

TOWARDS DEFINING BIOLOGY TEACHER EDUCATOR COMPETENCIES:
A DELPHI STUDY

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FULYA KOYUNCU

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submitted by **FULYA KOYUNCU** in partial fulfillment of the requirements for
the degree of **Doctor of Philosophy in Science Education in Mathematics and
Science Education, Middle East Technical University** by,

Prof. Dr. Halil Kalıpçılar
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. Erdinç Çakıroğlu
Head of Department, **Math. and Sci. Edu.**

Prof. Dr. Ayhan Kürşat Erbaş
Supervisor, **Math. and Sci. Edu., METU**

Assoc. Prof. Dr. Bülent Çetinkaya
Co-Supervisor, **Math. and Sci. Edu., METU**

Examining Committee Members:

Prof. Dr. Jale Çakıroğlu
Mathematics and Science Education, METU

Prof. Dr. Ayhan Kürşat Erbaş
Mathematics and Science Education, METU

Prof. Dr. Serhat İrez
Mathematics and Science Education, Marmara University

Prof. Dr. Ceren Öztekin
Mathematics and Science Education, METU

Assoc. Prof. Dr. Meryem Selvi
Mathematics and Science Education, Gazi University

Date: 31.01.2020



I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : Fulya Koyuncu

Signature :

ABSTRACT

TOWARDS DEFINING BIOLOGY TEACHER EDUCATOR COMPETENCIES: A DELPHI STUDY

Koyuncu, Fulya

Doctor of Philosophy, Science Education in Mathematics and Science Education

Supervisor : Prof. Dr. Ayhan Kürşat Erbaş

Co-Supervisor: Assoc. Prof. Dr. Bülent Çetinkaya

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The main aim of the study is to constitute competency framework of biology teacher educators by identifying needed competencies and competency indicators. Delphi method was preferred because this method enables to synthesize consensus of opinion of experts. There are some critics towards Delphi Method, to increase the validity and reliability of the study Delphi method was enriched by various additional stages under each Delphi Rounds. In this respect, the study differs from classical Delphi method. In the study, Delphi Method was applied in four main rounds. The aim of the Delphi 1st Round was to gather the opinions of experts on biology teacher educators' competencies. Therefore, data were gathered from 4 experienced biology teacher educators and a group of expert on teacher educators' competencies. In Delphi 2nd and 3rd Rounds biology teacher educators, biology education graduate students and biology teachers were participated to evaluate the need of identified competencies and competency indicators by biology teacher educators. In Delphi 4th Round the items which could not be reached consensus were asked to the participants in the Delphi 1st Round. At the end of the Delphi 4th Round, defined competency areas were Biology Education, Educating and Developing Biology Teachers, Educating Biology Teacher Educators, Positive Attitudes and Values for Biology

Education, and Supporting Biology Education in Society. 29 competencies and 178 competence indicators were defined under the competency area. The study provides a framework for the professional development of biology teacher educators and development of biology education programs at undergraduate and graduate levels.

Keywords: Biology teacher educators, Biology education, Competency framework, Competency, Delphi method



ÖZ

BİYOLOJİ ÖĞRETMEN EĞİTİMCİLERİNİN YETERLİKLERİNİN TANIMLANMASINA DOĞRU: BİR DELPHİ ÇALIŞMASI

Koyuncu, Fulya

Doktora, Fen Bilimleri Eğitimi, Fen ve Matematik Alanları Eğitimi

Tez Yöneticisi: Prof. Dr. Ayhan Kürşat Erbaş

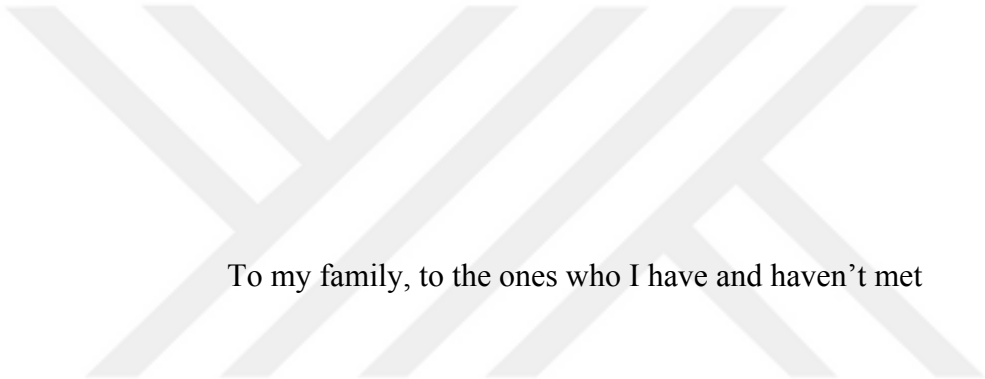
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Mevcut araştırmanın temel amacı; biyoloji öğretmen eğitimcilerinin sahip olmaları beklenen yeterlik ve yeterlik göstergelerini içeren bir yeterlik çerçevesinin sunulmasıdır. Delphi metodu, bir dizi anket kullanarak bir grup uzmanın görüş birliğine varmasını sağladığı için bu metot araştırmada ana metot olarak kullanılmıştır. Çalışmada Delphi metodunun sınırlılıklarının aşılması, güvenilirlik ve geçerliğinin artırılması amacıyla metoda çeşitli aşamalar eklenmiş ve metot zenginleştirilmiştir. Bu yönüyle çalışma aynı kişilerden sürekli geri bildirimle dayalı olarak uygulanan klasik Delphi metodundan farklılaşmaktadır. Çalışmada Delphi metodu dört turdan oluşan bir yapıda kurgulanmıştır. Delphi 1. turun amacı biyoloji öğretmen eğitimcilerinin yeterlikleri ve yeterlik göstergelerine yönelik uzman görüşünün alınmasıdır. Bu nedenle, dört deneyimli biyoloji öğretmen eğitimcisi ve öğretmen yeterlikleri konusunda uzman bir grup öğretmen eğitimcisi veri toplanmıştır. Biyoloji öğretmen eğitimcilerinin yeterlikleri ve yeterlik göstergelerini içeren taslak yeterlik çerçevesi oluşturulmuştur. Delphi 2. ve 3. turlarda biyoloji öğretmen eğitimcilerinin, biyoloji eğitimi alanında lisansüstü düzeyde eğitim gören öğrencilerin ve biyoloji öğretmenlerinin ortaya konulan yeterlik çerçevesindeki yeterlikler ve yeterlik göstergelerine yönelik görüşleri alınmıştır. Fikir birliğine

varılamamış maddelerle ilgili Delphi 4. turda, ilk tura katılan uzmanlarla görüşmeler yapılmıştır. Araştırma sonucunda oluşan biyoloji öğretmen eğitimcisi yeterlik çerçevesi kapsamında Biyoloji Öğretimi, Biyoloji Öğretmeni Yetiştirme ve Geliştirme, Biyoloji Öğretmen Eğitimcisi Yetiştirme, Biyoloji Eğitime yönelik Pozitif Tutum ve Değerler, Toplumda Biyoloji Eğitimini Destekleme olmak üzere 6 yeterlik alanı tanımlanmıştır. Araştırma sonunda belirtilen yeterlik alanları altında 29 yeterlik ve 178 yeterlik göstergesi tanımlanmıştır. Çalışma başta biyoloji öğretmen eğitimcilerinin mesleki gelişimleri olmak üzere, lisans ve lisansüstü düzeyde biyoloji öğretmenliği programlarının gelişimine yol gösterici bir çerçeve sunmaktadır.

Anahtar Kelimeler: Biyoloji öğretmen eğitimcisi, Biyoloji eğitimi, Yeterlik çerçevesi, Yeterlik, Delphi metodu



To my family, to the ones who I have and haven't met

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CHAPTER 1

INTRODUCTION

There has been a vast amount of research on student scientific literacy and student, school and teacher-related factors that reveal the qualities of teachers as one of the most important factors that have an effect on student scientific literacy, achievement, attitudes (Chetty, Friedman, & Rockoff, 2013; Darling-Hammond, 2000; Hattie, 2009; Lanier & Little, 1986; Swennen & van der Klink, 2009). This finding has led researchers and policy makers to understand the factors that are associated with the qualities of teachers (Darling-Hammond & Lieberman, 2012; Goodwin & Oyler, 2008). The only responsibility of teacher educators is not teaching teachers; they are also responsible for the education of pupils even though they do not have a direct influence (Swennen, Shagrir, & Cooper, 2008).

