nurturing preservice teachers’ development by observing, evaluating, and supporting them. Furthermore, the activities of supervisors were described as encouraging preservice teachers to reflect on their experiences by observing them and providing feedback. Moreover, the relationship between the three parties encountered challenges that stem from conflicts of interest, diverse perceptions of education, status, and intentions. Researchers also examined the outcomes of events in the practicum, and they determined two main classes. The first class of outcomes was related to self-confidence in teaching, perceptions, efficacy, and reflective abilities, whereas another class of outcomes was concerned with

preservice teachers' perceptions of their own teaching (Nevin et al., 2002; Vacc & Bright, 1999).

Preservice Teacher Education in Türkiye

The first Turkish teacher training institution is *Darulmuallimin* which has established in 1848 to train and prepare male teachers for successful teaching. After the Turkish Republic was established, Türkiye encountered contemporary demands that stem from the society's response to the changing political, social, and economic status. In order to reach the level of developed European countries, Türkiye emphasized education as a priority by facing reforms in education since then (Karagözoğlu, 1991; Mango, 2004; Sakaoğlu, 2003).

Although education is prioritized in Türkiye since the Turkish Republic was established in 1923, when an urgent need for teachers arose to enhance the educational level of the citizens, three main changes exist in teacher education in the Turkish context. In 1924, The Turkish educational system was centralized by the "Law of Unification of Instruction" putting all educational institutions under the MoNE's control (Government of Turkey, 1924). After that, two types of teacher education schools were designed: primary teacher schools for urban areas and village teacher schools for rural areas in 1926.

During the post-war period in Türkiye, learning about reading and writing was given top priority in school. The reason for this is that the most of the population lived in villages, and the literacy level was shallow among citizens. Primary Teacher Training Schools and Village Teacher Training Schools were established and begin to train teachers for primary education in accordance with the 1926 Law for Education Organization because of the increasing need for enhancement and reconstruction of education in the Turkish context (Karsli & Güven, 2011; Üstüner,

2004; Yüksel, 2010). "Village Institutes" were developed based on İsmail Hakkı Baltacıoğlu's "social school" idea and the practical requirements of the villagers (Baltacıoğlu, 1942). Village Teacher Training schools were subjected to debate frequently, especially during the period of transition to the multi-party era from the single-party era, which resulted in closing in 1933, reconstruction as institutes in 1940, and reclosing in 1954 permanently (Başgöz, 1995; Binbaşıoğlu, 1995; Gürşimşek et al., 1997; Yüksel, 2010). The beliefs of certain political groups regarding the necessity of teacher training to be only occurring in universities led to the placement of teacher training programs for all stages under the umbrella of the Faculty of Education in a four-year undergraduate program (Üstüner, 2004).

In the latter half of the 20th century, the "Basic Law for National Education," which required teachers to complete their education in post-secondary institutions, was employed. Teacher schools were reformed as higher teacher schools, and elementary education programs were transferred to two-year post-secondary institutions (Binbaşıoğlu, 1995; Gürşimşek et al., 1997). The first critical change held in 1981 transferred the responsibilities and activities of teacher training from the MoNE to the universities (Akyüz, 2004). In spite of these efforts, the Faculties of Education were not sufficient to solve the ongoing issues of teacher education due to the lack of collaboration with the MoNE and the Faculties of Arts and Sciences, the high number of compulsory courses with the inadequate number of electives and inconsistencies among programs training teachers (Council of Higher Education, 1998). To cope with these issues, the Faculties of Education were reconstructed through the Preservice Teacher Education Project with the partnership of the Council of Higher Education with the World Bank in 1994 (Grossman et al., 2007). In the scope of this project, a collaboration between Faculties of Education with teaching

practice schools and standardization between teacher training programs were secured. In addition, more teaching practice was also emphasized by increasing practice hours for preservice teachers, and master programs without a thesis for secondary school subject teaching were opened (Council of Higher Education, 1998). In 1997, teacher education programs and their curricula were restructured, and, in 2006, a revision of programs and curricula was made (Toy, 2015). After that, teacher certification, referred as pedagogical formation involving teaching practicum, was provided for graduates of related programs in 2009, and in 2014 giving teacher certificates to students beginning from their freshmen years with open and distance education led to new debates arising (Council of Higher Education, 2014). After that, the curricula of undergraduate teacher training programs were updated in 2018 to make them compatible with the international education norms and the changing learning needs of students with the developments in technology (Council of Higher Education, 2018). In 2020, pedagogical formation programs were closed. Then they were reopened in 2021 (Council of Higher Education, 2021).

Two routes to becoming a biology teacher exist in the Turkish context currently, which are graduating from a four-year undergraduate biology teaching program or getting a teaching certificate. The teaching practicum was involved in both routes to enhance the familiarity of preservice teachers with the requirements of the teaching profession. The two responsible partners, universities and practicum schools meet the particular learning needs of preservice teachers. While universities offer courses related to the subject area, teaching, and practicum with the monitoring of supervisors during the field experience, partner schools provide opportunities for preservice teachers to gain experience regarding teaching and the profession under the supervision of mentors.

Mentoring Teachers

The word “mentor” comes from a character mentioned in the *Odyssey* by Homer, who was asked to teach and advise the son of his friend (Garvey, 2018). The “mentor” referred to someone who is trustable, a guide, and an educator. The relationship between the “mentor” and mentee was idealized and similar to the relationship between a student and a teacher in the aforementioned book. There are many definitions of mentoring in the literature, all of which differ in terms of the role, purpose, and nature of the relationship of mentoring. However, in general, supporting less experienced or inexperienced practitioners by a more experienced practitioner to improve required skills and expertise by helping them become familiar with the culture of the profession is known as mentoring (Byars-Winston & Dahlberg, 2019). Some definitions refer to one-to-one settings (Hobson & Malderez, 2013), whereas others refer to group mentoring (Mitchell, 1999) or peer mentoring (Cornu, 2005).

School-based mentoring of teachers has become prominent in many areas of the world in the induction, preparation, and development of beginning teachers since the 1980s. For instance, the English national government mandated the spending of two-thirds of teacher education courses in practice schools where practicing teachers support and guide them to attain particular teaching competencies determined by the government (Department for Education and Skills, 2003). Subsequently, this initiative has been expanded in ways that include mentoring support as part of a broader program for the induction of newly qualified teachers (Department for Education and Skills, 2003). A number of reforms in various areas and the increase in economic competition worldwide triggered mentoring to become a part of teacher education.

The reasons why mentoring arrangements come to be common in teacher education can be categorized under three main reasons. One of the reasons is the intention to increase the supply of teachers in times of need with some certification programs (Feiman-Nemser, 1989), while another reason was related to the retention of teachers in the profession as they experience stress and difficulties due to the dissimilarity between their expectations of being a teacher and the reality (Gaede, 1978; Mintz et al., 2020). The third reason is related to policymakers' intention of using mentoring as a reward or retaining strategy for qualified teachers in the profession (Little, 1990).

Although mentors are seen as more experienced teachers in the education literature, various differences exist between the teaching profession and mentoring teachers. Smith (2015) describes mentoring as a “profession within a profession” by emphasizing the necessity of competencies to become mentors rather than teacher competencies. Therefore, being a good teacher doesn't always guarantee to become a good mentor supporting teacher candidates to learn to teach effectively as they did. Furthermore, one study from the Turkish context demonstrated that having an experienced teacher is not associated with being a competent mentor based on the teacher candidates' perceptions. According to the findings of the study, teacher candidates stated that younger or less experienced teachers showed better supervisory skills (Kiraz & Yıdırım, 2007).

Mentoring Preservice Teachers

Preservice teachers work with school-based mentors as a requirement of teaching practicum and as part of their placements in schools. Throughout their teaching practicum, they combine the components of instruction given in university courses and experiences they obtained in real classroom settings in terms of

pedagogy and subject-area-related teaching strategies. This school-based mentoring process makes significant contributions to their professional development (Zeichner, 2010). Therefore, the development of the relationship between the preservice teacher and the mentor can facilitate the preservice teacher's learning to teach, just like the enhancement of student engagement through a good relationship between a teacher and a student (Lejonberg et al., 2018; Pianta et al., 2012).

There is also evidence that the characteristics and approaches of mentors influence the development of preservice teachers' practices. For instance, in a quantitative study performed with 331 preservice teachers, the effect of a set of personal attributes that mentors possess to establish an effective relationship with preservice teachers was demonstrated by Hudson (2005). The interaction of mentors and preservice teachers is intended to be reciprocal and mutually beneficial in order to maintain the relationship, which happens only when they establish an effective mentoring relationship (Hogg & Vaughan, 2011). Increased confidence, self-reflection, professional development, improved teaching, and communication skills, having extra support in the classroom setting are some of the benefits of mentors, while preservice teachers found opportunities to be part of a real-life classroom setting by learning about students, getting familiar with school and education systems and culture of the profession (Hobson et al., 2009).

Mentoring has become associated with collaboration and interaction recently, as described by Heikkinen et al. (2012), by eliminating one-way guidance in which mentors have all the powers through a top-down process. In other words, mentoring involves discussions and dialogue in which mentors and preservice teachers exchange ideas reciprocally to construct knowledge through social interaction and collaboration (Burley & Pomphrey, 2011; Livingston & Shiach, 2010). The

aforementioned perspective regarding mentoring in education caused a shift in the orientation from traditional to reflective orientation through reciprocal relationship (Cornu, 2005; Keogh et al., 2006) even if the mentors in practice generally remain “directive” in terms of their approach stated by Mena et al. (2017).

Even though mentoring approach and relationship between the mentor and preservice teacher have a critical importance on effective mentoring, other elements exist contributing to the effective mentoring process. Collaboration between the practice schools and the university is one of the domains (Nguyen, 2017; Stenberg et al., 2016) for effective mentoring. Developing a disposition and professional knowledge in mentoring is another domain emphasized in the literature (Ambrosetti et al., 2014; Clarke et al., 2014; Izadinia, 2015b). Furthermore, modeling effective teaching by making connections between theory and practice was another critical element that contributes to effective mentoring (Izadinia, 2015b; Kindall et al., 2017; McGraw & Davis, 2017). Moreover, providing direction and support through a progressive mindset have also positive impact on supporting effective mentoring while working with preservice teachers.

Subject-Specific Mentoring

Knowledge of mentoring associated with its method and style was improved until lately (Edwards & Protheroe, 2004; Peterson et al., 1998; Reiman & Thies-Sprinthall, 1998; Rolph & Tomlinson, 1996). However, subject-specific mentoring became subject to investigation as some studies demonstrated that PCK and content area knowledge are critical for teacher training (Bradbury, 2010; Hudson, 2004a, 2004b, 2013; Rolph & Tomlinson, 1996; Stelter et al., 2020). One of the reasons for this is generic mentoring may limit preservice teachers’ experiences associated with particular teaching practices by focusing on the main elements of teaching rather

than the teaching content area (Hudson, 2004b). Another reason is that effective teachers usually integrate subject-specific literacy into their lessons to prevent their students from struggling to comprehend the content (Jamil et al., 2012).

Redmond (2015) focused on online mentoring for secondary school preservice teachers and demonstrated that discipline-specific mentoring resulted in acquiring enhanced knowledge of teaching their subject areas, increasing their access to resources and regulation expectations by bridging the gap between the university and workplace.

Furthermore, a study focusing on teachers' self-efficacy based on their mentoring experiences found that teachers were more likely to report high or moderate self-efficacy if their mentor, who can be considered as the expert on the content area, taught the same subject area (Feng et al., 2019). They also emphasized the differences among instructional practices, classroom management, and literacy. To exemplify, they mentioned the significance of necessary skills for modeling and scaffolding writing and reading practices for language teachers, whereas classroom management routines for laboratories and scaffolding for problem-solving for science teachers. To sum up, differing skills and knowledge exist in each area which subject teachers need to internalize by the guide of a capable mentor.

Mentoring Biology Preservice Teachers

Although some studies exist regarding the subject-specific mentoring focusing practices as mentioned above, the literature has a very limited number of studies focusing on biology preservice teachers in terms of their mentoring experiences during the teaching practicum. A case study conducted by Barnett and Friedrichsen (2015) focused on the relationship and work between a biology mentor and a biology preservice teacher by examining records of their daily meetings on the

“DNA/Protein Synthesis and Evolution” topic. The researchers reported that the mentor affected the teaching orientation of the preservice teacher by making comparisons between student-centered and teacher-centered approaches repeatedly. In addition, the mentor provided opportunities for the preservice teachers to reflect on his beliefs about student learning and the alignment of his instruction with his beliefs on learning. Furthermore, the mentor helped the preservice teacher to learn topic-specific knowledge by discussing common misconceptions analyzed through conversations with students and previous tests. Besides this, the mentor also helped the preservice teachers with the assessment of topic-specific knowledge by analyzing the previous exams critically in terms of their compatibility with the curriculum.

Moreover, another study performed with 60 biology preservice teachers demonstrated that implementing a mentoring model has a crucial impact on the development of pedagogical knowledge when compared to conventional models, especially for science teaching (Nopriyeni et al., 2019). They concluded that a systematic and effective mentoring model is required to support and enhance preservice teachers' pedagogical knowledge, which is knowing teacher competencies regarding the processes and practices to reach the overall educational objectives. Pedagogical knowledge involves knowing how learning occurs, instructional methods, the characteristics of students, assessment, and classroom management.

Roles of Mentors

Various roles devoted to mentors in education exist, and some of them will be mentioned in the current study. For instance, Maria-Monica and Alina (2011) compared the mentioned and desired mentor roles by investigating the literature and student-teachers' views. The researchers caught some roles associated with mentors in their review, such as “communicator”, “subject specialist”, “counselor”, “advisor”,

“broker”, “savvy” “insider”, “ally”, “guide”, “trainer”, and “model”. As teaching undergoes profound changes in today’s world, the role of mentors also changes regarding new needs and expectations. Student-teachers in the study identified six roles for mentors: “purveyor of information”, “behavior model”, “creator of learning situations”, “advisor and orientator”, “evaluator and therapist”, and “organizer and leader”. As a result, the researchers found a significant difference between desired and mentioned mentor roles.

Furthermore, a study conducted by Leshem (2014) investigated how mentors perceive their role through two questionnaires, including open-ended questions. Two groups of mentors, only one of which received professional training, were the participants who explained their views regarding their perception of mentoring. The study revealed four common themes: professional experience, interpersonal relationships, personality qualities, and role modeling. Despite the commonality of the two groups’ answers, there is a difference in their emphasis on those themes. While mentors who did not receive professional training associated being a good teacher with being a good mentor, the other group getting professional training recognized the complexity of mentoring by indicating that it should not be granted. In addition, the study revealed that low involvement in professional training might be linked with perceived uncertainty in their roles as mentors, causing problems during the mentoring process (Leshem, 2014).

A different kind of collaboration was examined between a first-year preservice teacher, a fourth-year preservice teacher, and a school-based mentor in Australia (Ambrosetti et al., 2017). Ambrosetti et al. (2017) found that the alternative mentoring triad supported preservice teachers in various ways, such as communicating in a common language with their peers, collaborating, and meeting

developmental needs. The reason for this is that even though the school-based mentor leads the process, the fourth-year preservice teacher became a mentor to the first-year preservice teacher.

Moreover, Kwan and Lopez-Real (2005) investigated mentors' perceived roles based on ten roles of mentors described in the literature. These roles are observer, provider of "feedback", "role model", "counselor", "critical friend", "instructor", "manager", "assessor", "quality controller", and "equal partner". Researchers asked mentors to rank their perception of the three most essential ones among those ten roles. Provider of feedback was chosen as the most crucial role for most mentors and secondary importance is mainly given to relational roles, such as "counselor", "critical friend", and "equal partner". Furthermore, mentors indicated a shift in their perceived mentor roles from a one-way process to a two-way process (Kwan & Lopez-Real, 2005).

Mentoring Models

Several mentoring models exist in the literature identifying the mentors' roles, responsibilities, supervisory behaviors, and relationships with mentees. Wang and Odell (2002) determined three mentoring models. Three fundamental classes of mentoring models are mentors' passing on knowledge to preservice teachers, bridging the gap between theory and practice by the mentor and teacher preparation program, and the collaboration of mentors and supervisors on mentoring preservice teachers based on a critical review of the literature.

MERID Model

Through a narrative literature review, Crasborn et al. (2008) constituted the Mentor (teacher) Roles in Dialogues (MERID) model by organizing mentors' behaviors under two dimensions: the amount of directiveness mentors demonstrated

and the degree of input by mentors. Four different mentors' roles emerged as a result of the combination of two dimensions: "initiator", "imperator", "advisor", and "encourager". The role of the initiator refers to the mentor who introduces topics and encourages a preservice teacher to think further regarding the topics. If a mentor makes direct interventions besides introducing topics, it indicates the role of the imperator. Mentors who do not introduce topics but give advice using directive skills can be associated with the role of "advisor" based on the MERID model. Nonetheless, mentors taking on an "encourager" role induce preservice teachers to reflect on their performances without introducing topics.

Mentoring Model for Inside and Outside Action

Another study revealed a conceptual framework regarding the forms of mentoring in two phases: inside and outside the action (Schwille, 2008). However, all forms of mentoring do not fall into one phase or another; rather, mentors suit their roles according to the preservice teachers' learning and situation. For example, a demonstration as a mentor role was observed both inside and outside the action. The roles that mentors present during the teaching are evaluated as inside the action, while other roles before and after teaching are regarded as outside the action. The research team associated coaching, stepping in, and teaching together with inside the action; they evaluated brief, informal conversation or mentoring on the move, mentoring sessions, debriefing sessions, co-planning sessions, videotape analysis, and writing as outside the action. Schwille (2008) suggested that good mentors can use this framework thoughtfully and purposefully to provide rich opportunities for prospective teachers through a more integrated practice, including inside and outside the action phases.

Strength-based Mentoring Model

As preservice teachers may encounter various challenges in their first year of teaching, mentors should offer strategies to improve their resilience and sustain their motivations (Hawkey, 2006; He, 2009). Considering that emotion is a crucial element in preparing preservice teachers better, He proposed a strength-based mentoring model. This model is quite different from the traditional apprenticeship model regarding mentors as guides, supporters, advisers, and preservice teachers as advice takers. He used the six-stage appreciative advising (AA) model as a framework existing of “disarm”, “discover”, “dream”, “design”, “deliver”, and “don’t settle” stages to propose the mentoring model for teacher education based on major positive psychology theories. The disarm stage enables the mentor and mentee to cultivate an open relationship by knowing each other as professionals and willing individuals. The mentor and the mentee identify their strengths at the “discover” stage. In the “dream” stage, the mentor and mentee set “we” goals having various focuses for the professional development of both parties, and they negotiate the best pathway to reach their goals in the design stage. Preservice teachers and their mentors can enhance their reflection on teaching, leading to the exploration of new ways, thanks to the delivery stage of the model. This collaborative partnership also requires them to challenge each other to promote their professional development, as described in the “don’t settle” stage.