Unfortunately, research studies have not given the same attention to the characteristics or qualifications desired in teacher educators and this lack of knowledge in the literature on teacher educators prevents us from evaluating their effects on teacher education (Buchberger & Byrne, 1995; Howey & Zimpher, 1990; Lanier & Little, 1986; Swennen & van der Klink, 2009). Although some researchers and institutions have given attention to teachers of teachers with questions about who they are, what they do, what they think and what their desired characteristics are in the last few decades, (Darling- Hammond & Bransford, 2005, Darling-Hammond, 2000) this field of research has not sufficiently answered, in particular, the question of what their desired characteristics and qualifications are (Goodwin et al., 2014).

At this point, the term of teacher educator itself needs a definition. Murray and Male (2005) classified teachers in two categories: first-order teachers and second-order teachers. They define the first-order teachers as the ones who teach subjects to their

pupils and students, and the second-order teachers as the ones who teach their students to become first-order teachers, who can also be named as teachers of teachers or teacher educators. Based on this definition of teacher educators, Swennen and van der Klink (2009) describe teacher educators as “teachers in higher education and in school who are formally involved in pre-service and in-service teacher education” (2009, p.3). Another definition for teacher educator is proposed by Koster, Brekelmans, Korthagen and Wubbels (2005) as people “*who provide instruction or who give guidance and support to student teachers, and who thus render a substantial contribution to the development of students into competent teachers*” (p.157).

Varying definitions of teacher educators result from the complexity of teacher educator roles. According to the European Trade Union Committee for Education (2008), the roles and profiles of teacher educators include:

- academic staff in higher education institutes who are teachers of education or teaching subjects
- education researchers
- other teachers of didactics or general courses
- supervisors of practice in schools closely linked to initial teacher education institutes
- trained and experienced teachers supervising practice in other schools
- tutors (counsellors, coordinators, mentors, guides etc.) supervising prospective teachers in the “on-the-job” qualifying phase
- networks of supporters in the “on-the job” qualifying phase (p. 34).

In addition to the roles and profiles of teacher educators, the expectations from teacher educators may change from country to country. According to Snoek, Shagrir, and Zogla (2009), curriculum designs differ even among the European countries due to having different national contexts. For instance, teacher education

takes place at universities in most of the European countries. However, in countries such as Norway and the Netherlands, there are different types of higher education institutes, which leads to a variety in terms of the position of teacher educators.

Although there are complexities about the roles and profiles of teacher educators, more interest needs to be paid to the qualifications of teacher educators (Goodwin et al., 2014). Moreover, according to the European Trade Union Committee for Education (2008), establishing the qualifications of teacher educators needs to be taken as a goal in order to secure the improvement of teacher education.

Although not enough, the first steps to identify the qualities of teacher educators were taken by some institutions. One of these organizations is the Association of Teacher Education (ATE), which outlined the nine key elements for effective teacher educators as the Standards for Teacher Educators (Association of Teacher Educators, 2006). The Standards for Teacher Educators involve nine main standards, which are teaching, cultural competence, scholarship, professional development, program development, collaboration, public advocacy, teacher education profession and vision. All of those standards are briefly explained in terms of meaning and scope. Additionally, indicators and suggested artifacts are also presented for each standard.

The Association of Teacher Education proposed three main uses of these standards (ATE, 2006). First, the standards can provide better insight into teacher educators and facilitate a discussion about the definition, roles and expectations of teacher educators. Second, they can promote research on teachers. Third, they can be used to determine the expectations or assess the performance of teacher educators.

The Flemish Association of Teacher Educators also issued standards for teacher educators. However, the Association adopted the terms standard with an alternative term development profile, which gives a sense of instrument for professional development. These standards were classified into 10 categories (VELOV, 2012). All of the development profiles begin with a short section on what kind of personal professional practice matches any particular component. Additionally, the list of

knowledge, skills and attitudes that are subsequent to the standards were presented. The first development profile was defined as “The fundamentals of being a teacher educator” and others focused more on the roles of teacher educators as listed below.

The teacher educator as a/n:

- supervisor of learning and development processes,
- supporter and supervisor of personal, social and interactive processes,
- teacher education specialist (an expert in teacher education didactics),
- content expert,
- organizer,
- innovator and researcher,
- member of a teacher education team,
- partner for external stakeholders and as a member of the educational community,
- involved and critical social participant (VELOV, 2012, p. 8).

In addition to teacher educators, different institutions defined standards for specific fields. The Association for Science Teacher Education (ASTE, 1997) published Professional Knowledge Standards for Science Teacher Educators, categorizing these standards into six: knowledge of sciences, science pedagogy, curriculum instruction and assessment, knowledge of learning and cognition, research/scholarly activity and professional development activities. The scope of these standards was explained briefly in the document. The purpose of proposed standards was expressed as providing a clearly defined framework for the knowledge, skills, experiences, attitudes, and habits of mind that are essential for a successful science teacher educator. These standards aimed to provide a vision for the development of science teacher educator programs, and criteria for the qualifications of science educators who work at universities.

The qualifications of teacher educators proposed by different institutions are taken as standards, though the naming may vary. The advocates of possession of

professional standards for teacher educators describe standards briefly as they usually refer to what the profession expects teacher educators to know and be able to do (Ingvarson, 1998). Ingvarson (1998) emphasizes the importance of establishing standards as a way to provide guidelines and a reference point for people. Even though some researchers dwell on the importance of the standards in terms of their functions, there are also some critics who criticize the professional standards for teachers or teacher educators. One important criticism on the standards is that they do not take account of the complexity and unpredictability of the teaching and learning environment (Korthagen, 2004). Finally, the validity, reliability, and practical feasibility of teacher educator assessments are also criticized (Zeichner, 2005).

In terms of standards, competencies can be defined to frame the qualifications of the teacher educators. Spencer and Spencer (1993) mention that competencies need to be a combination of knowledge, skills, attitudes, motives and personal characteristics that an individual possesses to act effectively in a particular situation. There is also a discussion on the generalization or specification of descriptions of the competencies in the literature (Stoof, Martens & Van Merriënboer, 2000, retrieved from Koster, Dengerink, Korthagen & Lunenberg 2008). Some think that if competencies are overspecialized, this may lead to very long lists to manage so as to decide whether teacher educators possess these competencies. Besides, some other critics also claim that general statements of competencies do not have clarity, which leads to poor communication and diminished credibility (Eraut, 1994). These discussions lead us to conclude that the qualifications of teacher educators need to reveal the complexity of the roles but should not cause overspecialization.

When it comes to the practices in Turkey, first of all it should be mentioned that there are no definitions or roles established for teacher educators. In general, the requirements for all faculty members are stipulated by The Law on Higher Education (1981) in every field of academics:

1. To carry out and have carried out education and practical studies at the pre-baccalaureate, baccalaureate and post-graduate (post-baccalaureate) levels in the institutions of higher education in line with the purpose and objectives of this law, and to direct project preparations and seminars.
2. To undertake scientific and scholarly research for publication in the institutions of higher education.
3. In accordance with a program arranged by the head of the related unit, to set aside certain days for the advising and guidance of students, helping them as needed and directing them line with the aims and basic principles of this law.
4. To carry out the duties assigned by authorized organs (p. 24)
5. To perform other duties assigned by this law.

In brief, the responsibilities of teacher educators in Turkey are defined similarly to the other academics and they do not have any other ascribed responsibilities or minimum standards related to their own field, namely teacher education.

On the other hand, in 2006, the Council of Higher Education (YOK) started “National Qualifications Framework for Higher Education in Turkey” project (YOK, 2011), which aims to determine knowledge-based academic qualifications and practice-based academic qualifications of all faculties categorized in eight fields. All qualifications required for these fields are listed according to the degree of education, which are associate, bachelor's, master's and doctoral degrees. In 2011, knowledge-based academic qualifications were shared by the stakeholders. Even though this project is not directly related to the qualifications of teacher educators, it involves the education of teacher educators at doctorate level. One of these eight fields is Teacher Training and Educational Sciences. According to these listed qualifications, all of the doctors in the education field need to possess 20 competencies that are categorized into three: skill, knowledge and competence. However, when these

qualifications are analyzed, it can be seen that most of them are not distinguishable from the other eight fields.

In addition to these attempts conducted by different institutions in Turkey, the need for defining the country-based competencies of teacher educators was also realized by Gözalan Çiçek (2016). In her study, she aims to determine the general subject area competencies of teacher educators and evaluate their perceptions of owning these competencies. This study has two important roles for the current dissertation. First of all, the need for determining the competencies of teacher educators was seen simultaneously in both dissertations and therefore, data collection processes were close in terms of timing for both studies. On the other hand, the study conducted by Gözalan Çiçek (2016) focuses on the general competencies for all teacher educator fields independently. In Turkey, each teacher education field is conducted in different departments by the teacher educators specific to that field of education. Despite the fact that Gözalan Çiçek (2016) presents the general competencies needed for every teacher educator, the need for defining the competencies for teacher educators specific to specialized fields still abides.

According to Snoek et al., (2009), there are differences in curriculum designs even across Europe as a result of different national contexts. Therefore, the qualifications of teacher educators need to be described in the context of teacher education in Turkey. Primary school, elementary school and high school teacher education processes are much more detailed in Turkey. In the context of science, there is no specific education department for teacher education at primary school level. The specification starts for the second level of elementary school teachers. However, teacher education for science is detailed at high school level. For high school science teacher education, there are three different fields at undergraduate level of education, which are biology, chemistry and physics. Since the undergraduate level of science education has different fields, teacher education needs to be considered as per this differentiation. Moreover, the competencies of teaching profession and competencies for specific fields of teachers are defined by MoNE of Turkey (2013)

in each teaching field and for primary, secondary and high school teachers. Three competency areas, 19 competencies and 120 performance indicators are defined for biology teachers. Since special attention is given to the education of biology teachers and their specializations, the competencies of biology teacher educators need to be given the same specific attention. To this end, the current study focuses on the competencies of biology teacher educators.

1.1. Statement of Purpose

The purpose of this dissertation study is to determine the professional competencies for the biology teacher educators in Turkey from the point of view of biology teacher educators, biology education graduate students, and biology teachers.

1.2. Research Questions

1. What competencies should biology teacher educators possess from the perspective of biology teacher educators, graduate students in biology teacher education programs and biology teachers in Turkey?
2. What are the indicators of the competencies that biology teacher educators should possess from the perspective of biology teacher educators, graduate students in biology teacher education programs and biology teachers in Turkey?

1.3. Significance of the Study

As teachers have a vital role in student learning and development (Chetty et al., 2013; Darling-Hammond, 2000; Hattie, 2009; Lanier & Little, 1986; Swennen & van der Klink, 2009), we need to understand the factors associated with the qualities of teachers (Darling-Hammond & Lieberman, 2012; Goodwin & Oyler, 2008). Even though teacher educators have a great importance, relatively few studies have been conducted to focus on their qualifications and to reveal the competencies that they need to possess (Lanier & Little, 1986; Swennen & van der Klink, 2009).

This need of focus is acknowledged on an international level and various countries establish teacher educator competencies under different names and frameworks. The Association of Teacher Educators (2006) proposed Standards for Teacher Educators to provide better insight into teacher educators, facilitate a discussion about the definitions and roles of teacher educators, determine their expectations or assess their performance. Besides, VELOV (2012) proposed The Flemish Teacher Educator Development Profile to provide an overview of knowledge, skills and attitudes that a teacher educator needs to work effectively. On a global scale, specific standards are defined for science teacher education fields by the Association for Science Teacher Education (ASTE).

However, in Turkey, the requirements are established for all faculty members as stipulated by the Law on Higher Education (1981) without any specification in terms of education field, and doctorate degree qualifications are defined by YOK in the National Qualifications Framework for Higher Education in Turkey Project, which is still not differentiated from the other eight fields in higher education. Besides by Gözalan Çiçek (2016) presents the general competencies of teacher educators, however they are not specific to the field of biology teacher educators. Moreover, it is known that most teacher educators do not even have a PhD degree in the field of education or have not conducted any research or made any contribution to improve themselves in the field of education (Gençdoğan, 2004).

As mentioned before, the structure of each teacher education program is different from one another due to the variations in national contexts (Snoek et al., 2009); therefore, they need to be researched from a contextual point of view. Although enough attention is not given to define teacher educator qualifications, the Turkish context of high school biology teacher education programs is a specific field of undergraduate study that is distinct from many teacher education programs in other countries. Moreover, in Turkey, specific competencies for biology teachers are defined by MoNE of Turkey (2013), which indicates the attention given to the specification of the biology education field in Turkey.

To this end, this study focuses on the professional competencies desired in biology education teacher educators in Turkey and aims to contribute to:

- the professional development of biology teacher educators,
- the re-evaluation of biology teacher educator education.
- the criteria for academic assignment and promotion of biology teacher educators.
- the future studies on the other fields of teacher educators.

1.4. Definitions of Key Terms

Swennen and van der Klink (2009) describe teacher educators as teachers in higher education and in school who are formally involved in pre-service and in-service teacher education. Koster, Brekelmans, Korthagen and Wubbels (2005) defines teacher educators as who provide instruction or who give guidance and support to student teachers, and who thus render a substantial contribution to the development of students into competent teachers. Moreover, mathematics teacher educators were defined by Çetinkaya (2014) as social scientists who are professionally interested in learning and teaching biology, conduct scientific studies in the field of mathematics education and provide instruction to pre-service or in-service teachers both on undergraduate and graduate degree levels. The definitions of key terms for the present study are given below.

Biology teacher educators: Social scientists who are professionally interested in learning and teaching biology, conduct scientific studies in the field of biology education and provide instruction to pre-service or in-service teachers both on undergraduate and graduate degree levels.

Competency: An underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or a situation (Spencer & Spencer, 1993, p. 9)

Competency indicators: The quantitative or qualitative parameters that determine and provide evidence for meeting a competency.

Delphi Method: is a research method to synthesize the most reliable consensus of opinion of a group of experts, by using a series of questionnaires with controlled feedback, (Dalkey & Helmer, 1962).



CHAPTER 2

LITERATURE REVIEW

Since the aim of education is to increase student literacy, the factors that contribute to this literacy have been researched for decades. One of the most important factors crucial to student literacy, achievement, attitudes and so on is the quality of teachers (Darling-Hammond, 2000; Hattie, 2003; Lanier & Little, 1986; Swennen & van der Klink, 2009; Chetty et al., 2013). Yet, as teachers are once the students of teacher educators, the qualifications of teacher educators should be scrutinized, as well. The attributes of a qualified teacher are discussed by teacher educators, however the number of studies conducted on qualified teacher educators is limited (Lanier & Little, 1986; Swennen & van der Klink, 2009). This gap in the literature has been remarked by some researchers and institutions in the last two decades.

Even though this research area has been growing in the literature, it is not possible to say there is a significant volume of research into this direction. One of the main research areas on teacher educators is conducted by relevant associations in different countries that have in place certain standards for qualified teacher education (ATE, 2006; ASTE, 1997; VELON, 2012; VELOV, 2012). In the literature, there are not many research studies conducted in order to identify teacher educator competencies in detail, which is criticized by some researchers (Morberg & Eisenschmit, 2008; Koster et al., 2005; Koster, et al., 2008). Although there are some studies that focus on the qualifications of teacher educators, most of them mainly aim to ascertain how teacher educators gain their qualifications. However, these qualifications are mostly abstract and do not present the general framework of the qualifications and/or competencies of teacher educators. Additionally, there are also some efforts to comprehend the professional development of teacher educators.

To this end, firstly, the professional standards presented in some of the discussions on the needs of professional standards are examined in the literature review chapter of this study. These are followed by the research conducted in order to determine the qualifications of teacher educators and the studies conducted to identify their qualifications. Moreover, the research on the education of teacher educators and their professional development are also presented in the second section. Various international and national studies are presented in these two sections. Here it should be noted that there is no consensus on using the term standard or competency to define the qualifications of teacher educators in the literature. Therefore, the arguments related to this topic are also presented at the end of the literature review.