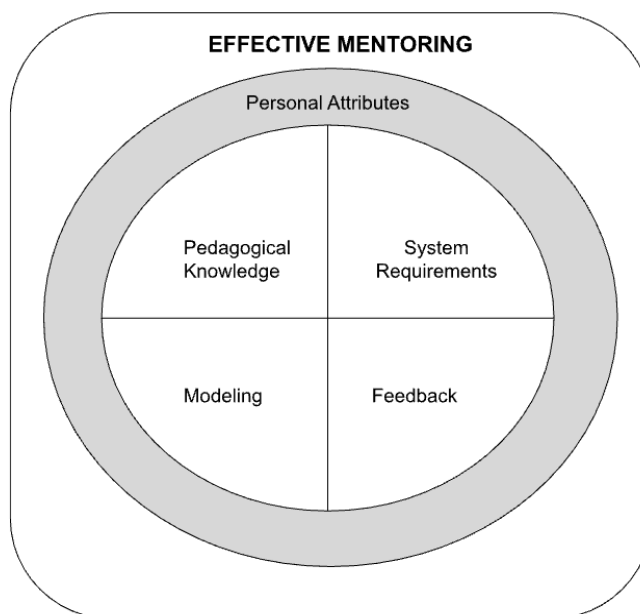
Mentoring Model for Professional and Institutional Growth

Moreover, Lofthouse (2018) suggested a complex and interrelated mentoring model for professional and institutional growth. When cultural conditions such as interpersonal and institutional conditions and personal attributes align, it is likely to enable and promote professional learning. Besides cooperation, creativity, and

authenticity, mentors should also provide opportunities for preservice teachers to try new ideas. As a result of co-review, they should be willing to expand their teaching repertoire (Lofthouse, 2018). This model includes various aspects such as the mentee's characteristics, the mentor's approach, the use of tools, and resulting behaviors working as an ecological cycle since the mentoring process is not linear but a chaotic cognitive journey.

Five-Factor Mentoring Model

Learning occurs most effectively when individuals construct meaning by using new skills and knowledge according to the constructivist theory (Bickhard, 1998), which also has the potential to be applied in mentoring context. For instance, complex and particular teaching knowledge can be built on the beginning knowledge of preservice teachers with the help of progressive mentors (Glaserfeld, 1998). Constructivism might be useful in improving particular mentoring roles, which contribute to preservice teachers' learning to teach. Therefore, Hudson and Skamp (2001) developed a mentoring model based on the constructivist theory called the "Five-Factor Mentoring Model", which emphasizes the pedagogical knowledge, system requirements, modeling, and feedback for effective mentoring concerning preservice science teacher education, as depicted in Figure 1.

Figure 1*Five-Factor Mentoring Model*

Note. Adapted from “Mentoring preservice teachers of primary science,” by P. Hudson and K. Skamp, *The Electronic Journal for Research in Science & Mathematics Education*, 7(1).

As shown in Figure 1, five components were found to affect the preservice teacher mentoring process in terms of effectiveness, which are explained below.

Personal Attributes. Mentors need to possess some personal attributes such as instilling positive attitudes, being supportive, assisting the preservice teacher in reflecting on their practices, and encouraging preservice teachers. Possessing and exhibiting such personal attributes have the best potential to facilitate preservice teachers’ learning to teach as learning is a social process (Wenger-Trayner & Wenger-Trayner, 2014). Mentors need the abovementioned personal attributes to manage the mentoring process effectively. Otherwise, preservice teachers’ confidence to teach may be diminished.

System Requirements. The requirements obligated by curriculum exist in all subject areas for most countries, so related policies to implement system

requirements should be known by teachers. Mentors need to address system requirements in their work with preservice teachers for them to understand and plan their teaching by acknowledging curricula and implementing system requirements for quality educational practices.

Pedagogical Knowledge. Mentors' pedagogical knowledge has a critical importance in affecting preservice teachers' development as they need to learn how to prepare a lesson and deliver instruction. To facilitate preservice teachers' learning to teach, mentors should have the necessary pedagogical knowledge and PCK.. Preservice teachers may learn classroom management strategies, time allocation based on subject implementation, questioning, and problem-solving skills through mentors' support in pedagogical knowledge. Furthermore, mentors should also discuss content-specific teaching strategies and content knowledge to enhance preservice teachers' PCK.

Modeling. Mentors can be considered as experts who model effective teaching practices according to the definition of Barab and Hay (2001). Because of the considerable impact of modeling on preservice teachers' learning, mentors should model different aspects of teaching, such as planning, preparation, implementation of the lesson, and assessment of students' learning. In addition, they also need to model subject-specific instruction consistent with the educational system requirements by showing enthusiasm towards the teaching profession. Such a mentoring practice may help preservice teachers to understand effective teaching practices and construct knowledge and skills accordingly.

Feedback. Providing meaningful feedback is essential for learning, as this helps learners to understand their practices' strong aspects and aspects needing improvement. Therefore, mentors should provide constructive feedback for

preservice teachers, which contributes to preservice teachers' self-confidence. Furthermore, mentors should also inform preservice teachers regarding how to evaluate a teaching practice so that preservice teachers might be able to evaluate their practices.

Challenges and Facilitators of Teacher Mentoring

Many mentors reported challenges while working with preservice teachers during teaching practicum (Hoben, 2021). The study revealed that mentors were frustrated about the absence of time as they had too limited time to allow preservice teachers to teach and complete mentoring requirements. Another challenge was uncertainty about the aspects of mentoring, making mentors less effective in their mentoring dialogue due to the lack of information regarding the expectations. Mentors also mentioned constraints beyond their ability to control, including internal and external factors such as the timing of the practicum and lack of administrative support. Furthermore, the perceived shortcomings of preservice teachers and emotional load are identified as other challenges during mentoring.

Another study revealed that building and sustaining a range of relationships is challenging for many mentors (Gardiner & Weisling, 2018). Since mentoring involves dynamic communication with administrators, colleagues, students, and other mentors besides preservice teachers, mentors are expected to manage those relationships effectively. Another challenge identified by mentors was applying what they have learned during professional training successfully and effectively.

When it comes to what facilitates mentoring, some studies investigated the efforts supporting mentoring practices. The researchers investigated the views of mentors to identify what they perceive as necessary for effective mentoring through teacher involvement/support, staff development, administrative support, and resource

materials domains (Barrera et al., 2010). Almost all mentors agreed that a professional development program with well-defined objectives might help mentors work with novice teachers. Half of the mentors mentioned educational skills to work with students who have special needs, which can be achieved through focused professional development programs. In addition, working with novice teachers who completed all the requirements for a teaching certificate might be helpful. Apart from this, a supportive relationship with the administrator can make mentors' jobs easier.

Furthermore, Gardiner (2010) observed and conducted in-depth interviews with mentors to illuminate their insights regarding their expectations to be better mentors. The study revealed that mentors need support and feedback for effective mentoring practices. Most of them indicated the importance of knowing their strong and weak points as mentors to develop themselves better (Gardiner, 2009).

Mentoring Conceptions

The conceptions of mentoring are subject to investigation as it is assumed that mentoring practices are determined based on how mentoring is conceived (Franke & Dahlgren, 1996). Previous studies identified four fundamental perspectives, which are a humanistic, situated apprentice, and critical constructive perspectives shaping the relationship between mentor and novice teachers in preservice and induction programs. In other words, mentors' conceptions regarding mentoring affected their approach to novice teachers, their perceived roles, and practices. The humanistic perspective emphasized the enhancement of learners' self-confidence through a counseling-like mentoring process (Gold et al., 1989). Mentors' aim is to help to teach candidates to cope with reality shock and stress during their induction process of transition to the teaching profession based on a humanistic perspective (Enz & Cook, 1992). However, the goals of mentors are to provide instrumental support for

novice teachers to gain relevant knowledge skills required for teaching and becoming a part of the teaching community through apprenticeships based on the situated apprenticeships perspective (Dewey, 1964; Kennedy, 1997).

On the other hand, critical constructive perspectives rely on two theories regarding how learning happens. The first theory explains learning as a continuous deconstruction and reconstruction process (Noffke, 1997), while the second implies that learners actively build knowledge through an assimilation and accommodation process based on their initial conceptions (Von Glasersfel, 2013). The goals of mentors who hold critical constructive perspectives are inquiring current structure, knowledge, teaching, and schooling culture by acting like a change of agents to improve new ideas regarding teaching (Feiman-Nemser & Parker, 1993; Goswami & Stillman, 1987; Howey, 1988).

Conceptions of science teacher mentoring were investigated through a qualitative study by Koballa et al. (2008) as a result of interviews with 12 teachers, 6 of which are beginning teachers and 6 of them are mentors. The findings of the study demonstrated the existence of three classes of conceptions which are apprenticeship, personal support, and co-learning. In addition, the researchers found that both groups of teachers hold apprenticeship conceptions dominantly among other conceptions. Furthermore, mentoring can also be assumed as a process of socialization and induction, as teachers are encouraged to adopt the culture and norms of teaching through inducting into the school system (Rippon & Martin, 2006).

Moreover, Ginkel et al. (2015) defined mentoring conceptions as “an internally coherent set of beliefs about the goals, sources, and nature of mentored learning to teach” in a quantitative study. They claimed that mentoring conceptions involve conceptions of teaching from their schooling experiences as pupils, guiding

experiences as mentors, and teaching experiences from their student teaching as teachers (Hall & Davis, 1995; Koerner et al., 2002). Previous studies demonstrated the existence of two fundamental mentoring conceptions: developmental conception and instrumental conception (Franke & Dahlgren, 1996; Orland-Barak & Klein, 2005). The instrumental conception is similar to a teacher-centered/content-oriented approach, while the developmental conception matches a student-centered/learning-oriented approach. Mentors holding instrumental conceptions dominantly regard effective teaching practice (Orland-Barak & Klein, 2005), by helping novice teachers to gain control over classrooms (Rikard & Veal, 1996). Therefore, the main goal of mentors is to facilitate novice teachers to manage students' behaviors as soon as possible by regarding themselves as "maestros" (Graham, 2006), resulting in an asymmetrical relationship with novice teachers.

On the other hand, mentors holding instrumental conception dominantly mainly concerned about the learning of teacher candidates and professional development (Orland-Barak & Klein, 2005) by providing opportunities for them to empathize with pupils during the learning process and reflect on their experiences (Feiman-Nemser, 2001b). They also try to introduce various perspectives on teaching, encouraging them to build their personal theories of teaching (Graham, 2006) by seeing themselves as creative partners in cooperation in teaching (Franke & Dahlgren, 1996), resulting in a more symmetrical and reciprocal relationship with novice teachers (Hall & Davis, 1995). Moreover, Ginkel et al. (2015) also found a strong correlation between personal learning motive and developmental conception ($r = .50, p < .01$), which was statistically significant.

Mentoring Motivations

The reasons why mentors want to work with preservice teachers during their practicum and remain as mentors are one of the most important factors that impact the quality of mentoring and preservice teachers' practicum experiences. Despite of its significance, the knowledge regarding mentoring motivations is limited due to the inadequacy of studies in this area. Although limited, previous studies introduced some motives such as intrinsic, extrinsic, and altruistic motivations as related to becoming a teacher (Watt et al., 2012) as well as serving as a mentor.

A recent study demonstrated that mentors have high intrinsic motivation as they regard the mentoring process as a mutual learning opportunity that can be supported by a school environment where preservice teachers are welcomed and their work is appreciated (Kuhn et al., 2022). According to this study, a combination of expectancy, value beliefs, and of teachers, including intrinsic and extrinsic personal utility values, competence beliefs, and social utility values, affect them to become mentors. Another study conducted in Israel indicated that both intrinsic factors, like increasing their self-confidence and having opportunities to learn new ways of thinking, and extrinsic factors, such as developing their own school and altruistic desire to help somebody contribute to teachers' decision to become mentors. (Iancu-Haddad & Oplatka, 2011).

Palmer (2018) determined some motives that mentors hosting music preservice teachers held by performing a qualitative study. In spite of the high load of cocurricular and extracurricular activities of being a music teacher, some of the teachers also served as mentors who work with music preservice teachers during their teaching practicum. The results of the study showed that "helping the teaching profession", "experiencing positive mentoring as a preservice teacher and returning it

back”, “the desire to share their expertise”, “learn themselves”, and “having an opportunity to reflect on their own practices” are some of the motivators encouraging music teachers to serve as mentors. In addition, they also mentioned the benefit of the existence of two teachers (one of them is a mentor, and the preservice teacher is another) for the students’ learning. Furthermore, they also stated that discussing the curriculum and content with preservice teachers also helps them to understand better.

Allen et al. (1997) suggested that two groups of motivations which are self-focused and other-focused exist in mentoring preservice teachers. Desiring to help others by transmitting knowledge and contributing to the building of competent teachers are some of the other-focused motivations while self-focused motivations involved the desire to enhance learning and enjoy. In addition, the obligation to contribute to the profession was the dominant motive for mentors, and they also regard the opportunity to evaluate their own practice based on a study (Stout, 1982).

One of the studies conducted with 726 secondary education mentors demonstrated that mentoring motivations could be classified under two main categories, which are generative outcome motive and personal learning motive (Ginkel et al., 2015). Generative outcome motive can be defined as *‘to invest one’s substance in forms of life and work that will outlive the self’*, and it also includes the transmission of the culture and traditions to the next generations (Kotre, 1995). However, personal learning motives are self-focused and highlight personal development through self-reflection (Lopez-Real & Kwan, 2005).

The mentors who have personal developmental motives to serve as mentors perceive mentoring as a more reciprocal relationship that they can develop themselves through the process with a focus on self. However, mentors with

generative outcome motives have concerns about transmitting the knowledge and experience to the next generations with other-focused approaches. Therefore, generative outcome motives may lead to perceiving mentoring as a single-sided process that only they can pass related knowledge. Ginkel et al. (2016) developed a scale to measure the motivations and conceptions of mentors. They used this scale to determine which motivation and conception factor were held dominantly by mentors, which found that generative outcome motives are more common among Dutch mentors based on this quantitative study.

The Roles of Supervisors in Teaching Practicum

Preservice teachers act more independently in teaching practicum under the guidance of a school-based mentor and a supervisor from universities (Graham & Thornley, 2000). As a third party of a teaching practicum, supervisors usually serve as quality assurers and university representatives to ensure that the requirements of preservice teachers' practicum experience have been completed appropriately by evaluating the effectiveness (Barahona, 2019). In other words, university supervisors guide the mentors' ways of mentoring preservice teachers in terms of alignment with the outlined obligations so that it responds to the learning needs of preservice teachers by eliminating their concerns (Richards & Brumfield, 2010; Siebert et al., 2006). This study also revealed that the practices of supervision by academic staff should enhance the learning of teachers for the benefit of pupils in terms of achieving better outcomes rather than assessing teachers' competencies.

Through a systematic literature review, Cohen et al. (2013) explored the activities of three participants who are preservice teachers, mentors, and supervisors. 31 activities are found related to supervisors' activities, most of which are carried with preservice teachers, such as getting to know the school and themselves by

acknowledging their skills, knowledge, and feelings. In addition, encouraging the collaboration between mentors and preservice teachers and guiding preservice teachers with mentors are two classes of supervisors' work based on the study.

In a teaching practicum setting, schools are territories of mentors who have the authority, while supervisors and preservice teachers are only short-time visitors. Therefore, preservice teachers experience difficulties regarding time, authority, and establishing their own space to act independently (Slick, 1998). The differences between the three actors in terms of backgrounds, teaching philosophies, expectations, and statutes cause some problems, such as superficial supervisory meetings, lack of effective collaboration, and limited guidance, influencing preservice teachers' development negatively (Lunenberg, 2007; Siebert et al., 2006).

Even though some teacher educators disagreed with the value of supervisors, recent studies emphasized that university supervisors are valuable and necessary participants in the teaching practicum for preparing teachers better (Gimbert & Nolan, 2003). The results of a more recent study by Burns et al. (2016) indicated changes in supervising preservice teachers and supervisors' roles because of the increase in importance given to the teaching practicum. They identified five tasks for the roles of supervisors, involving "targeted assistance", "collaboration and community", "individual support", "curriculum support" and "research and innovation" in order to respond to the changing needs of preservice teachers better (Burns et al., 2016).

CHAPTER 3: METHOD

Introduction

This chapter presents information regarding the methodology of the current study. After the research design was introduced, context, participants, and data collection were described. Finally, data analysis was explained in detail.

Research Design

This study had a mixed-method research design using qualitative data as a primary data set. Mixed-method research design, which is the reconciliation of qualitative and quantitative approaches, has become more common in social sciences (Tashakkori & Teddlie, 2010). The qualitative approach is interpretive and ethnographic based on detailed observations and explanations, while the quantitative approach is empirical; both have their strengths and weaknesses (Ochieng, 2009). The quantitative approach allows more extensive groups of participants with quicker administration and evaluation. However, it may lack human beliefs and perceptions making the results superficial by missing experience description (Choy, 2014). On the other hand, the qualitative approach is good at managing and simplifying data by probing underlying reasons such as values, beliefs, and perceptions. Yet, the qualitative approach may be time-consuming and impossible to extend to larger populations with the same degree of certainty. Therefore, the qualitative and quantitative approaches can be incorporated, which is called a mixed-method approach to overcome the limitations of both methods (Alkan et al., 2019; Creswell, 1999; Creswell & Garrett, 2008). In other words, the mixed-method study design is performed when either qualitative or quantitative approaches are not enough to respond to the research questions and complete the story.

The embedded design is a type of mixed-method research where one data set plays a secondary role in supporting the study's primary data set (Creswell, 2003). Researchers use embedded design when they need to include quantitative data in a predominantly qualitative study or vice versa to answer the research question comprehensively (Ivankova et al., 2006). In this study, a mixed-method embedded design is utilized to identify biology mentors' and university supervisors' insights and practices (Creswell, 2012). These insights include mentors' preconceived ideas about the teaching profession, guiding preservice teachers, transferring the subject area knowledge, and supervisors' expectations from mentors to prepare preservice teachers more effectively. There are three research questions to investigate biology mentoring based on mentors' and supervisors' views:

1. What are the perceptions of biology mentors regarding the purpose of mentoring?
 - a. What are the aims of mentoring preservice teachers?
 - b. What are the motivations of mentors regarding working with preservice teachers?
2. What are the mentoring practices regarded as effective by biology mentors?
3. What are the insights of university supervisors regarding effective biology mentoring?

Although the qualitative data is the primary data set, it needs a quantitative data set to illuminate aims and motivations of mentors based on their perceptions when the research questions are considered. The quantitative strand consists of mentors' responses to Likert-type questions related to their purposes of mentoring while working with preservice biology teachers. Moreover, the qualitative strand

includes semi-structured interviews with some mentors who completed surveys and open-ended questions in questionnaires responded by mentors. Furthermore, supervisors' responses to what effective mentoring looks like also contribute to the study's qualitative strand. The qualitative and quantitative data were analyzed separately, and quantitative data were used to refine the qualitative data in the study. Qualitative and quantitative data are incorporated for triangulation purposes to make a more comprehensive interpretation and create an in-depth picture of research questions (Denzin, 2012; Nightingale, 2009). Thus, the embedded research design is found appropriate for this particular research.