2.1. Teacher Educator Standards

2.1.1. Importance of Professional Standards for Teacher Educators

According to Koster et al. (2005), teacher educators are people “who provide instruction or who give guidance and support to student teachers, and who thus render a substantial contribution to the development of students into competent teachers” (p.157). Based on this definition and other similar ones, some researchers propose that the quality of education given to student teachers is directly related to the educators of these teachers at universities or in-service training. Therefore, there are several teacher educators who emphasize the need for competencies and qualifications of teacher educators to be addressed by researchers (Çelik, 2011; Darling-Hammond, 2000; Imig, & Imig., 2007; Koster et al., 2005; Koster, et al., 2008). These researchers and/or academics claim that since there is no specific educational preparation program for teacher educators before they inaugurate at the university, they are obliged to develop their own professional competencies at the beginning of their professional lives. For this reason, professional standards would be helpful to see their inadequate and strong competencies (Koster et al., 2008).

The advocates of professional standards for teacher educators describe the standards briefly when they usually refer to what the profession expects the teacher educators

to know and be able to do (Ingvarson, 1998). By accepting this definition, some researchers indicate that competencies have a vital importance in defining standards. Therefore, competencies need to be a combination of knowledge, skills, attitudes, motives and personal characteristics that teacher educators possess to act effectively in a particular situation (Spencer & Spencer, 1993). Ingvarson (1998) emphasizes the importance of establishing standards as a way to provide guidelines and a point of reference for individuals.

Researchers focus on the different aspects of professional standards in teacher education, thus professional standards can have different functions for different perspectives (Koster et al., 2008). Ingvarson (1998) categorizes these functions so as to reach a consensus about what the profession in question expects highly accomplished teachers to know and be able to do, help professionals about their practice, and provide a guideline and a point of reference for individual professional development planning.

In addition to this perspective, some researchers base their thinking on the quality of teacher educators without using any standards. According to Katyal and Fai (2010), if pedagogical content knowledge is to be proposed by teachers and if university education is also an education process, teacher educators need to possess pedagogical content knowledge suitable for teacher education.

There is also a discussion on the generalization or specification of descriptions of competencies in the literature (Stoof et al., 2000, retrieved from Koster et al., 2008). Some think that if competencies are over-specialized, this may lead to long lists to manage in the attempt to understand whether teacher educators possess these competencies. Besides, there is also a debate on the idea that general statements of competencies do not have clarity, which leads to poor communication and diminished credibility (Eraut, 1994).

On the other hand, the professional standards for teachers or teacher educators are criticized, as well. The way standards are developed is one criticism, since these

researchers believe that these standards violate teacher educator rights and teacher educators who do not possess them would be valued as unprofessional (Zuzovsky & Libman, 2006). Not assessing the complexity and unpredictability of the teaching and learning environment by standards is another criticism (Korthagen, 2004). Another critical viewpoint is that if these standards were taken as the sole assessment tool, this would lead to deprofessionalization (Cochran-Smith, 2001; Valli & Rennert-Ariev, 2002). Finally, the validity, reliability, and practical feasibility of assessments of teacher educators are criticized (Zeichner, 2005). In another respect, it should also be mentioned that even though the development of standards is criticized, the value of professional standards for the purpose they are presented is supported (Zuzovsky & Libman, 2006).

Although there is no consensus on establishing professional standards for teacher educators, standards are generally favored since they can serve as guidelines for teacher educators themselves, as well as decision-makers and program designers. Additionally, they serve as benchmarks in assessing teacher educators and their work, which makes them invaluable (Çelik, 2011). If these standards are used as guidelines for work within a specific context and help individuals guide their professional competence and growth (Crooks, 2003) and yet are not used as an authoritarian assessment system (Ingvarson, 1998), they can be useful and serve the purpose fruitfully (Çelik, 2011).

2.1.2. Standards Proposed by Organizations and Researchers

The roles of professional standards are set by government publications, professional organizations and by some researchers. Three of the most important standards for teacher educators are defined by institutions and developed without any reference to the field of education.

The Standards for Teacher Educators established by the Association of Teacher Education (ATE, 2006) is the first initiative in this area. These standards are proposed with the purpose of revealing the accomplished teacher educators who have

a direct impact on teachers and school personnel who affect student learning. They define the accomplished teacher educator in consideration of nine key elements as presented briefly in Table 2.1.

Table 2.1. *Standards for Teacher Educators proposed by the Association of Teacher Education*

Standards for Teacher Educators
<u>Standard 1 Teaching:</u> Model professional teaching practices that demonstrate knowledge, skills and attitudes reflecting the best available practices in teacher education.
<u>Standard 2 Cultural Competence:</u> Apply cultural competence and promote social justice in teacher education.
<u>Standard 3 Scholarship:</u> Inquire into and contribute to one or more areas of scholarly activity that are related to teaching, learning and/or teacher education.
<u>Standard 4 Professional Development:</u> Inquire systematically into, and reflect on their own practice and demonstrate commitment to lifelong professional development.
<u>Standard 5 Program Development:</u> Provide leadership in developing, implementing, and evaluating programs for educating teachers that embrace diversity and are rigorous, relevant and grounded in accepted theory, research, and best practice.
<u>Standard 6 Collaboration:</u> Collaborate regularly and in significant ways with the representatives of schools, universities, state education agencies, professional associations and communities to improve teaching, learning, and teacher education.
<u>Standard 7 Public Advocacy:</u> Serve as informed, constructively critical advocates for high quality education for all students, public understanding of educational issues, and excellence and diversity in the teaching and teacher education professions.
<u>Standard 8 Teacher Education Profession:</u> Contribute to improving the teacher education profession.
<u>Standard 9 Vision:</u> Contribute to creating visions for teaching, learning and teacher education that take into account issues such as technology, systemic thinking and worldviews.

In addition to establishing the standards, ATE (2006) also defines the indicators and artifacts for each standard. For example, two of the 10 indicators of Standard 1 are to model effective instruction to meet the needs of diverse learners and to demonstrate appropriate subject matter content. Two of the 11 artifacts of the same standard are evaluations from supervisors, colleagues, students, or others, and course syllabi. As per this classification, there are 12 indicators and 10 artifacts for Standard 2; 10 indicators and 11 artifacts for Standard 3, 5 indicators and 7 artifacts for Standard 4, 5 indicators and 8 artifacts for Standard 5, 7 indicators and 5 artifacts for Standard 6, 3 indicators and 5 artifacts for Standard 7, 10 indicators and 10 artifacts for Standard 8, and 6 indicators and 9 artifacts for Standard 9.

The Flemish Association of Teacher Educators (VELOV, 2012) published The Flemish Teacher Educator Development Profile for the aim of facilitating professional development of teacher educators. However, the Association adopts the term standard with an alternative term development profile that can potentially act as an instrument for professional development. These standards are classified into 10 categories (VELOV, 2012). All of the defined categories begin with a short description of the quality required for the profile and also include the list of knowledge, skills and attitudes needed for each specific profile category. The categorization of the teacher educator profile proposed by VELOV (2012) is summarized in Table 2.2.

Table 2.2. *The Flemish Teacher Educator Development Profile proposed by VELOV*

The Flemish Teacher Educator Development Profile
<u>1. The fundamentals of being a teacher educator:</u> Teacher educators should exhibit mastery, technical repertoire, background knowledge, communication skill, congruence, and helicopter perspective.
<u>2. The teacher educator as a supervisor of learning and development processes:</u> Teacher educator should master the skills of teachers, be aware of the choices that they themselves and others make in teaching situations, provide explicit explanations of learning processes, possess a broad repertoire of didactic methods and methods for practice, serve as an example to beginning and existing teachers.
<u>3. The teacher educator as a supporter and supervisor of personal, social and interactive processes:</u> Teacher educator should be a guide to pre-service and in-service teachers; see the needs, capabilities, limits, and ambitions of teachers; and know how to deal with emotions, conflicts and problems.
<u>4. The teacher educator as a teacher education specialist (an expert in teacher education didactics):</u> Teacher educator should possess extensive didactic repertoire on teaching and learning. Their approach to teacher education should be in accordance with their own conceptions about learning and teaching.
<u>5. The teacher educator as a content expert:</u> Teacher educators should master their subject and the disciplines that they clarify to beginning and existing teachers.
<u>6. The teacher educator as an organizer:</u> Teacher educators should organize their time in a professional manner so that they perform their tasks efficiently and effectively.
<u>7. The teacher educator as an innovator and researcher:</u> Teacher educators should be conversant with research results related to learning and teacher education. They integrate these research results into the teacher education of beginning and existing teachers. Teacher educators should also engage in research.
<u>8. The teacher educator as a member of a teacher education team:</u> Teacher educators should share their work with colleagues and provide induction supervision of new colleagues. Teacher educators participate constructively in the necessary work-related consultation with colleagues.