Context

The challenges new teachers face in their first years of teaching are assumed due to the lack of connection between professional experience and teacher preparation (Achinstein & Barrett, 2004; Feiman-Nemser, 2001a; Stokking et al., 2010). Thus, the teaching practicum has given critical importance to overcome transition difficulties. Teaching practicum as a part of teacher education programs provides various opportunities for preservice teachers to put their theoretical knowledge into practice by integrating many aspects of teaching at schools by working with mentors (Çakmak & Gündüz, 2018; Lawson et al., 2015). School-based teacher mentors and university-based teacher educators support preservice teachers to cope with the challenges they can encounter while teaching at schools.

In Türkiye, preservice teachers attend classes at partner schools through the partnership of the Faculty of Education and the school (Teacher Practicum Guideline by MoNE, 2021). The teaching practicum lasts two semesters, requiring preservice teachers to attend six hours a week at the partner school for twelve weeks each semester. Within the scope of teaching practicum, preservice teachers observe

classes, acquire knowledge regarding all the aspects of the teaching profession and teach for at least 20 hours each semester for the courses offered more than two hours weekly. Preservice teachers are assigned to mentors in partner schools and work with their mentors throughout the process. Mentors who are experienced at teaching in preservice teachers' subject area guide preservice teachers during teaching practicum in close cooperation with supervisors (Council of Higher Education, 2005). In addition, mentors participate in mentor training seminars organized by MoNE to learn about the teaching practicum process.

Moreover, preservice teachers must attend teaching practicum courses given by their supervisors throughout the teaching practicum. The teaching practicum course provides opportunities for preservice teachers to reflect on their experiences at partner schools and develop their teaching skills through microteaching sessions and teaching activities (Council of Higher Education, 2005). Supervisors who offer teaching practicum courses inform preservice teachers regarding the partner school and introduce preservice teachers to the school coordinator and mentors. They also ensure that preservice teachers implement the necessities of teaching practicum. To evaluate the progress of preservice teachers, supervisors, and mentors by taking necessary measures to enhance the development of preservice teachers.

The context for mentors is public and private high schools in Türkiye, located in İstanbul, Ankara, and Trabzon, accepting preservice teachers for teaching practicum. Those mentors work in Anatolian high schools, science high schools, and Anatolian Religious High Schools, applying different curricula based on school types. Although biology course is offered in all three types of school, the weekly allocated time for a biology course differs. Furthermore, students' achievement levels in those schools are different as they are accepted to high schools based on their

results of a high-stakes exam. The mentors working in public high schools teach approximately 25 hours, while mentors working in private high schools usually teach more than 25 hours weekly. Moreover, mentors also have other responsibilities besides teaching, such as participating in parents' meetings, directing students' clubs, and duties in extra-curricular activities such as tutoring students who are willing to participate in the science olympics. All mentors working with preservice teachers have loaded schedules working with preservice teachers.

Furthermore, the context for supervisors is universities, including supervisors who offer/were offering preservice teachers practicum courses from Türkiye and the UK. While the university where two supervisors work in the UK offers postgraduate programs, supervisors from Türkiye work in universities offering both undergraduate studies and postgraduate programs for teaching certification. Furthermore, all universities where supervisors work strongly collaborate with high schools to enable preservice teachers to gain authentic experiences and increase their familiarity with the profession.

Participants

The target population for the mentor study consists of biology mentors working in private and public high schools in İstanbul, Ankara, and Trabzon. These three cities were chosen by convenience sampling. Convenience sampling is a sampling technique in which the researcher chooses a group of individuals who are available to participate (Fraenkel & Wallen, 1993). After contacting public and private schools in those three cities and delivering the survey, 17 biology mentors participated in the study. Table 1 demonstrates the characteristics of survey participants based on their cities.

Table 1*Survey Participants for Mentoring Conceptions and Motivations Scale*

Mentoring Experience (in years)	Mentors	Gender		School Type		City		
		Male	Female	Public	Private	Ankara	Istanbul	Trabzon
1-5	M ₁ , M ₂ , M ₃ , M ₄ , M ₅ , M ₁₂ , M ₁₃ , M ₁₄ , M ₁₇	3	6	7	2	4	3	2
6-10	M ₆ , M ₇ , M ₈ , M ₉	4	0	1	3	4	0	0
10-15	M ₁₀ , M ₁₁ , M ₁₅ , M ₁₆	2	2	2	2	2	1	1

As shown in Table 1, 12 (71%) participants are female and five (29%) participants are male. Seven (41%) participants work in private schools and 10 (59%) work in public schools, making the sample less biased in terms of school type. However, there is quite a difference in the number of mentors participating in this study in terms of the cities where they live. While Ankara has the largest number of participants, fewer biology mentors participated from Trabzon. Eight participants who are biology mentors from private and high schools in three cities are planned to be interviewed, and their characteristics are described in Table 2 below. Each mentor is assigned the letter “M”, as a short version of mentor, and a number to protect their personal data.

Table 2*Interview Participants*

Mentor	Gender	Age	Teaching Experience	Mentoring Experience	School Type	City
M ₁	Female	35	14	1	Public	Ankara

Mentor	Gender	Age	Teaching Experience	Mentoring Experience	School Type	City
M ₄	Female	41	18	3	Private	İstanbul
M ₈	Female	34	9	7	Private	Ankara
M ₁₁	Female	47	26	>10	Public	Trabzon
M ₁₀	Female	49	26	15	Private	Ankara
M ₁₃	Male	43	21	4	Public	Trabzon
M ₁₄	Male	35	11	5	Public	İstanbul
M ₁₅	Male	45	23	13	Private	Ankara

Table 2 demonstrates the characteristics of the mentors who are the participants of interviews including their genders, ages, teaching, and mentoring experiences, cities, and school types. Although mentor 11 met the requirement for the follow-up interview, she did not respond to the invitation despite three reminders. Therefore, the interviews were done with the remaining seven mentors. Furthermore, Table 3 demonstrates the characteristics of supervisors participating in the study. The letter “S” as a short version of supervisor and a number were used to entitle supervisors to keep their personal information confidential.

Table 3

Area Specialized Effective Mentoring Opinion Form Participants

Supervisor	Gender	Title	Specialization	University
S ₁	Female	Professor	Biology Teaching	Trabzon University

Supervisor	Gender	Title	Specialization	University
S ₂	Female	Professor	Science Teaching	Ağrı İbrahim Çeçen University
S ₃	Female	Professor	Biology Teaching	Bilkent University (Nottingham University)
S ₄	Female	Professor	Biology Teaching	Middle East Technical University
S ₅	Female	Professor	Biology Teaching	Western University
S ₆	Female	Professor	Biology Teaching	Gazi University
S ₇	Female	Associate Professor	Biology Teaching	Çanakkale Onsekiz Mart University

Table 3 shows the characteristics of supervisors who are native and foreign professors or associate professors who offer/were offering practicum courses for preservice biology teachers and working at public and private non-profit universities. Thus, they have experience in biology teaching and opinions regarding effective biology mentoring. Likewise, the mentor participants were chosen by convenience sampling. There are seven participants for supervisors; all of them are female and working in Türkiye or the UK. Six of them specialized in biology teaching, while one specialized in science teaching.

Instrumentation

In line with the purpose of the research, data were collected to reveal the insights of mentors and supervisors. To obtain multifaceted information to address the research questions, this study used three different instruments, including qualitative and quantitative parts:

- Mentoring Conceptions and Motivations Scale
- Semi-structured interviews
- Area Specialized Effective Mentoring Opinion Form

Mentoring Conceptions and Motivations Scale

Mentoring Conceptions and Motivations Scale (Appendix A), which was adapted by a science research project team and translated into Turkish in 2020 (BAP, BU-BAP-15961) consists of two separate questionnaires which are, *mentoring conception scale* and *mentoring motivation scale*. This scale also includes a demographic information part consisting of ten open-ended questions and two open-ended questions to have a deeper understanding of where mentors stand in terms of effective mentoring. All sections of the survey contain several questions to inquire about their conceptions and motivations regarding mentoring. Cronbach alpha level of each section was checked to ensure internal consistency by performing item reliability analysis shown in Table 4.

Table 4

Cronbach's Alpha Coefficients of Items

Sections of the Survey	Number of Items	Cronbach's Alpha
Mentoring Conception Scale	18	.89

Sections of the Survey	Number of Items	Cronbach's Alpha
Mentoring Motivation Scale	19	.95

Cronbach's alpha coefficients of sections of the survey are .89 and .95 based on the answers of seventeen participants as shown in Table 4. Cronbach's alpha coefficient higher than .70 is ideally acceptable while it indicates moderate reliability if it is between .50 and .75 (George & Mallery, 2003). Therefore, the reliability of the instruments can be considered as excellent.

Mentoring Conception Scale

Mentoring Conception Scale was developed by Ginkel et al. (2016) to understand perceptions of mentors and where they stand in terms of mentoring. It consists of three parts which are mentoring goals and intentions, beliefs on the teaching of teachers, and beliefs on sources of learning to teach. This scale was adapted by a science research project team and translated into Turkish in 2020 (BAP, BU-BAP-15961). This study uses only mentoring goals and intentions part including 18 Likert type questions of this scale.

Mentoring Motivation Scale

Ginkel et al. (2016) developed Mentoring motivation scale to investigate what are the motivations that mentors hold to carry out mentoring. This scale was adapted to Turkish within the scope of a research project in 2020 (BAP, BU-BAP-15961). In addition, this scale consists of 19 Likert type questions.

Semi-Structured Interviews

Semi-structured interviews were performed with seven mentors after completing the survey to understand their perspectives better. Participants' ages, cities, genders, the type of school they worked in, mentoring, and teaching

experiences are the criteria for interviewing participants to obtain a less biased and more representative sample to get richer data as possible. Semi-structured interviews are one of the unstructured qualitative research interview methods which do not have predetermined sets of questions (Bettez, 2014). Therefore, these interviews enable researchers to explore the details of the responses from the participants' perspective (Brown & Danaher, 2019; Gill et al., 2008). In addition, researchers use some key questions in order to define the areas of research. Semi-structured interviews of this study included three key questions that direct mentors to talk about their experiences. Furthermore, mentors were asked to share practices that they regard as an example of effective biology mentoring, they have performed in previous years. In light of this question, their definition of effective biology mentoring was determined. Moreover, what motivates them to carry out mentoring was also inquired to identify the motivations behind mentoring. The responses of mentors in semi-structured interviews expanded and contributed to specify their responses on Mentoring Conceptions and Motivations Scale to obtain more specific insights.

Area Specialized Effective Mentoring Opinion Form

Furthermore, the form to learn supervisors' opinions was developed by the experts working on a research project, consisting of demographic information and views on area specialized effective mentoring (TÜBİTAK, 220K086). The demographic information part contains six questions. On the other hand, the survey includes nine open-ended questions regarding supervisors' insights on effective mentoring and expectations from mentors to prepare preservice teachers better in the scope of practicum. Furthermore, supervisors' opinions on mentors' personal and occupational characteristics were explored, which can contribute to mentor choice in future teaching practicums. Moreover, mentoring practices regarding feedback,

system requirements, modeling, and pedagogical knowledge were other aspects explored through Area Specialized Mentoring Opinion Form (Appendix B).

Data Collection

Research instruments were finalized at the end of January 2021, and ethical permission was secured by Trabzon University in February 2021. After that, MoNE permission (Appendix C) was secured in March 2021. Afterward, high schools are informed about the study by sending a letter of invitation and an informed consent form (Appendix D) in October 2021. Then, high schools are contacted via telephone, and contact information of volunteer biology mentors is learned to share the Mentoring Conceptions and Motivations Scale, which was administered via google forms. Mentors were given three weeks to complete the survey, and after three weeks, the first reminder was given, and one week later, they took the second reminder. The data was collected from mentors between October 2021 and January 2022. After participants sent their responses to the Mentoring Conceptions and Motivations Scale, they were assigned by numbers to keep their personal information confidential.

Furthermore, interview participants from the respondents were determined based on criteria. After that, semi-structured interviews with selected participants were planned and conducted over three-week period between July and February 2022. These interviews were carried out via Zoom meetings which were videotaped and transcribed.

Moreover, the Area Specialized Effective Mentoring Opinion Form consisting of open-ended questions, was sent to supervisors via email as a word document in January 2022. They are given one month to complete so that supervisors that are experts in the biology teaching area can give more comprehensive answers

based on their professional knowledge and experiences. After one month, supervisors were given a reminder to deliver their responses for the Area Specialized Effective Mentoring Opinion Form. After that they delivered their responses on February 2022.

Data Analysis

The data were analyzed separately, and different methods were utilized for the analysis of qualitative and quantitative data. The source of quantitative data Mentoring Conceptions and Motivations Scale. Statistical Package for Social Sciences (SPSS, v.24.0) was used to conduct a descriptive and inferential analysis of the data. Mentoring conceptions and mentoring motivations parts contain 18 and 19 items respectively, rated by using a seven-point Likert scale.

Reliability analysis of the Mentoring Conceptions and Motivations Scale was carried out by calculating Cronbach's alpha coefficients for each section separately. The results of item reliability analysis showed that each section of the instrument has an excellent reliability. Confirmatory factor analysis was performed in order to check the construct validity of the Mentoring Conceptions and Motivations Scale. In addition, content validity was also ensured by taking feedback on clarity, relevance, and representativeness from 7 experts who are specialists in teaching subject areas such as mathematics, physics, chemistry and biology. The instrument was revised and refined based on the expert review in the scope of a research project (TÜBİTAK, 220K086). Furthermore, descriptive analysis of responses to the Mentoring Conceptions and Motivations Scale was done by using descriptive procedures of SPSS. For this reason, mean, standard deviation, variance, range, minimum maximum, standard error, and skewness were computed. Moreover, Wilcoxon signed-rank test was performed to evaluate whether or not there is a statistically

significant difference among conception and motivation factors. The Wilcoxon signed-rank test is a non-parametric statistical test which is used to compare dependent data or when the data doesn't have a normal distribution (Rey & Neuhäuser, 2011; Rosner et al., 2006). It calculates the signed-rank sum by using ranked differences between paired variables. It is an alternative to the t-test for such cases and is useful for studies where assumptions for parametric tests aren't met (TaHERi & Hesamian, 2013; Woolson, 2008).

The qualitative data was obtained from the responses to the open-ended question of the Mentoring Conceptions and Motivations Scale, semi-structured interviews, and Area Specialized Effective Mentoring Opinion Form. Inductive and deductive data analysis approaches are two main methods for qualitative data analysis that can be conducted in various ways (Burnard et al., 2008). The deductive approach utilizes predetermined frameworks and themes while coding the data (E. Brown et al., 2006; Love et al., 2022). On the other hand, inductive approaches use data itself to form a structure by using little or no predetermined theory (Azungah, 2018; Braun & Clarke, 2006; Miles & Huberman, 1994). This research uses inductive approaches of qualitative analysis due to the lack of the framework specialized to mentoring biology preservice teachers.

Inductive approaches were carried out for the participants' responses on semi-structured interviews and the open-ended question placed in the Mentoring Conceptions and Motivations Scale. Their responses were transcribed and translated from Turkish to English. The letters assigned to each participant were kept the same while coding the data. Content analysis is a commonly used and flexible method to make meaning out of written, verbal, or visual data by using qualitative and quantitative ways with inductive or deductive approaches (Forman & Damschroder,

2007; Mayring, 2015; Stemler, 2019). The content analysis consists of three main phases, which are preparation, organization, and reporting phases (Guthrie et al., 2004). For the preparation phase, the unit of data analysis was chosen, and all transcripts were read several times. After that, open coding was carried out and open codes were grouped under some categories. Then these categories were grouped under higher-order headings and a general description was formulated to define the categories which are called abstraction (Burnard, 1996; Polit & Beck, 2004).

Analysis of Area Specialized Effective Mentoring Opinion Form used content analysis by following the preparation, organization, and reporting phases. For that reason, the responses of supervisors were read carefully for several times and then some themes were identified. After that those themes were grouped under broader headings and abstraction was completed. After the data were analyzed, the responses of mentors and supervisors were compared to investigate whether or not their perspectives aligned.

In order to assure the reliability and validity of the data analysis, inter-rater consistency was achieved. Inter-rater reliability is a statistical value measuring the extent of agreement between raters (Armstrong et al., 2016; Fink, 2010; Wright & Craig, 2011). Data obtained through open-ended questions of the Mentoring Conceptions and Motivations Scale was sent to a researcher working on the same research project and asked to analyze in two weeks. Then she analyzed 10% data, and her analysis was compared to the analysis of this study's researcher. The inter-rater reliability of the coding was .92, implying high level of agreement between the researchers (Miles & Huberman, 1994).

CHAPTER 4: RESULTS

Introduction

This chapter presents the study's findings deduced by using qualitative and quantitative research methods to explore mentors' perceptions, practices, and supervisors' opinions regarding effective biology mentoring. The results were analyzed based on the research questions of the current study.

Findings of the Study

Biology Mentors' Perceptions Regarding the Purpose of Mentoring

Perceptions of biology mentors regarding the purpose of mentoring are explored by investigating the aims and motivations for mentoring preservice teachers. While quantitative data collected through Mentoring Conceptions and Motivations Scale was analyzed to uncover both sub-questions, qualitative data obtained through semi-structured interviews were analyzed to determine the motivations of mentors.

The Aims for Mentoring

The questions on the mentoring conception section of Mentoring Conceptions and Motivations Scale were used to explore biology mentors' perceptions about the aims of mentoring. The mentoring conception section consists of 18 items, nine related to the developmental conception factor and nine related to the instrumental conception factor. Mentors' responses on a seven-point Likert scale were analyzed, and descriptive statistics were calculated based on conception factors. Table 5 demonstrates the descriptive statistics of conceptions factors.

Table 5*The Descriptive Statistics of Conception Factors*

Conception Factors	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Developmental Conception	6.13	1.01	5.41	6.59
Instrumental Conception	5.99	1.35	4.88	6.47

Mean scores of developmental and instrumental conception factors out of seven were calculated and given in Table 5. Mentors have developmental conceptions ($M=6.13$, $SD= 1.01$), slightly higher than instrumental conceptions ($M=5.99$, $SD=1.35$) based on descriptive analysis. However, a Wilcoxon signed-rank test revealed that biology mentors' developmental conceptions are not significantly higher than their instrumental conceptions ($Md=6$, $N=17$, $SD=0.74$), $p=.572$.

When items are examined in detail, minimum and maximum mean scores of developmental conceptions items ($Min=5.41$, $Max=6.59$) were higher than instrumental conception scores ($Min=4.88$, $Max=6.47$). Furthermore, mentors' conception scores for each conception factor based on their mentoring experiences are depicted in Table 6.