Table 2.2. (Continued)

The Flemish Teacher Educator Development Profile
9. <u>The teacher educator as a partner for external stakeholders and as a member of the educational community:</u> They engage in debate with other people about educational topics, present their work to colleagues outside their own organization.
10. <u>The teacher educator as an involved and critical social participant:</u> They should be open to the outside world for its own sake and not merely in as far as it affects their work. They should take an interest in the world in general, and in the position of children and teenagers in particular. They should also be curious about things that are not immediately useful in their daily work.

The Dutch Association for Teacher Educators – VELON proposed the Dutch Professional Standards of Teacher Educators (VELON, 2012) with a different perspective. The Association defines a model instead of listing the standards desired in teacher educators. In this model, the fundamental principles of the profession are placed at the heart of the model and four competency areas are established as the standards which are surrounded by different perspectives on the profession of teacher educators as shown in Figure 2.1.

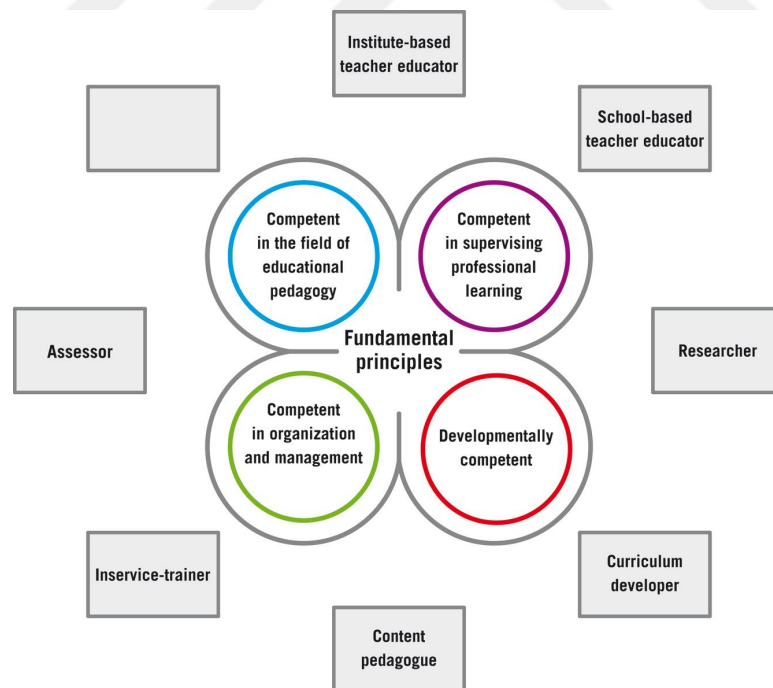


Figure 2.1. Dutch Professional Standard of Teacher Educators proposed by VELON (2012)

In addition to the standards proposed for teacher educators in general, The Association for the Education of Teachers in Science (ASTE, 1997) particularly defines standards specific to science teacher educators. ASTE (1997) criticizes the fact that significant attention is given to both in-service and pre-service science teacher educators in line with the reform in science education but the same importance is not given to science teacher educators despite their critical role in teacher education. Therefore, they maintain the need for setting standards for the individuals who design and implement teacher education programs, institutes, workshops, etc. Guided by this criticism, ASTE (1997) published the Professional Knowledge Standards for Science Teacher Educators.

These standards are developed not for the sake of presenting absolute prescriptions, but with an emphasis on providing guidance for the development and revision of science teacher education programs; improving the qualifications of individuals who conduct staff development projects, institutes, and workshops; and for raising awareness in beginning science teacher educators of the idea that being a teacher educator is an on-going development process that continues throughout their professional careers. These standards and their contents are summarized in the following:

Standard 1, which is named Knowledge of Science, mentions the importance of strong knowledge in several science disciplines for science teacher educators based on the idea that a science teacher educator needs to have an expertise in a particular area of science and/or wide knowledge across other science disciplines.

Standard 2, Science Pedagogy focuses on the formal background in science pedagogy equivalent to that required of the in-service and pre-service teachers.

Standard 3 is Curriculum, Instruction, and Assessment, and involves developing and implementing the curriculum and instructional materials, and assessing materials, as science teacher educators should have experience in a school environment.

In-depth functional knowledge on learning outcome, instructional and assessment approaches need to be possessed by science teacher educators, which constitutes the basis for Standard 4 called Knowledge of Learning and Cognition.

Standard 5 is Research/Scholarly Activity and means that science teacher educators need to possess specific skills to find answers to significant questions in different research studies by relating them to the research literature. This standard also includes synthesizing, applying, and creating knowledge related to science teacher education by having an in-depth knowledge of research approaches.

Standard 6 is Professional Development Activities, which emphasizes the awareness of the continuous process of being a teacher educator that starts from undergraduate education and lasts until the end of one's professional career. According to this standard, the qualified individual must have a strong knowledge of, and experience in science faculty development, including the design and implementation of workshops and institutes.

In addition to science in general, Professional Knowledge Standards for Physics Teacher Educators were also developed and recommended for a specific field of science by the National Institute for Physics Teacher Educators – NIPTE (Wenning, et al., 2011). Since the aim of NIPTE is to provide professional development opportunities for physics teacher educators, in order to help faculties, achieve this goal, University's Center for Mathematics, Science, and Technology (CeMaST) of Illinois State University has developed recommendations for the professional knowledge base of physics teacher educators to identify what teacher educators should know and be able to do. Recommended Professional Knowledge Standards for Physics Teacher Educators has three main standards and the extent of these standards can be summarized as in the following:

Content Knowledge Recommendations: an understanding of physics subject matter as well as research experiences within the discipline; a knowledge of science in general and of mathematics; an understanding of the nature of science, including its

history, philosophy, and epistemology at levels that exceed those specified in science education reform documents.

Pedagogical Knowledge Recommendations: experience in teaching at high school level and ideally formal teaching credentials for their state; an understanding of and experience with age-appropriate inquiry-oriented teaching practices; both knowledge of and skill in teaching with the use of effective inquiry practices; an understanding of how to establish and maintain effective classroom atmospheres that serve to motivate student learning; a theoretical background and practical experiences with curriculum, instruction, and assessment, including their development, implementation, and alignment; a knowledge of student learning and cognition; a knowledge of students' learning difficulties, and an empathy toward students' inability to understand physics; an understanding of the utility of and experience with appropriately using teaching and learning technologies; an understanding of the need of and resources for reflective practice, self-assessment, and ongoing professional development; an understanding of the state's school law as well as the teaching profession's ethical code of conduct.

Pedagogical Content Knowledge Recommendations: an understanding of the main goal of science education, and an understanding of what it means to be scientifically literate; an understanding of the authentic best practices of physics teaching; an understanding of the various approaches and practices associated with exemplary and successful physics teacher education programs; an understanding of how best to prepare future physics teachers; an understanding of the basic findings of science education research, but especially that of physics; an understanding of how best to recruit and retain high school physics teacher candidates; an understanding of safe teaching practices as outlined by the American Association of Physics Teachers and other competent authorities; a knowledge of effective high school curricula that can serve as teaching resources; an understanding of how best to formatively and summatively assess the performance of pre-service physics teacher candidates; an understanding of the role of clinical experiences, their role in teacher preparation,

and the effect of clinical placements of teacher candidates; an understanding of how best to provide transitional, mentoring, and professional development experiences for pre-student teachers as they move toward and work at their student teaching sites, and as first-year teachers; an understanding of the need for and an ability to work with the university's and educational program's accrediting agencies.