Table 6*The Descriptive Statistics of Developmental Conception Items*

Item	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
D6	5.41	1.28	2	7
D5	5.65	1.46	1	7
D7	5.76	1.35	2	7

Item	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
D9	6.29	1.05	3	7
D2	6.29	0.69	5	7
D4	6.35	0.49	6	7
D1	6.41	0.51	6	7
D3	6.41	0.51	6	7
D8	6.59	0.62	5	7

Table 6 shows the mean, standard deviation, minimum and maximum values of items related to developmental conception regarding the aims of mentoring. The means of developmental conception items vary between 5.41 and 6.59 out of 7. D6, which is “providing opportunities for preservice teachers to choose a few minutes of the lesson to discuss the lesson” had the lowest mean ($M=5.41$, $SD=1.28$). However, D8, which is “making preservice teachers feel that they are part of the profession” had the highest mean ($M=6.59$, $SD=0.62$) according to the score given by mentors. Furthermore, when the minimum and the maximum values given to these items were examined, the lowest minimum score was assigned to the D5, which is “trying to encourage preservice teachers to discuss with others regarding the different views on teaching”, implying at least one mentor strongly disagrees with this developmental conception item. However, D1, D3, and D4 had the highest minimum scores, which is 6 out of 7. These items are “providing opportunities for preservice teachers to discover the principles behind a good lesson”, “helping preservice teachers discover what kind of teacher they want to become”, and “making preservice teachers see

their lessons from the students' points of view" respectively. In other words, these items had a high level of acceptance among mentors, and all mentors agreed or strongly agreed with these items. Table 7 shows the descriptive statistics of instrumental conception items.

Table 7

The Descriptive Statistics of Instrumental Conception Items

Item	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
I6	4.88	2.15	1	7
I7	5.18	1,85	1	7
I2	6	1,27	3	7
I3	6.12	0,86	4	7
I4	6.18	1,19	3	7
I5	6.24	0,97	4	7
I1	6.35	0,79	4	7
I8	6.47	0,72	5	7
I9	6.47	0,87	4	7

The mean, standard deviation, minimum and maximum values of items related to instrumental conception regarding the aims of mentoring were given in Table 7. The means of instrumental conception items vary between 4.88 and 6.47 out of 7. I6 which is "getting preservice teachers to use a particular lesson structure" had the lowest mean ($M=4.88$, $SD=2.15$) with the highest standard deviation. However,

I9, which is talking to preservice teachers and evaluating their teaching based on lesson observation, had the highest mean ($M=6.47$, $SD=0.87$) according to the score given by mentors. In addition, I6 and I7, which attach importance to the determination of the process of the course by preservice teachers rather than the students, had the lowest minimum score, which is 1 out of 7, implying at least one mentor strongly disagrees with these instrumental conception items. However, I8, “reviewing the lesson from beginning to end while evaluating preservice teachers’ teaching”, had the highest minimum scores of 5 out of 7, implying that these items had a high level of acceptance among mentors.

The Motivations for Mentoring

The current study investigated the reasons for encouraging mentors to guide preservice teachers throughout the teaching practicum. Therefore, the motivations of participants for mentoring are explored through 19 Likert-type items of Mentoring Motivations part of the Mentoring Conceptions And Motivations Scale and semi-structured interviews. Mentors responded to 11 items related to generative outcome motive and eight items related to personal learning motive using a seven-point Likert scale. Furthermore, when semi-structured interviews were analyzed to find out the motivations behind mentoring, mentors’ responses were also found to be compatible with the personal learning motive and generative outcome motive except for two motives stated by mentors which are the payment and sense of belonging.

Table 8

The Descriptive Statistics of Motivation Factors

Motivation Factors	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Personal Learning Motive	5.79	1.23	4.94	6.24
Generative Outcome Motive	5.84	1.22	4.94	6.29

Mean scores of personal learning and generative outcome motivation factors out of seven were calculated and given in Table 8. Mentors have generative outcome motives ($M=5.84$, $SD=1.22$), slightly higher than personal learning motives ($M=5.79$, $SD=1.23$). Furthermore, a Wilcoxon signed-rank test also revealed that generative outcome motives of biology mentors are significantly higher than personal learning motives of biology mentors ($Md=6$, $N=17$, $SD=0.87$), $p<.001$.

When items are examined in detail, minimum mean scores of personal and generative outcome motive items are equal. However, the maximum mean scores of the generative outcome motive ($Max=6.29$) are slightly higher than the personal learning motive's maximum mean score ($Max=6.24$). Furthermore, Figure 2 demonstrates the mentoring motives described by mentors during the semi-structured interviews. However, the difference between personal learning motive and generative outcome motive was evaluated through Wilcoxon signed-rank test, it was seen that this difference is not statistically significant ($p=.658$).

Figure 2

Mentoring Motives Described by Mentors during Semi-Structured Interview

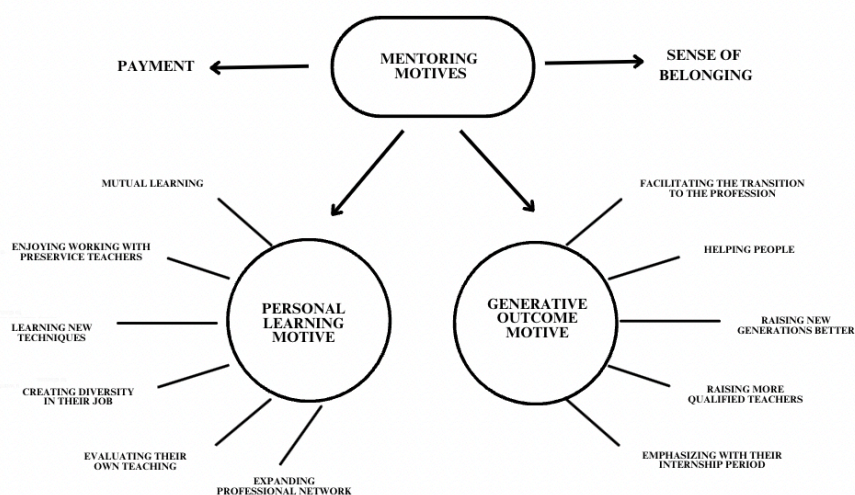


Figure 2 shows the mentoring motives under two categories which are personal learning and generative outcome motives. The examples provided by mentors were categorized under these categories as depicted in the figure. Mutual learning, enjoying working with preservice teachers, learning new techniques, evaluating their own teaching, and expanding their professional network are the themes related to the personal learning motive factor. In addition, mentors mentioned about facilitating the transition to the profession, helping people, raising new generations better, and emphasizing with their internship period, which are related to the generative outcome motive factor.

Personal Learning Motive. Qualitative and quantitative data were used together to determine mentors' personal learning motives. For the quantitative data strand, mentors' scores on personal learning motives are calculated through their responses on a seven-point Likert scale to eight related items. On the other hand, mentors' responses to why they practice mentoring on semi-structured interviews were analyzed to get a deeper insight regarding their personal learning motives. Table 9 shows the descriptive statistics of personal learning items based on mentors' responses.

Table 9

The Descriptive Statistics of Personal Learning Motive Items

Item	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
PL1	4.94	1.75	2	7
PL2	5	1.62	2	7
PL7	5.94	1.09	4	7

Item	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
PL8	5.94	0.90	5	7
PL3	6	0.87	4	7
PL4	6.12	0.86	4	7
PL6	6.12	1.05	4	7
PL5	6.24	0.67	5	7

Table 9 demonstrates the mean, standard deviation, minimum and maximum values of items related to personal learning motives. The means of personal learning motive items vary between 4.94 and 6.24 out of 7. PL1, which is “being informed about the current developments in the field” had the lowest mean with the highest standard deviation ($M=4.94$, $SD=1.75$), while PL5 which is “allowing to look critically at their own teaching performance” had the highest mean ($M=6.24$, $SD=0.67$) with the lowest standard deviation according to the score given by mentors. Furthermore, when the minimum and the maximum values given to the items are examined, the lowest minimum score was assigned to the PL1, implying at least one mentor disagrees with this personal motivation item. However, PL5 had the highest minimum score, which is 5 out of 7, implying that PL5 had a high level of acceptance among mentors and all mentors partially or strongly agree with this item.

They reported during the semi-structured interviews that learning mutually, enjoying working with preservice teachers, learning new techniques that students enjoy, creating diversity in their job, having opportunities to evaluate their own

teaching, developing new ideas for effective teaching, and expanding their professional network by maintaining communication as a colleague motivates them to be mentors. One of the mentors mentioned mutual learning by stating:

M₈: We learn together with preservice teachers. We can feed off each other in many different ways. Because biology is a very broad field, everyone's areas of expertise can be very different. Frankly, I see it as an opportunity. When I start to work with a preservice teacher, I think about what I will learn from this preservice teacher. I look at it this way, frankly, both ways. I think there is a good two-way motivation, an opportunity to learn new things.

Two mentors indicate that they personally enjoy practicing mentoring. While one of them asserts that he learns new teaching strategies that students enjoy, the other mentor remarks that working with preservice teachers provides diversity in his work. Furthermore, one of the mentors explained that she was able to evaluate her own teaching and think about the effective ways of teaching, these mentors explained their motivations by stating:

M₁₃: Mentoring is fun, we are enjoying it. We learn various techniques from preservice teachers and new techniques enjoyed by students.

M₁₅: Learning new things from preservice teachers, it also provides a diversity of tasks in my work. I enjoy working and sharing with preservice teachers.

M₁₀: I am able to evaluate my own teaching thanks to the preservice teacher and I develop ideas about how teaching should be done.

As it can be observed from mentors' explanations in the semi-structured interviews and responses to the motivation items in the questionnaire, some mentors hold personal learning motives dominantly to perform mentoring which is mostly related to personal development. These mentors regard mentoring as an opportunity

to improve themselves by learning new approaches, collaborating, and creating together. Furthermore, some mentors also perceive mentoring as an opportunity to reflect on their own teaching practice and find new ways to develop.

Generative Outcome Motive. In order to determine mentors' generative outcome motives, two data sources which are qualitative data through semi-structured interviews and quantitative data obtained through mentors' responses on generative outcome motive items were evaluated together. For the quantitative data strand, mentors' scores on generative outcome motives were calculated through their responses on a seven-point Likert scale to eleven related items. Table 10 shows the descriptive statistics of generative outcome motive items based on mentors' responses.

Table 10

The Descriptive Statistics of General Outcome Motive Items

Item	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
GL1	4.94	1.56	2	7
GL9	5.12	1.45	2	7
GL10	5.47	1.50	2	7
GL2	5.83	1.29	2	7
GL7	5.94	1.03	4	7
GL11	5.94	1.09	4	7
GL3	6.06	0.90	4	7
GL4	6.18	0.88	4	7

Item	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
GL8	6.12	0.93	4	7
GL5	6.29	1.10	3	7
GL6	6.29	0.85	5	7

The descriptives of mentors' responses to generative outcome motives items on a seven-point scale was depicted in Table 10. The means of generative outcome motive items vary between 4.94 and 6.29 out of 7. According to the table, GL1 which is "making sure that the subject area is taught by a well-trained teacher" had the lowest mean score ($M=4.94$, $SD=1.56$) with the highest standard deviation. However, GL6 which is the "teaching practicum is the best place to learn to teach" had the highest mean score ($M=6.29$, $SD=0.85$) with the lowest standard deviation. Minimum scores were given to GL1, GL2, GL9, and GL10 are equal, which is 2 out of seven, implying at least one mentor disagrees with these items. GL2 remarks on the need for new people in education in the future, GL9 is preventing newcomers from quitting the profession, and GL10 is giving preservice teachers a chance to prove themselves. On the other hand, GL6 has the highest minimum score, which is 5, implying all mentors at least partially agree with this item.

Moreover, some mentors elaborated on what motivates them to be a mentor during the semi-structured interviews. Some of the reasons they explained in the semi-structured interviews were related to generative outcome motives. Facilitating the transition of preservice teachers to the profession, helping people, raising new generations in a better way, raising more qualified teachers, emphasizing with their internship period, and helping preservice teachers accordingly are the generative

outcome motives to practice mentoring that mentors mentioned during the semi-structured interviews. For instance, one of the mentors, M₁ stated her motivation by saying “*To transmit my experiences to preservice teachers*” while others remarked that they experienced the same process with preservice teachers and wanted to help to raise new generations better by stating:

M₁: My aim is to guide preservice teachers, facilitate the job of teacher candidates, developing better teachers, being able to help people and supporting preservice teachers.

M₈: Empathizing and remembering my teaching practicum are my motivations. Helping someone makes me so happy and I am willing to teach preservice teachers something as they will raise the next generations.

M₁₁: I was not well guided when I was a teacher candidate, and I want to help preservice teachers as much as I can.

Based on mentors’ responses obtained through the questionnaire and the semi-structured interview, generative outcome motive was another type of motivation that some mentors hold for performing mentoring. The examples related to generative outcome motives were other-focused rather than self-focused. This type of motive involves transmitting the knowledge and traditions to the next generations and serving others by investing their sources to the works outlasting them, as exemplified by some mentors above.

The Mentoring Practices Regarded as Effective by Biology Mentors

The current study explores effective mentoring practices by examining mentors’ insights on semi-structured interviews and their responses to an open-ended question on the questionnaire. The qualitative data obtained through semi-structured

interviews and the open-ended question in the questionnaire were evaluated together to explore the mentoring practices regarded as effective by mentors.

Mentors summarized one of their experiences that they regard as an effective mentoring example for the open-ended question in the questionnaire as well as they explained their insights on which practices and aspects are critical for effective mentoring beyond their experiences and current practices during the semi-structured interviews. Because of the lack of a theoretical framework for effective mentoring in biology education, semi-structured interviews and an open-ended question were analyzed, and five main themes emerged as shown in Figure 3.

Figure 3

Emerging Themes for Effective Mentoring

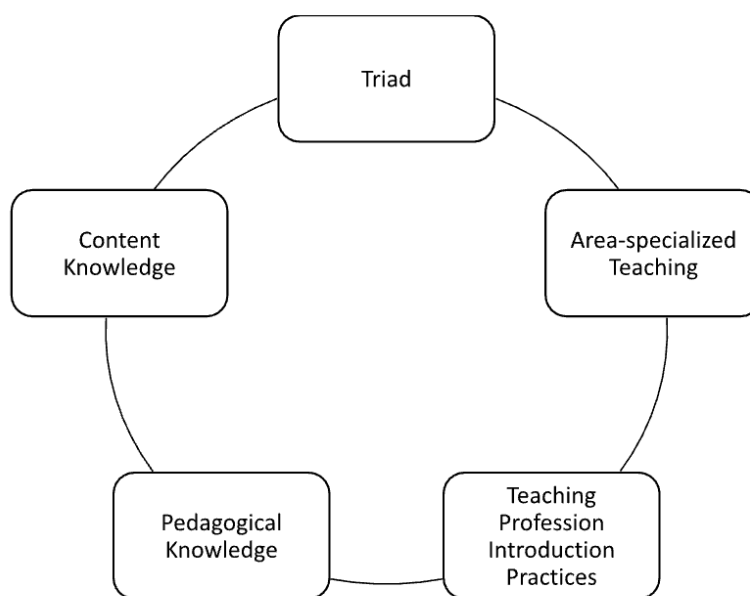


Figure 3 depicts five emerging themes: Tripartite Cooperation (TRIAD), Area-specialized Teaching, Teaching profession introduction practices, Pedagogical Knowledge, and Content Knowledge. Open codes obtained from mentors' responses are categorized under these five themes shown in the figure. Furthermore, Table 11

shows the frequency and percentage of open codes obtained through semi-structured interviews underlying each theme.

Table 11

Mentors' Insights on Effective Mentoring

Themes	<i>f</i>	%
Tripartite Cooperation (TRIAD)	132	49.81%
Area-specialized Teaching	77	29.06%
Teaching profession introduction practices	25	9.43%
Pedagogical Knowledge	25	9.43%
Content Knowledge	6	2.26%

As shown in Table 11, the percentages of open codes vary between 2.26% (Content Knowledge) and 49.81% (TRIAD). The “Area-specialized Teaching” theme had 29.06% of open codes while “teaching profession introduction practices” and “Pedagogical Knowledge” had the same proportions as 9.43 % each. Mentors’ responses had the least emphasis on “Content Knowledge” whereas emphasizing “TRIAD” the most while mentioning their mentoring practices and their conception of effective mentoring.

In order to understand mentors’ insights better, an open-ended question asking mentors’ examples of effective mentoring in the Mentoring Conceptions And Motivations Scale was also utilized. Moreover, mentors’ responses to the open-ended question are analyzed based on emerging themes. The distribution of responses based on emerging themes is given in Table 12.

Table 12*Mentors' Responses for Effective Mentoring coded with Emerging Themes*

Themes	<i>f</i>	%
Area-specialized Teaching	6	35.29%
Tripartite Cooperation (TRIAD)	5	29.41%
Pedagogical Knowledge	4	23.53%
Teaching profession introduction practices	2	11.77%
Content Knowledge	0	0%

Table 12 demonstrates the distribution of open codes obtained through the open-ended question asking mentors' examples of effective mentoring in the Mentoring Conceptions and Motivations Scale based on the themes emerged as a result of analysis of interviews. The response rate for this question was 47.06 % ($N=17$). Mentors' examples include open codes related to area-specialized teaching, TRIAD, pedagogical knowledge, teaching profession introduction practices themes. However, there is no open code related to content knowledge for effective mentoring. First of all, area-specialized teaching theme has the highest frequency (35.29%), while only a few mentors (11.77%) gave examples related to teaching profession introduction practices. TRIAD and pedagogical knowledge themes also have high frequencies 29.41% and 23.53%, respectively.

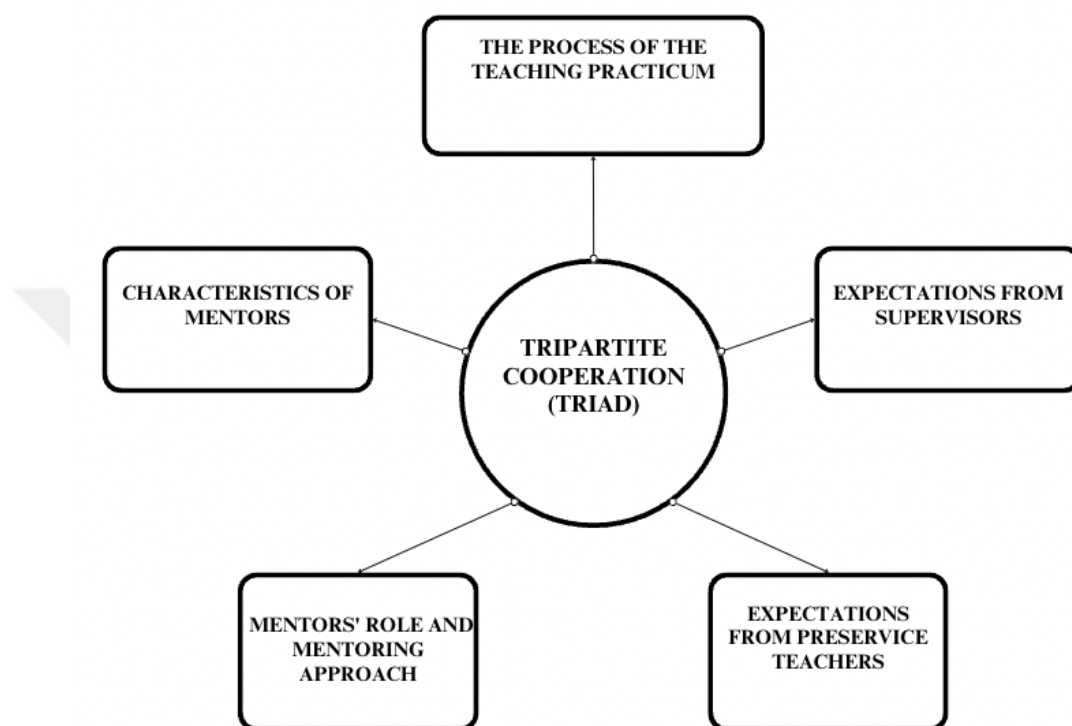
Tripartite Cooperation (TRIAD)

Tripartite Cooperation (TRIAD) describes the cooperation between three parties of teaching practicum as follows: the preservice teacher, the mentor, and the supervisor. In the current study, the TRIAD theme includes mentors' views on the process of the teaching practicum and the mentors' role and mentoring approach, characteristics of mentors, their expectations from supervisors and preservice

teachers as depicted in Figure 4. It was the most emphasized theme by mentors regarding effective mentoring (49.81%).

Figure 4

Sub-themes Described by Mentors for Tripartite Cooperation (TRIAD)



Mentors mentioned the periods of observation, participation, and practices for preservice teachers that they worked together while describing the process of teaching practicum. In addition, they stated various opinions regarding the mentoring roles and approaches such as approaching as a guide, a brother/sister, a teacher, and a colleague. They also exemplified how their approach affected preservice teachers in terms of their attitudes and actions such as improving a positive attitude and being more confident regarding teaching.

Furthermore, being open to communication, sincere, supportive, helpful, and effective in communication as personal attributes, and being open to feedback, accessible, flexible, open to collaboration, and willing to share experiences as

professional characteristics were reported by mentors as the characteristics that every mentor possesses. Apart from this, mentors also expressed their opinions regarding their expectations from preservice teachers such as having a good knowledge of biology, being competent in performing experiments, being open to feedback, and being eager to learn. Moreover, providing information regarding the preservice teacher's knowledge and performance in the areas that need to improve and maintaining communication were the expectations of mentors from the university supervisors during the teaching practicum. Mentors also emphasized the significance of cooperation between the university, the mentor, and the preservice teacher for the effective teaching practicum process by mentioning the consistent and well communication between the supervisor and the mentor besides the participation of the supervisor in the preservice teachers' teaching practice. And one of the mentors stated her opinion regarding this issue:

M₈: So, I think the communication of stakeholders is also very important. For example, the university-mentor relationship, that is, what the university expects from us, must be very clear...You know, I think the university should definitely offer us a very clear guide on us mentors, they should be in constant communication with us about their expectations. The aim is if we are raising a teacher, we are doing it together. I think the most important thing is communication, communication with the university. Then, the mentor's communication with the preservice teacher, because sometimes the preservice teacher has difficulties in communicating with us regarding whether or not s/he really want to be a teacher. These parts are a bit ambiguous sometimes at that point. I think these three stakeholders should be in very clear communication with each other.

For instance, one of the interviewers described the teaching practicum process and stated:

M₁: They came for about 12 weeks, they were supposed to attend the class for 72 hours, 6 hours each. There was an observation period in the first 8 weeks of this... In the seventh week of this observation period, that is, the week before it ended, we asked her to prepare a 40-minute lesson plan in accordance with what she observed. According to this lesson plan, we wanted a 40-minute lecture. In fact, their supervisors also observed their teaching.

As it was observed in interviews, mentors have various opinions regarding the role, approach, and characteristics of mentors. For instance, while *M₁₃* is describing the mentoring approach as “brother-like”, *M₁₀* depicts a more professional relationship. In addition, *M₁₅* remarks that the role of mentor is being just a guide, nothing more.

M₁₀: I think the mentor should really be willing to share his/her experiences. Meeting hours are very important and should never be missed. It is also very important for us to give feedback to the student when he/she sends his/her presentation, lesson plan and so on during the meeting hours.

M₁₃: Of course, we took care of them warmly like a big brother, we helped them. We introduced them to other teachers at work in the teachers' room, ordered tea, and got them used to the environment.

M₁₅: We already have our presentation, but the preservice teacher should shape his/her lesson the way s/he wants to tell, the way s/he wants to shape it. I always thought that the mentor should be just a guide.

Mentors also talked about the ideal characteristics and approaches for effective mentoring. For instance, one interviewee, when asked about her definition of effective mentoring said:

M₈: In my opinion, the mentor should definitely be open, be very open to communication and be someone who likes to help and should act with the conscientious obligation of being able to support that preservice teacher as much as s/he can by not forgetting that s/he once went through those times. Because a teacher is growing up and that teacher will have children, they will have students in the future. You know, it is very important that a mentor should be very supportive, motivating, always open to feedback, accessible at every stage.

Furthermore, some mentors provided examples emphasizing TRIAD theme as a response to the open-ended question asking their examples of effective mentoring. For instance, two mentors mentioned about their effect on the preservice teacher's actions and attitudes thanks to their mentoring approach by stating:

M₈: In a few weeks, I convinced the preservice teacher who did not want to teach, and I was faced with a successful lecture process.

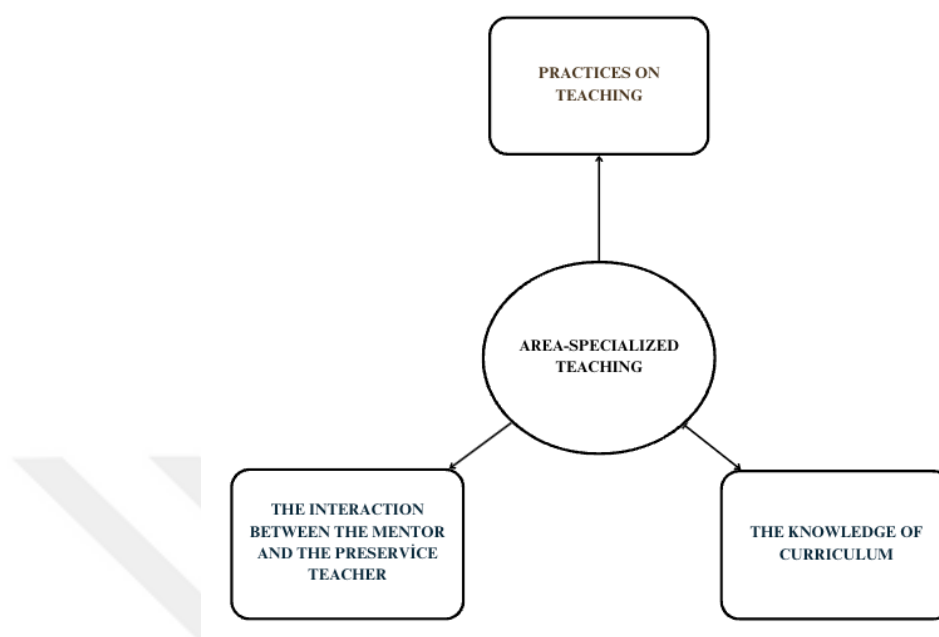
M₁₃: I helped the preservice teacher gain self-confidence by encouraging her when she was shy while teaching.

Area-Specialized Teaching

Area-specialized teaching theme includes practices on teaching, the interaction between the mentor and the preservice teacher, and the knowledge of the curriculum. Mentors' descriptions of relationships, discussing curriculum knowledge with preservice teachers and the aspects of biology teaching are categorized under area-specialized teaching theme. Figure 5 demonstrates these sub-themes described by mentors for the "Area-specialized teaching" theme.

Figure 5

Sub-themes Described by Mentors for Area-Specialized Teaching



Mentors mentioned the teaching practices by emphasizing some strategies such as inquiry-based teaching, designing hands-on activities, performing experiments, place-based teaching, and reflection. Mentors also reported their ways of interaction with preservice teachers such as preparing lesson plans together, sharing their experiences and knowledge while working together, asking critical questions, providing feedback that also focuses on strong points, and interfering during the preservice teachers' teaching.

One of the interviewers (M₄) mentioned about practices in biology teaching that mentors support preservice teachers and said, "*Mentors should assist preservice teachers in preparing online activities, preparing online courses, and teaching biology online*". Another interviewee (M₁₃) explained how he shared his comments on their teaching with preservice teachers by saying "*I give feedback to preservice teachers alone or in the meetings.*". In addition, M₈ shares her experiences regarding the impact of feedback and said: "*In fact, seeing the improvement and how she was*

in the last lesson were amazing. That is, because she repeated the experiment 4 times, with different classes. It was incredible to see that development in that feedback process.”

Some of the mentors explained their experiences and expectations regarding lab practices which are significant in biology teaching:

M₁: The laboratory is not just about the teacher experimenting and demonstrating. Like giving the recipe, the student stuck there and said ahh how did this gas come out? It is not like that. We have a 6-person experiment table in front of the children, and we put various items in front of them, waiting for them to choose. Let's show me the presence of protein here, you know, we start from this and get it done.

M₈: Mentors should support preservice teachers on how to manage the laboratory sessions, how to prepare an experiment, how to teach this to the students, objectives and how to achieve these objectives.

M₁₄: I formed groups of two students and assigned one preservice teacher to each laboratory hall and they performed experiments.

When it comes to interfering with preservice teachers while they are teaching, there was a controversy between two interviewers as observed in interviews.

Excerpts from these mentors are given below:

M₁: However, instead of that, I did the following, I stepped in and said what are your thoughts on what the preservice teacher thinks about this subject, and I threw the ball to the students.

M₁₃: Of course, I didn't interfere in class, because he would be humiliated in front of the students.

Besides mentors' responses on the semi-structured interviews, they also described some practices that they regard as effective mentoring in the open-ended question placed in the questionnaire which are related to the “Area-specialized mentoring” theme. For example, one of the mentors mentioned about a weekend trip that students had chances to learn some biology concepts in the field while another mentor explained the process of working with the preservice teacher for well-configuration of a biology lesson focusing on fermentation and they stated:

M₂: We took the class of which I am a classroom teacher, on a weekend trip, for picnic and entertainment purposes. The children had a lot of fun. Preservice teachers designed many different activities with the children for teaching some biology concepts. The process was full of fun and learning.

M₈: We planned a lesson with a preservice teacher who makes fermented products, and we did it together with the students. Throughout the process, I gave feedback on how the lesson was planned, processed, and evaluated with continuous feedback, and these feedbacks made the preservice teacher think about the reality of the plan and directed it to revision. I think this is effective mentoring.

Teaching Profession Introduction Practices

Teaching profession introduction practices theme consists of activities, duties, and sharing experiences regarding the nature of the teaching profession. Mentors explained the activities such as being on duty, participating to the seminars and student clubs, preparation of exam papers, school orientation, relationship with the administration, colleagues, and parents that they tried to involve preservice teachers for making them understand what brings being a teacher. Therefore, one of the mentors mentioned how they introduce the school, another interviewee explained

how she assigns duties to preservice teachers to make them experience different aspects of being a teacher:

M₁: First of all, we definitely give them a tour of the school so that they can understand what climate they are in. We definitely introduce the student profile.

M₄: While we were planning the process, we chose some preservice teachers to be with us on duty.

The majority of mentors emphasized that actively participating in the daily tasks of teachers and being there with teachers until the end of a school day is the best way to familiarize preservice teachers with the teaching profession. Furthermore, they all agreed that knowing the profession in detail is very critical for preservice teachers to be prepared. The comments of these mentors are given below:

M₁₅: While living that process together, the preservice teacher learns everything. In other words, s/he learns about group relations, s/he learns about friendships, s/he learns about administrative relations, s/he participates in many meetings. So, in a way, s/he is learning to live like a teacher.

M₁: However, I think that teacher candidates should stand at school from morning to night, just like a teacher and they should actually observe how the process works. Because the classroom may be just the place where you close the door, but school is not all about that.

M₁₄: I want them to help us with the preparation, photocopying and similar process of exam papers, to observe how the process works and then how to read a written paper.

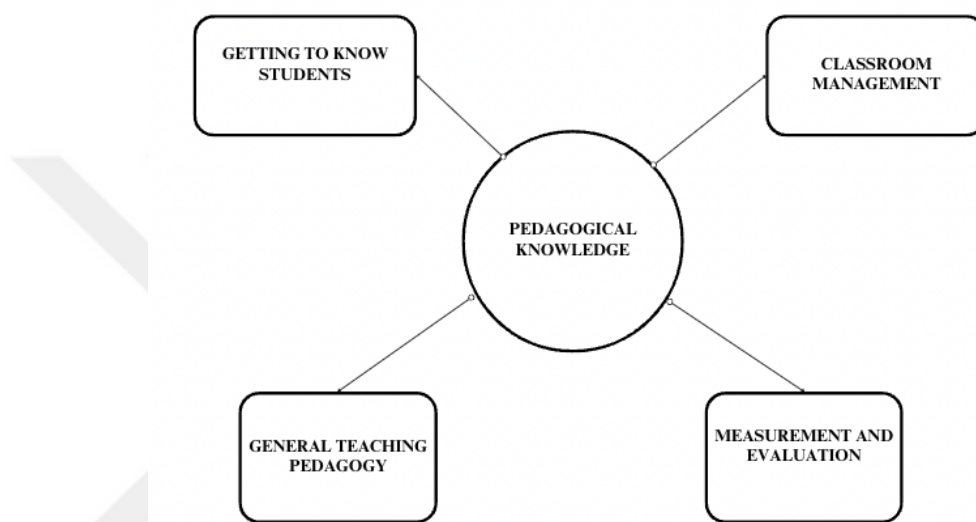
Pedagogical Knowledge

Getting to know students, classroom management, general teaching pedagogy, measurement, and evaluation are included in the pedagogical knowledge

theme as given in Figure 6. Mentors' responses regarding biology teaching strategies that they would like preservice teachers to observe, crucial aspects regarding students, and classroom management are some of the examples of pedagogical knowledge theme.

Figure 6

Sub-themes Described by Mentors for Pedagogical Knowledge



Mentors mentioned introducing the level of students before preservice teachers' observation, demonstrating the roles of teachers and students during the lesson, observation of students' learning process, modeling student-centered teaching strategy, and classroom management at different settings such as a laboratory, a school garden, and a library. Furthermore, mentors also talked about the practices regarding the measurement and evaluations, such as preparation and evaluation of exam questions, grading students' papers, and using alternative assessment techniques like portfolios. Some of the mentors' responses are quoted below:

M₁: We are trying to design biology lessons based on inquiry, what can be done in the course, how that thinking process can be improved.

M₄: It is also very important to see students outside of school, and I think one of the most difficult things is to be with children outside of school.

M₈: We talked about what s/he should do in classroom management.

M₁₀: I'm talking about students, for example, the child was actually doing something like this at the beginning of the year, I would say that I took such precautions against them.

There are also some insights regarding pedagogical knowledge on mentors' responses to the open-ended question asking mentors' effective mentoring examples apart from the semi-structured interviews. For instance, one of the mentors stated that she provided feedback for the preservice teacher's lesson planning and configuration. Another mentor asserted that she shared classroom management strategies with the preservice teachers and informed them regarding the students in the particular classroom. And they stated:

M₁₁: When one of the preservice teachers was teaching, she finished the lesson in 15 minutes. When I asked why this was so, she explained that it was because of her excitement. Of course, the excitement could affect, but the preservice teacher stated that she did not plan her lesson. I talked to her about lesson planning, and she agreed that she should always attend class for teaching with a plan whenever it happens.

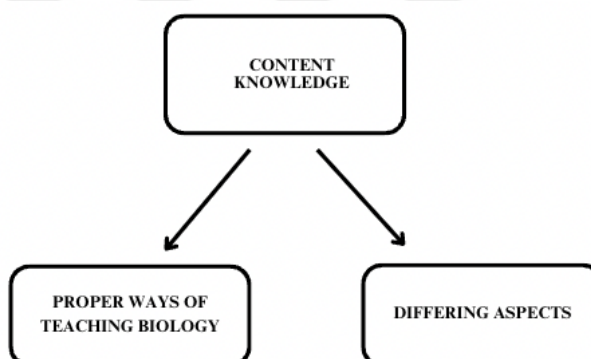
M₄: I share classroom management strategies with preservice teachers especially if they are going to enter a classroom with different students. I also correct the wrongly pronounced words during the lecture. In addition, I look at the lesson plan and materials in advance and give feedback.

Content Knowledge

Content knowledge theme contains the aspects of biology differing from other subject areas and the proper ways of teaching biology in terms of content knowledge, which is depicted in Figure 7. Mentors mentioned the difference of biology that impacts its teaching and learning process since they stated that student engagement and their involvement with the learning activities have critical importance rather than solving problems in terms of comprehending a topic in biology.

Figure 7

Sub-themes Described by Mentors for Content Knowledge



They also emphasized the significance of the correct use of terminology and dissection experiments to gain a deeper understanding in biology. Two mentors mentioned about the different aspects of course and lab structure of biology, while another interviewee explains what she pays attention during the practices of preservice teachers regarding content knowledge:

M₄: In the regular curriculum, we perform dissection experiments. It is a bit different from other fields and our lab report format is also different.

M₁₅: In biology, especially laboratory studies and the structure of the course are slightly different, for instance, in class activities and laboratory studies are critical in order to learn biology.

M₁₀: I was taking notes in detail regarding what preservice teachers said and then sharing things like “you said that here, etc. You used the term correctly or you used it in the wrong way. Look, you said it like it could cause such a misunderstanding.”

Supervisors’ Insights regarding Effective Biology Mentoring

To explore supervisors’ opinions, the questions of the Area Specialized Effective Mentoring Form were utilized, and data were analyzed through content analysis. Through the analysis, Triad Cooperation in Teaching Practicum (TRIAD), Mentoring Practices in Teaching Practicum, and The Characteristics of the Mentor themes emerged, as depicted in Figure 8. Supervisors’ insights on effective mentoring are categorized under these three themes.

Figure 8

Emerging Themes of Supervisors’ Insights

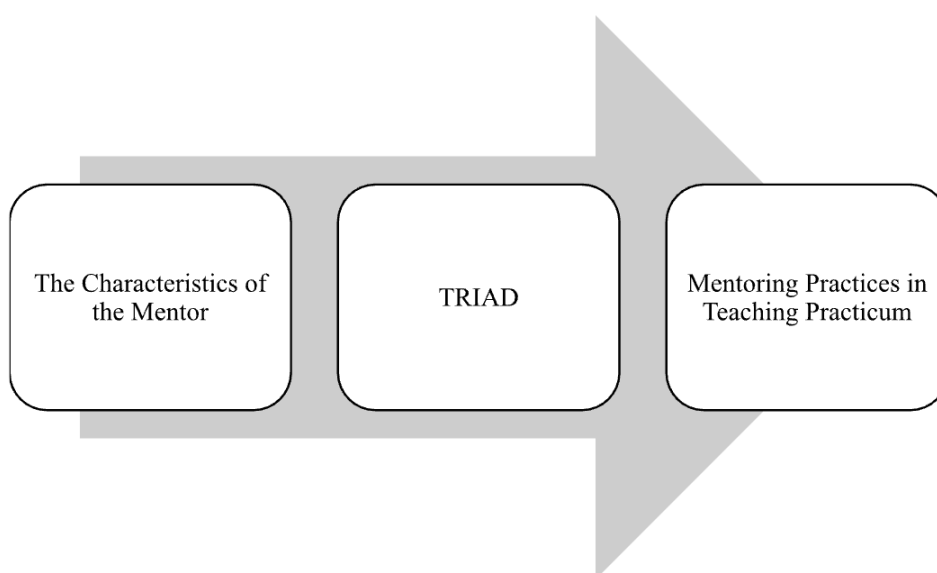


Figure 8 depicts the emerging theme as a result of the analysis of supervisors' responses on the Area Specialized Effective Mentoring Form based on inductive approaches. Supervisors' responses were read carefully and categorized under three emerging themes. Furthermore, the frequency and percentages of open codes under each theme are illustrated in Table 13.