Unlike the other standards documents, the standards for the educators in mathematics teacher education were devised as a result of criticism made towards the doctoral programs in mathematics education. The goals, components and expectations of mathematics education doctoral programs across the United States were discussed in the National Conference on Doctoral Programs in Mathematics Education held in 1999 (Reys & Kilpatrick, 2001). Following this conference, the main expectations from doctorate graduates, namely future teacher educators, were defined by the Association of Mathematics Teacher Educators (AMTE, 2002) to be a guide for the design and implementation of doctoral programs in mathematics education. Besides, these requirements are named by AMTE (2002) as core knowledge and categorized into seven. Core knowledge expectations for the doctorate graduates in the field of mathematics education proposed by AMTE (2002) are summarized in Table 2.3.

Table 2.3. *Core Knowledge Expectations for Doctorates in Mathematics Education proposed by AMTE (2002)*

Core Knowledge Expectations for Doctorates in Mathematics Education
Mathematics Content: Doctorate graduates should have broad and deep mathematical knowledge sufficient to identify the big ideas in K-14 mathematics curriculum and the development of those ideas throughout the curriculum.
Research: Doctorate graduates should be able to synthesize the results of the studies, and carry out qualitative and quantitative research.
Historical, Social, Political, and Economic Context of Education: Since schools operate in a social context and are influenced by different historical, social, political and economic factors, and mathematics education is not immune to these effects, doctorate graduates should be able to understand such changes, effects and forces.
Teaching and Teacher Education: Since mathematics education doctorate graduates are going to be the ones who prepare future teachers, after they graduate they should be able to provide, teach and design mathematics content and methods courses for teachers, supervising the field experiences of prospective teachers, and organizing professional development experiences for practicing teachers.

Table 2.3. (Continued)

Core Knowledge Expectations for Doctorates in Mathematics Education
Technology: Since technological tools have a vital role in mathematics education, as in the other fields of today's world, mathematics education doctorate graduates should have knowledge of, and an ability to use such tools effectively for teaching and learning mathematics.
Curriculum: In order to facilitate the development of deep and connected mathematical understanding, assigning effective curricula and learning environments is one of the main responsibilities of teacher education. Therefore, mathematics education doctorate graduates need to be able to analyze, design, and evaluate curriculum.
Assessment: Doctoral graduates should know the literature on assessment, should be informed about the interconnections among learning goals, assessment and teaching, and should understand different forms and purposes of assessment.

In the Turkish context, the scope of the responsibilities required for all faculty members is given in the following as per the Law of Higher Education (2000) for every field of academics;

1. Faculty members have a responsibility to carry out education and studies at baccalaureate, baccalaureate and post-graduate levels in higher education in accordance with the objectives of the law.
2. Faculty members should have scientific research publications in the institutions of higher education.
3. Faculty members should give guidance, help and direct faculty students in accordance with the aims and basic principles of this law.
4. The duties given by the authorized organs should be carried out by faculty members.
5. Faculty members should carry out other assignments given in this law.

On the other hand, the “National Qualifications Framework for Higher Education in Turkey (NQF, HETR)” has been studied by the Turkish Higher Education Council (YOK) since 2006 (YOK, 2011).

In this project, UNESCO's ISCED (International Standard Classification of Education) are used and higher education is divided into 8 fields of education and training with 22 specific fields of education and training. Teacher training and education science were two of those specific fields of education.

At the end of the project, the qualifications of all eight fields are listed in two areas, which are knowledge-based academic qualifications and practice-based academic qualifications. In 2011, knowledge-based academic qualifications were shared by the stakeholders. The qualifications required for all fields are listed according to the degrees of education including associate's, bachelor's, master's and doctorate. Since this dissertation aims to identify the qualifications/competencies needed in teacher educators, the doctorate degree is analyzed and listed in Table 2.4.

Table 2.4. *NQF-HETR Teacher Training and Educational Science Basic Field Qualifications (Academic)*

Qualifications	
KNOWLEDGE -Theoretical -Factual	1-Develops and deepens current and advanced knowledge in the field at the level of expertise through authentic thinking and/or research, and reaches authentic definitions that will bring innovation to science-based viewpoints on graduate qualifications. 2- Establishes relationships between various disciplines and sub-fields that the field is related to, and reaches original results by using expertise in the analysis, synthesis and evaluation of new and complex ideas.
SKILLS -Cognitive -Operational	1- Approaches the new information in his / her field systematically and conducts advanced research in his / her field. 2- Develops a new scientific method that brings innovation to science or applies a known method to a different field; design and conduct an original research at this point. 3- Analyzes, synthesizes and evaluates critically new and complex ideas.
PROFICIENCIES Competency of working individually and taking responsibility	1-Contributes to science through a unique, publishable study that brings innovation to science, develops a new scientific method or applies a known method to a field. 2-Expands the boundaries of knowledge in the field by publishing scientific articles related to the field in national and / or international refereed journals. 3- Assumes leadership in original and interdisciplinary studies. 4- Carries out his / her studies independently or as a team member.

Table 2.4. (Continued)

PROFICIENCIES	Competency of communication and sociality	1- Critically examines the social relations and the norms that direct these relations, develops them and manages actions to change them when necessary. 2-Defends original views in an expert community. 3-Establishes and discusses advanced written, oral and visual communication by using a foreign language at least at the C1 level of European Language Portfolio. 4-Communicates by considering cultural differences in all national and international studies.
	Competency related to the field	1- Critically examines the social relations and the norms that direct these relations, develops them and manages actions to change them when necessary. 2-Defends original views in an expert community. 3-Establishes and discusses advanced written, oral and visual communication by using a foreign language at least at the C1 level of European Language Portfolio. 4-Communicates by considering cultural differences in all national and international studies.

It can be observed that the qualifications defined for the field of education and training at doctorate level are too broad. When compared with the other 7 fields, it can be seen that they are not specific to education and training. Even the defined competencies related to the field in the field of education and training are the same with the fields of journalism and information.

On the other hand, Gözalan Çiçek (2016) conducted a research to determine the general subject area competencies of teacher educators in Turkey by interviewing 15 teacher educators, and in this study, 106 items with 12 sub-dimensions were identified under the general subject area competencies of teacher educators. The standards summarized herein are analyzed in detail in the following section, and the scope of the sub-dimensions defined for the general subject area competencies of teacher educators in Turkey include Scientific Research, Working Interdisciplinary, Field of Expertise, General Culture Knowledge, Educational Technologies, Learning-Teaching Process, Guidance, Assessment and Evaluation, Personal

Features and Values, Professional Development, Foreign Language Proficiency and Teacher Education.

2.2. Studies on Teacher Educators Qualifications and Competencies

Although many researchers and institutions have emphasized the importance of the competence of teacher educators, the volume of research in this area is still very limited to fill the gap in the literature. This gap is criticized by Morberg and Eisenschmit (2008) in that first-order teachers receive education to become a teacher but there is no special education for second-order teachers, which might be a necessity. Since there is no such specific education, teacher educators need to conduct their own professional development and lifelong learning both at university level and as a teacher in school to guide teachers and help teachers in guiding their own students.

However, there are some studies in the literature that can be regarded as an initiative to identify teacher educator qualifications. These research areas can be generally evaluated under two main categories. One of these categories is the research directly conducted with the aim of defining the qualifications of teacher educators. It should be mentioned that the research studies in this area are the most limited ones (Zaslavky & Leikin, 2004; Murray & Male, 2005; Berry, 2007; Abell et al., 2008; Berry & Van Driel, 2012; Masingila, Olanoff & Kwaka, 2012; Downing & Dymont, 2013; Superfine & Li, 2014; Goodwin, et al., 2014). The other category is based on the studies in which teacher educators follow their own professional development. Since the studies in this scope are applied to increase the competencies of teacher educators, they can be considered as studies evaluating the competencies of teacher educators in a way (Koster et al., 2008; Ben-Peretz, Kleeman, Reichenberg & Shimoni, 2010; Hollins, Luna & Lopez, 2014; Dengerink, Lunenberg & Kools, 2015; van der Klink, Kools, Avissar, White & Sakata, 2017; Ping, Schelling & Beijgaard, 2018). Although the research studies in this area are classified under two

categories, it should be noted that these categories cannot be separated from each other by clear-cut lines.