Table 13

Supervisors' Insights on Effective Mentoring

Themes	<i>f</i>	%
Mentoring Practices in Teaching Practicum	83	44.62%
The Characteristics of the Mentor	53	28.50%
Triad Cooperation in Teaching Practicum (TRIAD)	50	26.88 %

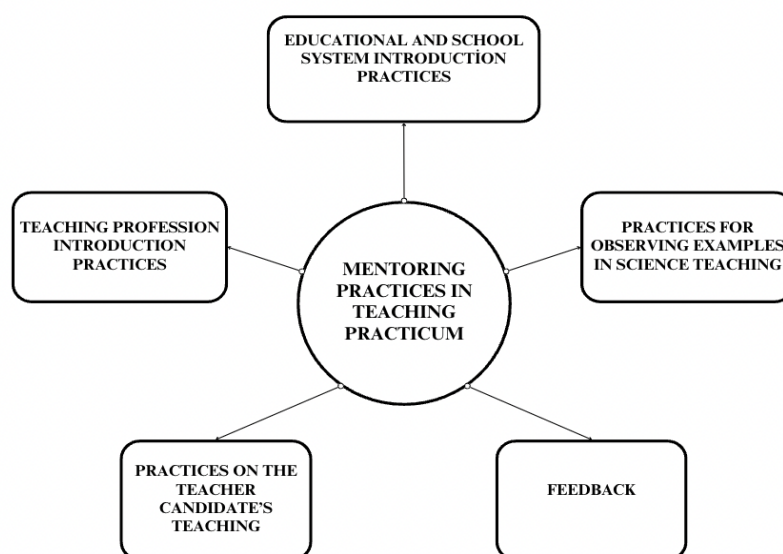
The majority of open codes obtained from supervisors' responses are related to "Mentoring Practices in Teaching Practicum" (44.62 %) whereas "TRIAD" (26.88 %) is the least mentioned theme by the supervisors.

Mentoring Practices in Teaching Practicum

Educational and school system introduction practices, teaching profession introduction practices, practices for observing examples in science teaching, practices on the teacher candidate's teaching, and feedback are the topics categorized under mentoring practices in teaching practicum. These sub-themes are depicted in Figure 9.

Figure 9

Sub-themes Described by Supervisors for Mentoring Practices in Teaching Practicum



Supervisors remarked that mentors should make preservice teachers familiarized with the teaching profession by involving them in various tasks such as parent meetings, exam preparation, and exam proctoring. Apart from this, they elaborated on the proper ways of providing feedback in terms of its time, such as after and before the practice, its characteristics, such as focusing on both strong parts and areas that need to develop, and its type, such as written and oral. Besides this, supervisors also mentioned providing opportunities for preservice teachers to teach by exploring their own ways of teaching without mentors' interference. In addition, they assert that preservice teachers should observe good examples in science teaching to learn effective strategies in area-specialized teaching, such as good use of teaching strategies based on a particular topic, effective classroom management strategies while performing experiments, and making the student active during the learning process. Furthermore, half of the supervisors regard school system introduction and describe some related practices such as communication between

teachers, administrative affairs, and school policies. For instance, S₆ and S₇ identified that mentors should inform preservice teachers regarding school policies and school administration, and S₂ stated:

S₂: In fact, the mentor teacher can inform the preservice teacher not only about the practices in the classroom but also about the practices at school, communication between teachers, and administrative affairs.

When it comes to evaluating preservice teachers' practices, supervisors described the characteristics of effective feedback by indicating the significance of focusing on well-practiced parts and the parts that need improvement. They also commented on the frequency and type of feedback. S₁, S₃ and S₆ stated:

S₁: Mentors should provide feedback for preservice teachers on a weekly basis and give some suggestions regarding preservice teachers' missing parts. They should provide encouraging and positive feedback for preservice teachers' well-executed behaviors and skills. Oral feedback is more appropriate at the end of preservice teachers' teaching practice.

S₃: Oral feedback should be given as soon as possible after an observation. It should be evidence-based (using the camera evidence where useful) and should be a two-way discussion. Ensure the trainee's points are included in the summary. Pull out about three main points at the end of the discussion for the trainee to work on, and make sure to check these points next time. Ensure the oral feedback then becomes a written summary, given to the trainee, and kept to feed into the final assessment. Don't demoralize the trainee; try not to leave a trainee in tears, but be honest. If you have to tell them that they will fail if they do that again, then tell them.

S₆: It is important to provide feedback at the end of every lesson, which might be oral for activities and written for lesson plans and preparing documents. The

mentor should allow the preservice teachers to improve themselves with constructive criticism, not judgment.

Supervisors also clarified some practices for observing teaching examples that preservice teachers need to experience before beginning to teach professionally. These examples of quality teaching may contribute to preservice teachers' perception of biology teaching and inspire them to use more effective strategies during their teaching as S₄ expects mentors to be exemplary teachers in every aspect of teaching. Furthermore, S₂ and S₆ state their insights regarding what practices mentors should model:

S₂: Mentor should be a good guide and role model to the teacher candidate and should be able to give her practical information about her profession.

S₆: The mentor should model classroom management skills in learning environments that make the student active instead of a quiet class representing a traditional classroom management skill. They should care about preservice teachers' social and emotional development. In addition, an effective mentor shares the lesson plan before the lesson and explains the chosen method specific to the subject and the reasons for choosing it to the preservice teacher.

Teaching profession introduction practices is another topic that supervisors highlighted for the teaching practicum to be effective. In fact, like S₁, most of the supervisors remarked that preservice teachers need to learn what it takes to be a teacher by being fully integrated into the overall school life. Therefore, they described the aspects of the teaching profession that preservice teachers should experience, and they stated:

S₁: Mentors should ensure the development of preservice teachers not only by having them teach in the classroom but also by giving them different tasks in the

school such as taking part in school administrative affairs, proctoring exams, preparing exam questions, and being on duty.

S₃: Schools should endure preservice teachers to participate in school staff meetings, events, even Saturday events, and parent meetings about pupil performance.

Moreover, supervisors also emphasized providing opportunities for preservice teachers to be involved in teaching, applying various teaching approaches, and what is expected from mentors for effective practices. For instance, S₁ states that mentors should provide a space for preservice teachers to design their own teaching without controlling everything. In addition, S₆ expects mentors to involve preservice teachers in some activities in class. S₂ and S₃ describe the practices of preservice teachers' teaching by mentioning the mentors' roles in this process:

S₂: Preservice teachers should be able to apply student-centered and hands-on teaching strategies and techniques. For example, it would be very beneficial to organize activities in nature related to environment and ecology, to organize field trips outside the classroom, and to assign various responsibilities to preservice teachers for this purpose. Thus, the preservice teacher will realize how alternative teaching techniques can be used in addition to classical teaching methods and techniques and what they should pay attention to. In addition, when laboratory work is carried out, preservice teachers should be provided with opportunities to use research and inquiry-based methods and techniques. The mentor can talk about effective teaching methods and techniques that attract students' attention and share some of the activities they use with the preservice teacher.

S₃: Pre-arranged and regular observations should be fixed, and mentors should not drop in on a preservice teacher's lesson unexpectedly. Mentors should

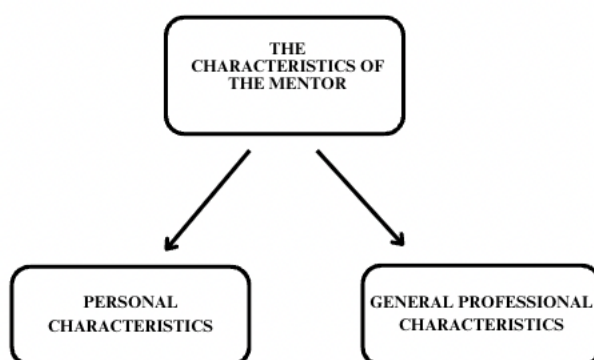
not take over from a trainee or interrupt a lesson (unless you really have to on the grounds of safety. They also should observe preservice teachers' interactions with pupils, use of board and other aids, how they plan and execute practical work and demonstrations, start and end of lessons.

The Characteristics of the Mentor

“The Characteristics of the Mentor” theme involves mentors' personal and general professional characteristics. Figure 10 shows these sub-themes that emerged related to “The Characteristics of the Mentor” theme. It was one of the least mentioned themes, as it was emphasized in 28.50% of open codes for effective mentoring by supervisors.

Figure 10

Sub-themes Described by Supervisors for The Characteristics of the Mentor



Most of the supervisors indicate that “being supportive” and “having good communication skills” are personal attributes that mentors should possess to make the process more effective for preservice teachers. Furthermore, “being patient”, “being open-minded”, “respecting ethical values”, “being helpful”, “being highly motivated”, “being eager to learn continuously”, “having problem-solving skills” and “following scientific developments” were some of the personal characteristics that

supervisors regarded as crucial for mentors to possess. Moreover, supervisors also described some professional characteristics such as “being experienced in teaching”, “willing to share”, “easily accessible”, “being well-prepared”, “being well-organized”, “using new teaching approaches”, “knowing the standards set by Ministry of Education”, “enjoying teaching”, “being an excellent practitioner” and “willing to offer time and expertise”. S₂ and S₃ described some of the personal attributes that they found useful:

S₂: The mentor should be open to communication, highly motivated, sharing, and always open to different opinions (for example, she can evaluate the ideas and suggestions from the preservice teacher), have ethical values and establish an equal relationship.

S₃: Mentors are all different, and I don't think there is one set of personal attributes which can be said to apply to all. But attributes such as being energetic, active, able to prioritize the trainee's needs, forward-thinking, knowledgeable, friendly, and approachable, and supportive are all useful.

Supervisors mostly mentioned some general professional characteristics that they prefer mentors to possess for working with preservice teachers effectively. For instance, one of the supervisors highlighted the quality of the teacher to be a mentor while another supervisor had an emphasis on the understanding of preservice teachers' mental state and needs as given below:

S₃: They should be empathic, able to understand the emotional state of the preservice teacher as well as her cognitive understanding and be able to respond easily and usefully.

S₃: The mentor should be an excellent practitioner – first-rate classroom teacher, evaluative and experimental. They should be able to articulate best practice, have the language to explain their own practice, be confident and secure in their own work but willing to listen, to take on new ideas and try out new ways to do things.

As preservice teachers observe the classes offered by their mentors, most supervisors expect for mentors to have some exemplary teacher characteristics and teaching competencies. S₄ indicated the importance of loving the profession, collaboration with other teachers and updating their knowledge. Furthermore, S₆ expects mentors to use new approaches, reflect and have a scientific perspective in their teaching.

S₅: The mentor should be someone who is open to development, learning and enjoys producing with her students, loves her profession, is open to working with other teachers to conduct interdisciplinary studies, keeps learning from being monotonous, follows scientific developments, and has strong communication skills.

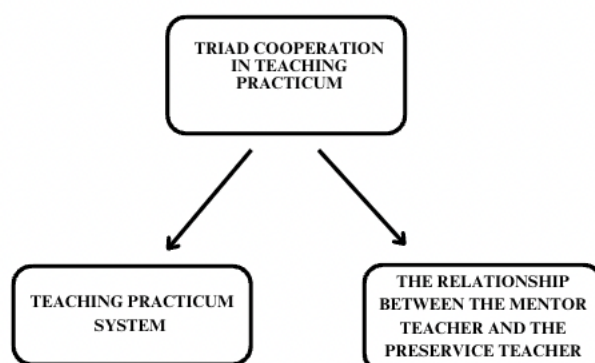
S₆: The mentor must be someone who integrates the nature of science into his lessons, uses new approaches, and reflects.

Triad Cooperation in Teaching Practicum

The “Triad Cooperation in Teaching Practicum” theme includes supervisors’ insights regarding the teaching practicum system and the relationship between the mentor and the preservice teacher as shown in Figure 11. Supervisors emphasized the importance of regular contact between the supervisor and the mentor, universities' responsibilities to train mentors and update their knowledge regularly, and effective mentoring approaches such as supportive, positive, sensitive, empathetic, and challenging.

Figure 11

Sub-themes Described by Supervisors for Triad Cooperation in Teaching Practicum



Apart from this, they remarked that supervisors and mentors should work together on providing feedback and overall assessment of the preservice teacher. In addition, they also stated that the preservice teacher and the mentor build a strong professional relationship to contribute to preservice teachers' development in a better way through formal and informal observations and meetings. S1 described the dynamics of the relationship between the mentor and preservice teacher by stating:

S1: Mentors shouldn't be too friendly or too formal and approach with empathy while criticizing preservice teachers. They should also share their experiences regarding communication with students, the ways of handling inattentive students, and what to consider while giving the right to students to answer. Besides this, mentors should teach preservice teachers that they can make a mistake, that this is okay and expected to a certain level, and that they can fix this faulty part later.

Furthermore, most of the supervisors commented on the collaboration and relationship between three parties: the mentor, the preservice teacher, and the supervisor throughout the teaching practicum for effective mentoring. For instance, one of the supervisors indicated that the faculties of education and the MoNE should

collaborate to ensure the three-partite cooperation. S₂, S₃, and S₇ remarked on the relationship between the mentor and the supervisor by saying:

S₂: Regular communication between the mentor and the supervisor offering the teaching practice course in the Faculty of Education, and a good partnership will make significant contributions to the development of the professional competencies of the preservice teachers.

S₃: The mentor and the supervisor need to be in contact throughout the practice and work together.

S₇: The feedback shouldn't be a two-way process, including only the preservice teacher and the mentor, the supervisor should also participate actively.

Moreover, one of the supervisors pointed out that the importance of mentors' involvement in teaching of preservice teachers at the university and their assessment. Another supervisor indicated that supervisors should support mentors while following the standards determined by the experts. In addition, S₅ stated updating mentors' knowledge is expected as given below:

S₃: Mentors are included in the government's inspection of preservice teachers and preservice teachers are assessed according to the standards set down by the Ministry of Education. Mentors should also be involved in teaching preservice teachers at the university.

S₄: In this process, what will be followed and reported should be determined by the experts, and the mentors should follow the development of the preservice teacher in line with this information with the support of the supervisor.

S₅: Mentors should be trained and updated regularly by the university.

Supervisors' responses to Area Specialized Effective Mentoring Form were categorized under three themes: Mentoring Practices in Teaching Practicum, The

Characteristics of the Mentor, and Triad Cooperation in Teaching Practicum

(TRIAD). After the examination of open codes in detail, it was observed that the most mentioned theme regarding effective mentoring was “Mentoring Practices in Teaching Practicum” while supervisors remarked “Triad Cooperation in Teaching Practicum (TRIAD)” the least. Supervisors provided an overview regarding the mentoring practices held on the teaching practicum process by focusing on the introduction of educational, the school system and the teaching profession, practices on the preservice teacher’s teaching, and feedback. They explained what should be done regarding these aspects for effective mentoring in detail.

Moreover, supervisors described mentor characteristics in terms of personal and general professional characteristics for effective mentoring. They indicated that certain personal characteristics such as "being patient," "being open-minded," "being eager to learn," and general professional characteristics such as "experience in teaching," "following scientific developments," and "problem-solving ability" are helpful. In addition, they considered the following statement as significant: the collaboration between the three parties of the teaching practicum, i.e., the mentor, the supervisor, and the prospective teacher. They also explained the importance of regular communication between the supervisor and the mentor, universities' responsibility for training and updating mentors, mentoring approaches, and collaboration in providing feedback to prospective teachers.

CHAPTER 5: DISCUSSION

Introduction

This chapter provides a discussion regarding effective biology mentoring. It begins with an overview of the study and continues with a discussion of the major findings provided in the previous chapter. After that, the implications for practice and further research are suggested. The final part of the chapter includes the limitations acknowledged by the study.

Overview of the Study

This study explores biology mentors' purposes of mentoring preservice teachers, effective mentoring practices, and supervisors' insights regarding effective biology mentoring. For this reason, the data was collected from biology mentors in Ankara, Istanbul, and Trabzon via a questionnaire. Some of the mentors were selected and interviewed to gain a deeper understanding of their opinions and current mentoring practices. Furthermore, the insights of supervisors who previously offered or currently offer teaching practicum courses were explored through an open-ended questionnaire. After data was collected, quantitative data were analyzed using SPSS, and inductive approaches were used to analyze qualitative data.

As presented in Chapter 4, biology mentors have instrumental and developmental conceptions regarding their aims of mentoring preservice teachers. When it comes to their motivations, it was observed that mentors have personal learning motives, generative outcome motives and two other motives with no classification which are payment and sense of belonging. Furthermore, five themes emerged based on mentors' responses on effective biology mentoring: Tripartite

Cooperation (TRIAD), Area-specialized Teaching, Teaching profession introduction practices, Pedagogical Knowledge and Content Knowledge. On the other hand, the “Triad Cooperation in Teaching Practicum (TRIAD)”, “Mentoring Practices in Teaching Practicum”, and “The Characteristics of the Mentor” themes emerged when the supervisors’ responses were analyzed.

Discussion of Major Findings

Biology Mentors’ Perceptions Regarding the Purpose of Mentoring

In the current study, mentors’ conceptions regarding their aims of mentoring were explored through the Mentoring Conceptions and Motivations Scale, which is adopted from the study by van Ginkel et al. (2015). Mentoring conception can be defined as a set of internally consistent beliefs regarding the goals, nature, and sources of guided learning to teach. It is possible to say that mentors may have different mentoring conceptions as they hold diverse beliefs regarding learning to teach based on the definition. Although mentors can hold diverse conceptions simultaneously, they tend to draw on one or two dominant conceptions (Franke & Dahlgren, 1996). Previous studies demonstrated that two main types of conceptions exist: instrumental and developmental conceptions (Helmsing et al., 2022; Orland-Barak & Klein, 2005; Van Ginkel et al., 2016). The developmental conception is student-centered/learning oriented; however, the instrumental conception is teacher-centered/content-oriented (Franke & Dahlgren, 1996). In other words, the instrumental conception of mentoring is related to concerns about effective teaching practices, while the developmental conception of mentoring is related to concerns about professional development and mentees’ learning to teach (Bettenev et al., 2018).

Reconstructing and evaluating teaching require mentors to have two focuses. They acknowledge what constitutes effective teaching for students and effective mentoring practices for preservice teachers' learning that can be associated with the developmental conception (Achinstein & Athanases, 2006; Athanases & Achinstein, 2003; Feiman-Nemser, 2001b). However, mentors who operate with instrumental conceptions usually have undeveloped opinions regarding this bifocal view. Therefore, they tend to prepare preservice teachers in a way that they can operate alone without any mentor support by trying to teach the mechanics and routines of teaching proficiency, which is the goal of many teacher training programs (Graham, 2006).

Because of the pursuit of traditional philosophies regarding learning to teach, it was expected that biology mentors participating in this study hold instrumental conceptions dominant to developmental conceptions. The reason for this is that mentors tend to hold instrumental conceptions dominant to developmental conceptions mostly, according to the literature (Korthagen, 2004; Wang & Odell, 2002). When the Turkish context is examined closely, there is no direct reference to instrumental and developmental conceptions of mentors. Nevertheless, their beliefs and conceptions of teaching may have shaped their mentoring conceptions since they approach preservice teachers as their students. A variety of studies demonstrated that Turkish teachers adopt teacher-centered, content-oriented teaching mostly even if they regard that student-centered/learning-orienting is more effective (Al-Amoush et al., 2014; Ekiz, 2006; Kaymakamoğlu, 2018; Sevimli, 2022). As teacher-centered/content-oriented teaching conceptions are related to instrumental conceptions, it was expected that mentors participating in this study hold instrumental conceptions more dominantly.

In contrast, biology mentors in this study demonstrated that they have developmental conceptions ($M=6.13$, $SD= 1.01$), slightly higher than instrumental conceptions ($M=5.99$, $SD=1.35$) based on descriptive analysis, even though the difference among these two factors is not significantly significant. The descriptive result of the sample of interest is not compatible with the expectations. For this sample, the result may stem from some circumstances, such as the impact of education reform movements in Türkiye, the Covid-19 pandemic. Apart from this, differences in teaching conceptions based on subject areas and increased time and effort for the teaching experience of preservice teachers in time might have an effect on the shift of mentors' conceptions from instrumental to developmental conception.

In many countries, it is possible to observe the impact of reform movements in education on teachers' views regarding the concept of teaching (Bradbury, 2010; Golden, 2018; Lloyd & Melvin, 1998). For instance, the study performed by Ginkel et al. demonstrated a difference among Dutch teachers' mentoring conceptions after reform movements in education, such as the models of realistic teacher education developed in the Netherlands (2016). Therefore, the reform movements in Türkiye may have an influence in the shift of mentors' conceptions from instrumental to developmental. In the 1980s and 1990s, the increase in economic competition and reform movements in education had a tremendous effect on education policies all over the world (Güven, 2008). These trends also triggered educational reform movements in Türkiye.

One of the major changes was the introduction of a unified system of higher education and the transfer of responsibility for teacher education to universities through the Council of Higher Education (Council of Higher Education, 1981). The Faculty-School Partnership program was the most critical reform in preservice

teacher education in the Turkish context, which sets rules for teaching practicum, roles, and responsibilities of partners. In the scope of this program, it was decided that preservice teachers perform teaching practices in their last year for the partnership of faculties and partner schools, and mentor training which takes 3 days, has started. The most significant change in this reform movement took place in teacher education, especially in the training of elementary science teachers. Previously, teachers who specialized in physics, chemistry, or biology were responsible for teaching science in elementary schools. These teachers were usually trained as part of secondary school teacher education. With the reform, a new teacher education program was established to train science teachers who specialize in teaching science in grades 6 to 8, and constructivism was introduced and highlighted through curriculum guidelines, textbooks, method courses, workshops, and conferences with the basic education reform held in 1998 (Dulger, 2004). Therefore, the subject area may be another variable contributing to learner-centered conceptions of biology mentors participating in this study. For instance, a study conducted with preservice primary science teachers in Türkiye showed that teachers' views on science teachers shifted from teacher-centered to learner-centered as a result of teaching education programs designed based on the constructivist approach (Ucar, 2012). The idea of constructing knowledge actively and the emphasis on collaboration for preservice education may have an impact on changes in mentors' conceptions even if reforms in preservice teacher education in the Turkish context are very limited.

Moreover, the changes in conditions that occurred during the Covid-19 pandemic influenced education dramatically as many institutions of higher education pivoted to remote with online modes of instruction. With the spread of Covid-19,

teacher education programs experienced a set of challenges and external concerns, such as teaching experiences in partner schools, redirecting and monitoring the plans of partnering schools, and collaborating with mentors and administrations of those schools under new uncertainties. These challenges forced mentors and university-based teacher educators to reevaluate various aspects of teaching practicum and resulted in unexpected pedagogical opportunities for preservice teachers, such as the chance to use virtually-based pedagogies and integrate new technologies with the instruction (Aksoy, 2003; V. Ellis et al., 2020; Kabakçi Yurdakul, 2011; Zenkov et al., 2021)

A group of researchers conducted a study with 33 mentors to explore the shifting nature of mentoring during the Covid-19 pandemic and found that there is a shift in mentors' conception from instrumental to developmental (Helmsing et al., 2022). They justified this shift with the unexpected conditions come with the pandemics and the change in mentors' approach and understanding of preservice teachers. During the pandemic, mentors stated that they relied on preservice teachers' collaboration to help them plan to teach and provide quality instruction for students. Helmsing et al. stated that empathy and using different means of instruction contributed to this shift (2022). Because of the similar challenges faced by teacher educators and mentors in the Turkish context, as reported by Aydın (2023) and Fidan & Yıldırım (2022), a shift from instrumental to developmental conception may happen in the conceptions of mentors participating in this study. The reason for this is that the data was collected during the Covid-19 pandemic.

The Motivations for Mentoring

Mentors' views on why they mentor preservice teachers were investigated through the questionnaire and semi-structured interviews. While the items of the

questionnaire related to two predetermined motivation factors, which are generative outcome and personal learning motives, mentors were free to express their motivation for mentoring during the semi-structured interviews without the obligation of connection of the aforementioned motivation factors. In this case, mentors mentioned about two diverse motives, which are the payment and sense of belonging which cannot be relatable with the generative outcome motive and personal learning motive. Although the literature defines various motives for mentoring in education, it is possible to reduce them into intrinsic/extrinsic motives or self-oriented/other-oriented motives (Deutsch et al., 2011; König et al., 2016; Kuhn et al., 2022; Tong, 2011).

As the views can affect people's behavior and attitude, it can be taught that the conceptions of teachers may have an influence on what motivates them to be mentors. When the relationship between conceptions and motivation factors was analyzed, generative outcome motives were found to be strongly related to instrumental conceptions rather than developmental conceptions by Ginkel et al. (2016). Therefore, it is expected that mentors have stronger personal learning motives than generative outcome motives in the current study as they have dominant developmental conceptions.

However, the results of the current study showed that mentors have generative outcome motives ($M=5.84$, $SD=1.22$), significantly higher than personal learning motives ($M=5.79$, $SD= 1.23$). Inferential statistics results imply that mentors hold other-oriented motives dominant to self-oriented motives significantly. Two different explanations could be speculated regarding the unexpected results faced in the current study. First of all, as Ginkel et al showed the strength of association between instrumental conception and generative outcome motive ($r = .38$, $p < .01$) is

higher than the association of personal learning motive and instrumental conception ($r = .11, p < .01$) (2016). Therefore, the reason of holding generative outcome motives can be because of the tendency of mentors to adopt instrumental, teacher-centered/content-oriented approaches in their practices even if they have positive feelings for student-centered approaches (Duru, 2015; Kaymakamoğlu, 2018). Despite of higher scores given to the developmental conception factor, mentors participating in this study may have strong beliefs regarding instrumental conception affecting their motivations for mentoring.

A group of researchers demonstrated that context and current circumstances may affect mentors' conceptions and motivations by discussing the difference among mentors' perceptions and reasons for mentoring in Spanish and Thai contexts (Mena et al., 2020). They concluded that mentors' conceptions and motivations are dominantly related to others because of the recent emphasis on growing Thai society in the new millennium (Fry & Bi, 2013). The vision of the country highlighting growth and improvement had a strong influence of mentors' perceived roles in the big picture, so they chose factors contributing to the society and others-generative outcome motives significantly higher than personal learning motives (Mena et al., 2020). Similarly, the dominance of generative outcome motives across mentors might stem from the Turkish context, where the necessity of improvement in the quality of education is emphasized recently, affecting mentors' motives. As knowledge and advanced level of skill are critical determinants for economic growth, improving the quality of education was emphasized in Türkiye (Kiral & Jiang, 2021; Taskinsoy, 2012). Therefore, the factors like raising more qualified teachers may become prioritized by mentors, serving as the goals of the country they live in.

Besides the motivators mentioned above, this study found two additional motives that encourage mentors to work with preservice teachers during their teaching practicum, which is the mentoring salary and sense of belonging. These motives in the context of mentors' motivation in preservice education were not mentioned directly. In Türkiye, mentors get a financial incentive for working with preservice teachers during teaching practicum. Although preservice teaching literature mentioned the existence of an extrinsic motivation to perform mentoring, there is no specific reference to salary. However, to become and serve as a teacher, there are studies demonstrating "money" as a motivator (Gemedda et al., 2015; Nawaz & Yasin, 2015; Williams & Kritsonis, 2007; Yüce et al., 2013). When it comes to the Turkish context, the findings are also compatible with the studies conducted in other countries, referencing "money" as an extrinsic motivation to become and serve as a teacher (OECD, 2005).

On the other hand, the "sense of belonging" as a motivator was not mentioned in the literature for mentoring preservice teachers. However, the current study demonstrated that the sense of belonging to their alma mater motivates them to serve as mentors to preservice teachers coming from their alma mater in the Turkish context. First of all, this result may be specific to the Turkish context as it was not mentioned in previous studies conducted in other countries. Another reason for this might be that they may be grateful for the training provided by their faculties of education, and they return the favor by contributing to raising more qualified teachers. Furthermore, they can think that they may be better in understanding and meeting of the needs of preservice teachers who have the same experiences with them in terms of the school culture, professors, and challenges. This may affect the

nature of relationship by resulting in more empathetic approach and effective communication throughout the teaching practicum.

The Mentoring Practices Regarded as Effective by Biology Mentors

The current study explored biology mentors' mentoring practices regarded as effective through semi-structured interviews. It is expected that mentors will emphasize the cooperation between preservice teachers, mentors, and supervisors the most. The reason for this is that tripartite cooperation is one of the most discussed concepts for effective mentoring practices in the literature, and it involves many factors affecting teaching practicum such as mentors' roles and approach and responsibilities of supervisors, preservice teachers, and mentors. The results were expected, the "Tripartite Cooperation (TRIAD)" theme, including the roles, characteristics, approach of mentors, teaching practicum process, and expectations from supervisors and preservice teachers, is the most highlighted theme (49.81%) by the biology mentors participating in the current study. biology mentors' agreement upon the significance of the TRIAD may stem from the crucial effect of school-university cooperation on effective mentoring practices and the reform movement highlighting this cooperation in Türkiye (Council of Higher Education, 1998).

A number of studies emphasized that cooperation between the parties of teaching practicum have a critical importance in terms of meeting the needs of new breeding teacher (Bjerke et al., 2013; Cole et al., 2002; Jakhelln & Postholm, 2022; Kuter & Koc, 2009). The word "partnership" was commonly used in the literature to define the relationship between universities and schools where preservice teachers found opportunities to gain professional experience. As a word itself, the partnership can be defined as "*a relationship between two or more people or organizations that are involved in or share the same activity*" (Walkington, 2007). According to the

study conducted in Australia showed the significance of a strong partnership between schools and universities to overcome the issues that stem from the insufficient number of teachers serving as mentors since this can secure a safe environment for all learners providing quality professional learning opportunities (Goh, 2021).

In addition, another study confirmed the critical role of the TRIAD established by a mentor, a supervisor, and a preservice teacher by analyzing a failed triad, showing that mentors and supervisors need each other not only for sharing the responsibility of preservice teachers' learning but also for their own growth (Bullough Jr & Roni, 2004). Cooperation between mentors and supervisors contributes to preservice teachers' learning to teach and also helps them to understand teaching richly. Furthermore, Hall et al. (2008) demonstrated that the confusion of mentors regarding their perceptions of roles and responsibilities undermines the efficacy of mentoring practices based on the study they conducted with 264 mentors. Therefore, they suggested that only collaboration with universities makes a significant difference in holding perceptions that turn into effective mentoring practices with adequate support from the universities.

Moreover, reform movements were held in 1998 in Türkiye, which was a result of changing the duration of compulsory education from 5 to 8 years and the need for standardized preservice teacher education (Yavuz, 2011). It was critical to determine the standards of teacher training to be compatible with the advancements in social, technology, communication, and economic aspects (Council of Higher Education, 1998). So, the teacher training system in Türkiye was revised in the framework of the school-university partnership included in the protocol and signed by the MoNE and the Council of Higher Education in 1998. Apart from this, some concerns regarding the quality of teacher training and the challenges of turning

theory into practice in the Turkish context (Çakiroglu & Çakiroglu, 2010). As mentioned in this study, the view of teaching is so different across universities and schools in the country since universities' approach teaching as more abstract and far from reality while school-based mentors are more concerned with practicality. This kind of diversity may cause preservice teachers to struggle with understanding the components of teaching and transforming their knowledge into practice. Because of the increased emphasis on the importance of such a partnership and cooperation on the quality of teacher training after these reform movements in the Turkish context, biology mentors in this study might have emphasized the "TRIAD" theme for effective mentoring over other themes.

However, other themes such as "area-specialized teaching", "teaching profession introduction practices", "pedagogical knowledge" and "content knowledge" are also emphasized by mentors participating in the current study for effective biology mentoring. The significance of these themes was demonstrated by the previous studies. Many studies stated a change from generic to specific mentoring based on subject areas is necessary for effective mentoring since the instructional decisions, necessary skills, and classroom management based on where teaching takes place differ according to the subject area. Therefore, mentors' work with the preservice teacher should focus on the skills and attitudes necessary for the subject area (Hudson, 2005; Hudson, 2004, 2013; Stelter et al., 2020).

As emerged in the current study, various studies demonstrated that pedagogical knowledge is one of the components that preservice teachers need to learn and practice with their mentor during the teaching practicum (Garza & Ovando, 2012; Hudson, 2013b; Hudson et al., 2012; Karimi & Monireh, 2017). PCK, which was defined as specialized knowledge that distinguishes the teacher from the content

specialist by Shulman (1987) was involved under the “pedagogical knowledge” theme in the current research. One of the studies conducted with primary science teachers showed that lack of PCK and content knowledge were primary reasons contributing to teachers’ hesitancy to teach (Appleton, 2003). Four main components were argued by Grossman (1990) contributing to PCK: “knowledge and beliefs about purpose”, “knowledge of students’ conceptions”, “curricular knowledge”, and “knowledge of instructional strategies. Another study highlighted “knowledge of students”, “knowledge of environmental contexts”, “knowledge of pedagogy”, and “knowledge of the subject matter” as components of PCK (Cochran et al., 1993). Therefore, preservice teachers need to gain knowledge and necessary skills regarding pedagogical knowledge and content knowledge, as mentioned in the literature.

Supervisors’ Insights regarding Effective Biology Mentoring

The views of supervisors who are the third party of the teaching practicum on effective biology mentoring were explored through an open-ended questionnaire. The findings of the study revealed that the “Mentoring Practices in Teaching Practicum” theme is emphasized the most by the supervisors. This theme included their opinions regarding education and school system introduction practices, teaching profession introduction practices, practices for observing examples in science teaching, practices on the teacher candidate’s teaching, and feedback topics. Some studies showed that modeling and observing examples in teaching such as using effective teaching strategies, are useful for preservice teachers’ learning to teach (Ambrosetti & Dekkers, 2010; Kolman et al., 2017; Weisling & Gardiner, 2018). The supervisors participating in the study conducted by Yılmaz and Bıkmaz (2020) stated that mentors should foster preservice teachers to reflect on their teaching by

evaluating instructional decisions they made, which is supported in previous studies (NIE 2009; Chizhik et al., 2017). The necessity of mentors' support and guide on preservice teachers' reflection is also mentioned by the supervisors in the current study under the practices on the teacher candidate's teaching topic.

In addition, as similar to the findings of the study, various characteristics that mentors possess were regarded as significant for effective mentorship for preservice teachers. For instance, the Five Factor Mentoring Model by Hudson and Skamp (2002) highlights some personal attributes such as “feeling comfortable in talking”, “assisting with university assignments”, “assisting in reflecting”, “providing opportunities for reflection”, “increased their confidence”, “instilling positive attitudes”, “addressing their anxieties” and “inspiring them to teach”. Apart from this, enjoying teaching which is one of the personal characteristics mentioned in the current study is stated by some researchers as necessary to be an effective mentor (Izadinia, 2015a; Mena et al., 2017). Furthermore, providing feedback for preservice teachers is one of the most emphasized components of effective mentoring for preservice teachers focusing on the teaching practice (Ambrosetti et al., 2014; Bullock, 2017; Izadinia, 2015a; McGraw & Davis, 2017; Rakicioglu-Soylemez & Betil Eroz-Tuga, 2014). These studies indicated the significance of regular, actionable, timely and critical feedback for preservice teachers' professional development, as mentioned by the supervisors who participated in the current study.

“Teaching profession introduction practices” and “education and school system introduction practices” are usually examined under “improving teacher identity” even though it is mostly related to learning what brings to be a teacher (Afrianto, 2017; Bezzina & Michalak, 2009; Hascher et al., 2007). The view of learning how to be a teacher during the teaching practicum is also supported by

Wenger's social learning theory, which claims that learning is a social process that occurs in a community of practice (Wenger, 1998). Therefore, the supervisors' perspectives regarding the introduction practices of the teaching profession and education and school system are also mentioned in the literature. However, little research exists regarding the supervisors' opinions about the components of effective mentoring.

Implications for Practice

The results of the current study revealed various prominent aspects regarding effective mentoring in biology teaching based on the views of supervisors and mentors. The views of supervisors and biology mentors on effective mentoring can be utilized to improve professional development programs to be used in mentor training specific to biology teaching. The nature of the mentor-preservice teacher relationship determined based on mentors' perceptions may be used in method classes in education faculties for preservice teachers to understand the expectations of mentors from them.

Understanding the motivations and conceptions of mentors may inspire MoNE and education faculties to make some changes in teacher education and teaching experience for a more qualified mentoring resulting in an increase in quality education. The common conceptions of learning to teach which are not effective might be eliminated by modifying the content of method classes, activities of teaching practicum, and mentor training. In this way, the dominance of conceptions determined as more efficient may become more common across new-breed teachers.