2.2.1. Professional Competencies and Qualifications of Teacher Educators

One of the main studies on the knowledge requirements for teacher educators is conducted by Goodwin, et al. (2014). For this study, essential teacher educating knowledge, a term differentiating teaching teachers from teaching students, is examined within the scope of three main research questions: “What do current teacher educators consider to be the foundation elements of their practice? How do they evaluate their own preparation in these areas? How can their experiences inform the preparation of teacher educators?” The study uses a mixed design method with a two-phase research design. In phase I, a survey with 45-point Likert scale items was sent to the respondents. In the survey, respondents were asked to answer each item in two questions. Firstly, they were asked how important the items were for their profession as teachers, and secondly they were asked to analyze the items, i.e. how well they felt their doctoral program prepared them in the particular area/item. These 45 questions were grouped under eight categories including theoretical knowledge, ability to apply theory, content knowledge, familiarity with research, ability to conduct research, interpersonal skills, reflection, and professional activities. In addition to these questions, there were some demographic items, as well as other items about respondents’ preparation to be teacher educators, and also two open-ended questions. This survey was e-mailed to the mailing lists of a large educational research organization. In phase II, qualitative data were collected by means of a semi-structured interview.

Taking the survey data used in Phase I into consideration, the relationships between the aforementioned seven categories and demographic information were analyzed. As a summary, it was found that the participants who reported teaching for less time tended to rate the ability to conduct research as significantly higher in importance. In addition, the participants who had been involved in teaching and education for

longer periods of time rated reflection as higher in importance. The participants who had more recently become involved in education believed they were better prepared in the ability to apply theory and in the domains of multicultural issues. More recent graduates also tended to rate their preparation as higher in the domains of theoretical knowledge ability to apply theory familiarity with research reflection and in multicultural issues. Female participants tended to rate several areas as higher in importance compared with male participants: theoretical knowledge content knowledge ability to apply theory familiarity with research interpersonal skills, professional activities and multicultural issues. 293 teacher educators who completed the survey were invited for interview. 20 of 125 voluntary respondents were randomly selected and interviewed. All interviews were conducted on the telephone, audio recorded, and transcribed. Afterwards, these interviews were analyzed using the interplay of inductive and deductive coding. Like the survey, during the interviews teacher educators were asked to evaluate their doctoral preparation in relation to their current works as a teacher educator. The result of the interview was summarized under three topics by the researchers: preparation of current teacher educators, elements foundational to the work of teacher educators and recommendations about preparation. Regarding the result of the first topic, almost all of the interviewees stated that they did not plan to become a teacher educator, it was just a happenstance; while five of them said that becoming a teacher educator was their career objective. Additionally, the interviewees mentioned that there was no specific professional development during their doctoral studies. In the second topic on the elements foundational to the work of teacher educators, it was mentioned that what teacher educators teach and how they teach needs to be identified and examined. Additionally, the interviewees also emphasized the importance of lifelong learning and collaboration with their colleagues. The participants also made some suggestions about teacher education preparation process, which is collected under the third topic for the result of the interviews. To sum up, they suggested that in the course of teacher educator preparation importance needs to be attached to a strong foundation of educational theories, knowledge about

the field of teacher education, intentional mentorship and apprenticeship in teaching and research, and mentoring throughout the professional life in the academy.

Another study on teacher educators' self-perceived competencies is conducted by Downing and Dymont (2013). In this study, a survey of 34 items was implemented with 27 of 97 teacher educators who give online lectures at an Australian university. In general, the survey aimed to analyze teacher educators' perceived readiness, preparation for online teaching and their support and professional development opportunities. In order to identify teacher educators' perceived competence, confidence, reluctance, and willingness of their own, they were asked to indicate their competence and confidence on a sliding scale from 0 to 100. The results were widely variable, where the minimum value was 0 for both competence and confidence, and the highest was 90 for competence, 81 for confidence with a mean of 34 for competence and 43 for confidence. Additionally, 26% of the participants stated that they were reluctant to teach online because they are not confident with their technical skills; whereas 37% stated that they have a lack of pedagogical knowledge for online environment, 33% mentioned that they are concerned about the students' abilities to learn effectively online and 26% said that they have a concern that they might not enjoy teaching online. In the study, the need of teacher educators to begin teaching online was also asked and 67% of the participants mentioned that they lacked the technical skills to develop online learning materials, and 81% of them believed that they lacked the pedagogical knowledge to teach well online. On the other hand, all of the participants had professional support and development opportunities from different resources. For example, almost half of the respondents indicated that the Faculty's eLearning Support team gave them individual support, which was seen as the most useful support by 49% of the teacher educators. In addition to personal support, teacher educators also mentioned that they read articles and books, and they learn technology by themselves. On the other hand, for 49% of the participants, the professional development workshops and seminars given by formal universities are the least useful support.

The studies on the qualifications of science teacher educators are much more limited. One of the studies in this field is conducted by Abell et al. (2008), which focuses on the lack of importance given to the preparation of future science teacher educators in doctoral programs. For this purpose, they propose a model based on the pedagogical content knowledge (PCK) of teacher educators, and they emphasize that in doctoral programs, the opportunity to observe, practice and reflect on their PCK must be given to prospective science teacher educators. At this point, authors criticize ASTE (1997) Professional Knowledge Standards for Science Teacher Educators for not having an aspect or a standard on how to teach future teacher educators.

The model presented by Abell, et al. (2008) is adapted from Grossman (1990) and Magnusson, Krajcik and Borko (1999). By the help of this model and the experiences of the authors involved, they mention that teacher educator programs and PhD programs should develop PCK of instructional strategies for teaching teachers (V_1), PCK of curriculum for teaching teachers (V_2), PCK of assessment for teaching teachers (V_3), PCK of learners for teaching teachers (V_4), and develop orientations for teaching teachers (V_5). Additionally, the authors mention that all of them are in continuum during the professional development of teacher educators. In addition to this model, they also offer a second model to show this continuum of learning, which is shown in Figure 2.2.

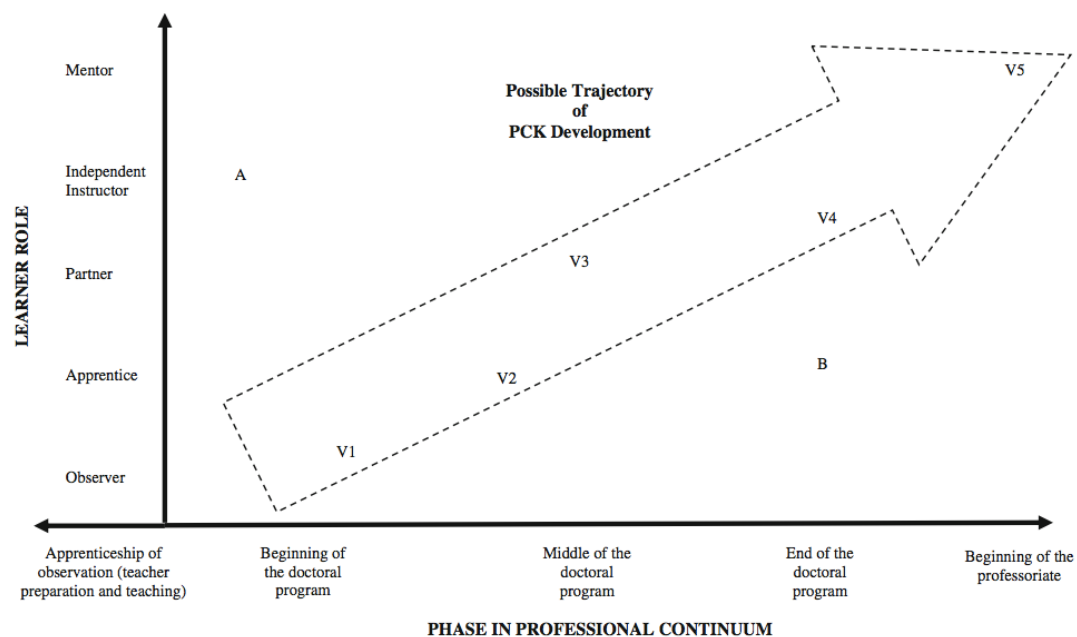


Figure 2.2.A model for the phases in professional continuum. Adapted from “Preparing the Next Generation of Science Teacher Educators: A Model for Developing PCK for Teaching Science Teachers” by S. K. Abell, M. A. Park Rogers, D. L. Hanuscin, M. H. Lee and M. J. Gagnon, 2008, Journal of Science Teacher Educator 2, p. 87. Copyright 2018 by Informa UK Limited.