As the current research revealed, the "Tripartite Cooperation (TRIAD)" was the most emphasized theme by mentors regarding effective mentoring. The collaboration between mentors, supervisors, and preservice teachers might be

improved so as to reach more qualified teachers with adequate support. In addition, new rules and regulations should be set to ensure that all partners fulfill the requirements of the teaching practicum process not just the preservice teachers. Supervisors and mentors should keep in contact to contribute to preservice teachers' development as much as they can by providing individual strategies based on preservice teachers' weaknesses and strengths.

Mentoring specific to the subject area is usually understudied in the literature. The findings of the current study revealed area-specialized mentoring practices. Apart from this, teaching profession introduction practices, pedagogical knowledge and content knowledge are other areas regarded as significant for effective mentoring for biology teaching. Therefore, they can also be used in might be utilized in the preparation of in-service professional development programs or long-term certification programs for mentor training.

The insights of supervisors revealed that triad cooperation in a teaching practicum (TRIAD), mentoring practices in a teaching practicum, and the characteristics of the mentor are critical for effective biology mentoring. Therefore, the characteristics they identify may be used as a criterion to accept teachers for mentor training and certification programs to ensure the preparedness and effectiveness of the mentors who will work with preservice teachers. In addition, the findings of the current research showed the mentoring salary and sense of belonging as motivators for mentoring in the Turkish context. Mentoring salaries may be increased to motivate and reach more qualified mentors, and some regulations to provide the collaboration of mentors with preservice teachers from their alma matter.

Implications for Further Research

The aim of the study was to explore biology mentors' conceptions, motivations, and practices that they regard as effective, as well as supervisors' insights on effective mentoring in biology teaching. Therefore, this study investigated biology mentors' conceptions by using a questionnaire improved based on the conception factors determined in the Dutch context. Further research may use interviews and different questionnaires to determine mentors' conceptions more objectively, as the conception factors found in the Dutch context may limit the key conceptions which will be identified in the future. In addition, further studies should acknowledge the time and context since critical incidents like the Covid-19 pandemics have an influence on teacher education.

In terms of what motivates biology mentors to work with preservice teachers were explored through a questionnaire and semi-structured interviews. Again, as the questionnaire used in the current study was developed by the dominant motives of Dutch mentors, other questionnaires may be utilized. Apart from this, teaching motivations may also be explored in further studies to separate them from mentoring motives in order to improve the mentoring literature. On top of this, further studies may also investigate "mentoring salary" and "sense of belonging" as motivators of mentoring in Turkish and other contexts.

Furthermore, mentors' views on effective mentoring practices for biology teaching were investigated through semi-structured interviews. However, mentors' responses were limited as they may respond in a way to affect the interviewer. In order to eliminate their biases, mentors and their work with preservice teachers may be monitored through regular observations and materials they prepared with preservice teachers. Apart from this, to fully understand and evaluate mentoring

practices for biology teaching, the insights of preservice teachers may also be investigated. With the determination of biology preservice teachers' learning needs, effective mentoring practices can be revealed.

Supervisors might also be interviewed, or a Delphi study methodology can be utilized with a larger number of supervisors to explore the components of effective biology mentoring. As a Delphi study bridges the gap between theory and practice by providing reliable consensus opinions based on the agreement rate of the area experts, it might help to determine effective mentoring practices for biology teaching more reliably. Moreover, further studies might work with a larger number of participants, and participants from every part of Türkiye and other countries may be involved in the study to increase the generalizability of the findings.

Limitations

The qualitative strand of the study can be less objective regarding trustworthiness which becomes more subjective with the utilization of inductive approaches. Inductive approaches were used in the current research as no predetermined theory or theoretical framework was used due to the gap in the literature to determine mentoring practices specific to biology teaching. One of the most known limitations of inductive data analysis is subjectivity based on the researcher's biases, so it is not sufficient to prove anything (Bell et al., 2022; Denzin & Lincoln, 2011). Therefore, biases may be involved during the data analysis process, which may limit the generalizability of the findings.

Although more objective, quantitative data were obtained through the questionnaire, participants may be biased while answering the questions to show themselves as better educators in educational studies, limiting the findings to what mentors and university supervisors said about their insights. The researcher of the

current study was unable to observe the actual process that mentoring held, so the nature of mentors' relationships and the practices they performed were limited to what they said about their experiences.



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Appendix A

Mentoring Conceptions and Motivations Scale

1. Demographic Information

1. Your name and your surname:
2. Your age:
3. Your gender:
4. University and Department/Program you graduated from:
5. The city in which you are living:
6. Name of the School where you work:
7. How many years have you been teaching?
8. How many years have you worked with teaching practice trainees in the teaching profession?
9. When you think about the last five years, how many preservice teachers do you mentor on average in an academic year?
10. How many preservice teachers did you mentor in the 2020-2021 academic year?

2. Mentoring Goals and Intentions

Some statements that include the aims and intentions of becoming a mentor are given below. Indicate whether you agree with these statements by marking one of the answers (1) Strongly Disagree, (2) Disagree, (3) Partially Disagree, (4) Undecided, (5) Partially Agree, (6) Agree, (7) Strongly Agree.

Items	1	2	3	4	5	6	7
1. In mentoring interviews, I try to provide opportunities for preservice teachers to discover the principles behind a good lesson.							
2. I try to ensure that preservice teachers constantly reflect on their own development.							
3. I try to help preservice teachers discover what kind of teacher they want to be.							

4. I try to make preservice teachers see their lessons from the student's point of view.							
5. I try to encourage preservice teachers to discuss with others different views on teaching.							
6. It is important to me to allow trainees to choose a few minutes of the lesson to discuss the lesson.							
7. I try to teach preservice teachers to get students to evaluate their own work.							
8. I try to make preservice teachers feel that they are a part of the profession.							
9. For me, it is important to schedule specific times for mentoring interviews with preservice teachers.							
10. I try to teach preservice teachers the basic rules of preparing lessons.							
11. I try to teach preservice teachers to maintain tight control in the classroom.							
12. I try to get preservice teachers to structure their lessons.							
13. I try to teach preservice teachers basic classroom routines.							
14. I try to teach preservice teachers the skills they need.							
15. I try to get preservice teachers to use a particular lesson structure.							
16. I think it is important that preservice teachers determine the process of the course, not the students.							
17. When evaluating instruction, I try to review the lesson from beginning to end.							
18. It is important for me to talk to preservice teachers and evaluate teaching based on lesson observation.							

3. Mentoring Motivations

Several statements are given that can answer the question, “Why am I mentoring preservice teachers?”. Whether you agree with these statements (1) Strongly Disagree, (2) Disagree, (3) Partially Disagree, (4) Undecided, (5) Partially Agree, (6) Agree, (7) Strongly Agree. Please indicate by ticking one of the answers.

Why am I mentoring preservice teachers?	1	2	3	4	5	6	7
1. To be informed about current developments in the field.							
2. To make sure my subject is taught by well-trained and competent teachers.							
3. Because there is a need for new people in education in the future.							
4. Because I think mentoring is a challenging task.							
5. Because it deepens my understanding of my job as a teacher.							
6. To facilitate the transition from teacher education to the profession for preservice teachers.							
7. Because it forces me to keep thinking about my own educational vision.							
8. To convey my knowledge and experience.							
9. Because it allows me to continue to look critically at my own teaching performance.							
10. Because I think that preservice teachers have the right to experience under the guidance of a mentor teacher at school.							
11. Because I like working with preservice teachers.							
12. Because it provides diversity in my work.							
13. Because it offers me new ideas and suggestions for my own teaching.							
14. Because the teaching practicum is the best place to learn to teach.							
15. To convey my enthusiasm for the teaching profession.							
16. To show preservice teachers the beauty of being a teacher.							
17. To prevent newcomers to this profession from leaving the profession							
18. To give preservice teachers a chance to prove themselves.							

19. Because I would like to convey my educational vision to preservice teachers.									
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5. General Questions Regarding Teaching Practicum

Please answer the question in this section by considering your mentoring experiences within the scope of the teaching practicum in the last five years.

1. Can you share an experience you think is an example of effective mentoring? Explain why you consider this experience as an example of effective mentoring.



Appendix B

Area Specialized Effective Mentoring Opinion Form

Demographic Information:

1. Gender: 1. Female ☐ 2. Male ☐

2. University affiliation:

3. Your specialization:

☐ Math Teaching

☐ Physics Teaching

☐ Chemistry Teaching

☐ Biology Teaching

5. Your Academic Title: ☐ Professor ☐ Associate Prof. ☐ Assistant Prof. ☐ Instructor

☐ Research assistant Other.....

6. Select the types of experiences that you have had regarding biology teacher education.

☐ Teaching undergraduate level courses

☐ Teaching graduate-level courses

☐ Presenting a paper

☐ Publishing an article/book/book chapter

☐ Taking part in research projects

☐ Preparing/conducting professional development for teachers

☐ Offering teaching practice (internship) course (Working with preservice teachers for practicum)

Other....

Your Views on Effective Mentoring for Biology Teaching

1. What are your expectations from a biology mentor teacher within the scope of a teaching practicum?
2. In your opinion, what are the factors affecting biology mentoring practices?
3. How would you describe effective mentoring in biology teaching? Please write a case that can be considered an example of effective mentoring.
4. How should the biology mentor teacher communicate with the preservice teacher?
5. Within working with the preservice teacher, what should be the personal attributes of the biology mentor teacher?
6. Within working with the preservice teacher, what should be the practices of the biology mentor teacher in terms of pedagogical knowledge (e.g., classroom management, communication with students)?
7. Within working with the preservice teacher, what should be the practices of the biology mentor teacher in terms of modeling (e.g., lecturing, use of equipment, method selection)?
8. Within working with the preservice teacher, what should be the practices of the biology mentor teacher in terms of feedback within the scope of their work with the preservice teachers?
9. Within working with the preservice teacher, what should be the practices of the biology mentor teacher on system requirements (e.g., curriculum, school policies) within the scope of their work with preservice teachers?

We appreciate the information you have provided so far. May we contact you to learn more about this matter?

☐ Yes ☐ No

Appendix C

The Permission from MoNE



T.C.
MİLLÎ EĞİTİM BAKANLIĞI
Strateji Geliştirme Başkanlığı

Sayı : E-49614598-605.01-21430504
Konu : Araştırma Uygulama İzin Talebi

01.03.2021

DAĞITIM YERLERİNE

- İlgi: a) Boğaziçi Üniversitesi Rektörlüğü'nün 30/12/2020 tarihli ve E-84391427-605.01-6723 sayılı yazısı.
b) Milli Eğitim Bakanlığı'nın 21.01.2020 tarihli ve 1563890 sayılı Araştırma Uygulama İzinleri 2020/2 Nolu Genelgesi.

İlgi (a) yazı ile Boğaziçi Üniversitesi Eğitim Fakültesi Matematik ve Fen Bilimleri Eğitimi Bölümü öğretim üyesi Doç. Dr Fatma ASLAN TUTAK'ın "Alan Eğitiminde Etkili Alan Eğitimi Mentörlük Modeli Oluşturulması ve Mentörlük Mesleki Gelişim Programının Geliştirilerek Uygulanması" başlıklı çalışmasında veri sağlamak amacıyla anket çalışması yapma izin talebine ilişkin yazı ve ekleri Başkanlığımız tarafından incelenmiştir.

Araştırmanın, virüsün etkilerinden korunmak amacı ile Bakanlığımıza bağlı resmi/özel okul ve kurumlarda öğrenci, öğretmen ve okul yöneticilerinin katılımı ile yapılması planlanan il/ilçe, ulusal ve uluslararası düzeydeki sosyal etkinliklerin (toplantı, çalıştay, sempozyum, konferans, forum, ödül töreni, spor müsabakası, yarışma vb.) tedbiren iptal edilmesi ve yüz yüze eğitim öğretime ara verilmesi göz önüne alınarak örgün eğitimin tam olarak başlamasıyla birlikte ilgili genel müdürlüklerin izni ile denetimi il/ilçe milli eğitim müdürlükleri ve okul/kurum idaresinde olmak üzere, kurum faaliyetlerini aksatmadan, faaliyetlerini aksatmadan, gönüllülük esasına göre; onaylı bir örneği Bakanlığımızda muhafaza edilen ve uygulama sırasında da mühürlü ve imzalı örnekten çoğaltılan veri toplama araçlarının uygulanmasına ilgi (b) Genelge doğrultusunda izin verilmiştir.

Gereğini bilgilerinize rica ederim.

Mehmet Fatih LEBLEBİCİ
Bakan a.
Başkan

Ek: Onaylı Veri Toplama Araçlar (14 sayfa)

Dağıtım:
Gereği:
İstanbul, Ankara ve Trabzon Valiliğine
(İl Milli Eğitim Müdürlüğü)

Bilgi:
Boğaziçi Üniversitesi Rektörlüğüne

Bu belge güvenli elektronik imza ile imzalanmıştır.

Adres : MEB Atatürk Bulvarı No:98 Bakanlıklar/ANKARA

Belge Doğrulama Adresi : <https://www.turkiye.gov.tr/meb-ebys>

Telefon No : 0 (312) 413 27 53

Bilgi için: İstatistikçi Özlem BEYAZPİRİNÇ

E-Posta: sgb_arastirmaizinleri@meb.gov.tr

Unvan : İstatistikçi

Kep Adresi : meb@hs01.kep.tr

İnternet Adresi: www.meb.gov.tr

Faks:3124186401

Bu evrak güvenli elektronik imza ile imzalanmıştır. <https://evraksorgu.meb.gov.tr> adresinden 46c9-e21f-3b49-9998-5943 kodu ile teyit edilebilir.

Appendix D

Informed Consent Form

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

BİLGİLENDİRİLMİŞ ONAM FORMU

LÜTFEN BU DÖKÜMANI DİKKATLİCE OKUMAK İÇİN ZAMAN AYIRINIZ

Sizi Boğaziçi Üniversitesi yürütücülüğünde, Trabzon Üniversitesi ve Bilkent Üniversitesi işbirliğinde yürütülen “*Alan Eğitiminde Etkili Alan Eğitimi Mentörlük Modeli Oluşturulması ve Mentörlük Mesleki Gelişim Programının Geliştirilerek Uygulanması*” başlıklı TÜBİTAK 1001 Projesi kapsamında desteklenen **araştırmaya** davet ediyoruz. Bu araştırmaya katılıp katılmama kararını vermeden önce, araştırmanın neden ve nasıl yapılacağını bilmeniz gerekmektedir. Bu nedenle bu formun okunup anlaşılması büyük önem taşımaktadır. Eğer anlayamadığınız ve sizin için açık olmayan şeyler varsa, ya da daha fazla bilgi isterseniz bize sorunuz.

Bu çalışmaya katılmak tamamen **gönüllülük** esasına dayanmaktadır. Çalışmaya **katılmama** veya katıldıktan sonra herhangi bir anda çalışmadan **çıkma** hakkında sahipsiniz. **Çalışmayı yanıtlamanız, araştırmaya katılım için onam verdiğiniz** biçiminde yorumlanacaktır. Size verilen **formlardaki** soruları yanıtlarken kimsenin baskısı veya telkini altında olmayınız. Bu formlardan elde edilecek bilgiler tamamen araştırma amacı ile kullanılacaktır.

1. Araştırmayla İlgili Bilgiler:

- a. **Araştırmanın Amacı:** Bu projede Matematik ve Fen Bilimleri (Fizik, Kimya, Biyoloji) öğretmenler adaylarının öğretmeyi öğrenmesini destekleyici etkin mentörlük uygulamalarının belirlenmesi ve belirlenen uygulamaların bir mesleki gelişim programına dönüştürülmesi amaçlanmaktadır.
- b. **Araştırmanın İçeriği:** Projenin ilk adımı Matematik-Fizik-Kimya ve Biyoloji eğitimi için Etkili Alan Eğitimi Mentörlük Modeli (ETALEM)’nin geliştirilmesidir. İkinci adım modelin

uygulanabilirliğinin test edilmesi ve ülkemizde mentor öğretmen eğitimi konusunda yol gösterici olabilecek bir Mentor Öğretmen Mesleki Gelişim Programı(MöGP)'nin tasarlanmasıdır. Çalışma İstanbul, Ankara ve Trabzon olmak üzere üç ilde yürütülecektir. Bu proje ülkemizdeki öğretmen eğitiminde önemli bir ihtiyaca bilimsel alt yapıyı oluşturmak üzere yürütülmektedir. Türkiye’de Matematik ve Fen Bilimleri alanlarında mentor 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, mentor öğretmenler ve öğretmen adayları ile yapılacak bir tarama çalışması oluşturmaktır. ETALEM’in geliştirilmesi aşamasında sizlerin de bu projede deneyimleriniz ile katkı sağlamanızı rica ediyoruz. Mentor öğretmenlerle yapılacak veri toplama sürecinin iki boyutu bulunmaktadır:

- Nicel ölçeklerin (Etkili Matematik/Fizik/Kimya/Biyoloji Öğretiminde Mentörlük Ölçeği, Mentörlük Motivasyonu Ölçeği, Mentörlük Anlayışı Ölçeği) kullanılarak mentor öğretmenlerin mentörlük motivasyonları, anlayışları ve uygulamaları üzerine bilgi toplanması. Bu anketlerin cevaplanması yaklaşık 30 dakikanızı alacaktır.
- Mentor öğretmenler ile yapılacak bireysel yarı yapılandırılmış görüşmeler ile etkili mentörlük uygulamaları üzerine görüşleri üzerine veri toplanması. Bu görüşmenin yaklaşık 20 dakika süremesi planlanmaktadır.

c. **Araştırmanın Nedeni:** Bilimsel araştırma: **X** Tez çalışması:

d. **Araştırmanın Öngörülen Süresi:** 3 yıl

e. **Araştırmanın Yapılacağı Yer(ler):** İstanbul, Ankara ve Trabzon illerinde öğretmenlik uygulaması stajları kapsamında uygulama öğretmenliği görevini yapmış olan Biyoloji, Fizik, Kimya ve Matematik öğretmenleri

2. Çalışmaya Katılım Onayı:

Yukarıda yer alan ve araştırmadan önce katılımcıya/gönüllüye verilmesi gereken bilgileri okudum ve katılmam istenen çalışmanın kapsamını ve amacını, gönüllü olarak üzerime düşen sorumlulukları tamamen anladım. **Çalışma hakkında yazılı ve sözlü açıklama aşağıda adı belirtilen araştırmacı tarafından yapıldı, soru sorma ve tartışma imkânı buldum ve tatmin edici yanıtlar aldım. Bana, çalışmanın muhtemel riskleri ve faydaları sözlü olarak da anlatıldı.** Bu çalışmayı istediğim zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabileceğimi ve bıraktığım takdirde herhangi bir olumsuzluk ile karşılaşmayacağımı anladım.

Bu kořullarda söz konusu arařtırmaya kendi isteęimle, hiçbir baskı ve zorlama olmaksızın katılmayı kabul ediyorum.

Katılımcının (Kendi el yazısı ile)

Adı-Soyadı :

İmzası :

Arařtırmacının

Adı-Soyadı: Doç. Dr. Fatma Aslan Tutak

İmzası:

Not: Bu form, iki nüsha halinde düzenlenir. Bu nüshalardan biri imza karşılığında gönüllü kişiye verilir, diğeri arařtırmacı tarafından saklanır.