At the beginning of the doctoral program, the students (prospective teacher educators) need opportunities to observe the teacher educator, and need to reflect on how the teacher educator has developed and implemented PCK for science teachers. When PhD students progress in the program, they need to go beyond observing and become apprentices. During this phase, PhD students need to actively engage in a discussion with a veteran teacher educator on the readings and small pieces of practices on teacher education. After this phase, PhD students engage in the partner phase in which they work with the teacher educator as a team on designing and implementing science methods courses. At the end of the doctoral program, PhD students would be able to have an independent responsibility for teaching to the teacher. The veteran can also play a significant role, but in this phase the veteran should become a mentor, providing feedback when needed. In this phase, the veteran

teacher educator is also a learner, who is in the fifth phase (mentor), because learning from mentoring has a significant role in the professional continuum of science teacher educators. From this perspective and with the help of the model, the authors propose an additional standard to ASTE's (1997) Professional Knowledge Standards for Science Teacher Educators named Knowledge for Teaching Pre-service Teachers and present this definition: *"The beginning science teacher educator possesses knowledge for teaching teachers of science in pre-service settings, including orientations, knowledge of pre-service teacher learning, knowledge of methods course curriculum, knowledge of instructional strategies for teacher education, and knowledge of assessment for methods courses."* (p.91)

Berry (2007) conducted a self-study to identify her understanding of the learning process to teach pre-service teachers. According to Berry, the knowledge of teacher educating practice is complex and ambiguous which creates a source of tension that challenges teacher educators to understand their work. Therefore, the main purpose of her study was to understand how this tension can increase teacher educators' understanding of their practice and promote their professional knowledge. The data sources were selected in the form of a written autobiography, videotapes of method classes, journals, field notes, colleague observations, student assignments, interviews with pre-service teachers and e-mail correspondence with one pre-service teacher all the year long. Even though Berry does not dwell on competencies in the findings of the study, the results of this study are nevertheless notable. In her study, Berry mentions that she has developed new levels of understanding about her teaching practice and indicates that her actions in practice and her intentions for practice are a slow and complex process.

As a further research, Berry and Van Driel (2012) conducted another research to identify the objectives of science teacher educators for teaching about science teaching and how their expertise developed on the basis of their professional background and experiences. They gathered data from 12 experienced science teacher educators through interviews and storyline protocol. The result of their study

revealed that the majority of science teacher educators prefer this career with aim of making science more comprehensible and more attractive to school students. All of them feel uncomfortable due to the lack of a structure that could help them develop their practice as a community.

Compared to the field of science, the number of studies conducted on the competencies of teacher educators in the field of mathematics is higher. Although mathematics teacher educators are not the subject of this dissertation, they are also put through this analysis since these studies are broader and give us an idea for the qualifications desired in science teacher educators.

Superfine and Li (2014) conducted a study with the purpose of exploring the knowledge needed for the teacher educators who teach pre-service elementary teachers in mathematics and for identifying how this required knowledge is different from the knowledge required in the K-12 teachers. For this purpose, two required content courses –one designed for developing mathematical knowledge needed for teaching and the other engaging pre-service teachers in explaining, representing, and understanding and reacting to mathematical thinking– were videotaped during the semester. Then, these videotapes were analyzed by two coders. The results of the study revealed that mathematics teacher educators use three different forms of knowledge, which are different from the knowledge needed by K-12 teachers. These three different knowledge types are: connecting student errors to instructional moves, connecting algorithms to the K-6 curriculum, and connecting research to mathematics content learning.

In another study, Murray and Male (2005) focused on 28 new teacher educators who had previously worked as a first-order teacher, which is obligatory to be a teacher educator in Britain. Since this study was a qualitative study and its purpose was to identify the experiences of new teacher educators, purposive sampling was preferred. Semi-structured interviews were conducted with the participants, which focused on the time when they felt that they should become a teacher educator and assume this

professional identity, and additionally due to which factors such feelings are aroused. In addition to the semi-structured interview, a questionnaire was put to use in order to collect relevant biographical information. The results of the study revealed that the first year of higher education work is especially a stressful time even though one had previously worked as a first-order teacher. In the second and third years of the work, teacher educators feel more self-confident as a result of their interaction with other colleagues. Although these teacher educators had experienced teaching as a first-order teacher, this did not help them to get satisfied with their pedagogical knowledge for higher education students, since the pedagogy that they need in higher education is different from what is needed in school teaching. Another area that teacher educators have difficulty in is becoming research-active. Even though this study reveals important findings about teacher educators, it does not give much information about their competencies; it rather gives information about the feeling and self-perception of teacher educators without any direction.

Unlike the previous studies, Zaslavky and Leikin (2004) proposed a model for the learning and teaching processes of teacher educators, and they verified their model in a five-year professional development project for mathematics teachers. The proposed model is designed as a three-layer model of growth practice as a conceptual framework, which is a combination of Jaworski's teaching triad and Steinbring's learning-through-teaching process model. This model proposes that teacher educators develop their knowledge both through learning and teaching.

During the implementation of this five-year teacher education program, which aims to facilitate the knowledge of teachers, promote their ability of teaching and learning experiences, enhance their and teacher educators' socialization and develop a supportive professional community, qualitatively multiple data were collected to test the model. These data were derived from the observational notes taken by the teacher educators while they were implementing the program, videotapes of the lectures, and detailed minutes of staff meetings. The authors confirmed their model after the analysis. In the model, it is suggested that just like teachers, teacher educators also

learn through a different channel; yet unlike teachers, there are three actors in teacher educators' learning processes: mathematic teachers (MT), mathematics teacher educators (MTE) and mathematics teacher educators' educators (MTEE). The interactions between these actors are also important. During the learning process of teacher educators, some integrations were detected between MTE-MTE, MTE-MTEE, MTE-MT, MTEE-MTE-MT.

A different study conducted by Masingila, Olanoff and Kwaka (2012) aims to identify the profile of primary mathematics education teacher educators with this research question: "Who teaches mathematics content courses for prospective elementary teachers, and what are the academic and teaching backgrounds of these instructors?" A survey was sent to 1925 institutions, and 42.8% of the faculty members from 825 institutions on teacher education programs participated in the survey. The results of the study revealed that 78.4% of the programs are specifically offered for prospective elementary teachers' mathematics content courses; while mathematics departments are given 88.3% of those programs. 7.6% of those remaining programs offer the same courses through education faculties and 4.1% through both mathematics departments and education faculties. Besides there were other important findings in this study which are relevant to this dissertation: The ratio of the respondents who mentioned that there was a person (or people) designated as the course supervisor(s) for the mathematics content courses specifically for prospective elementary teachers is 63.8%, the percentage of the respondents who indicated that the course supervisors taught one or more of these courses is 92.6%. Additionally, only 28.7% of the respondents stated that these course supervisors had a doctoral degree related to mathematics education and 24.3% had a doctoral degree related to mathematics. Moreover, 83.2% of the respondents indicated that these course supervisors had undergraduate mathematics teaching experience.

2.2.2. Professional Learning and Development of Teacher Educators

As it was mentioned at the beginning of this section, there are some research studies focusing on the professional development of teacher educators in recent years. The Standards for Teacher Educators presented by the Dutch Association of Teacher Educators Standards for Teacher Education were used in one of main studies in this area. In the Netherlands, a project named Professional Quality of Teacher Educators (SPR) aims to provide self-assessment, professional development and registration to teacher educators, and upon completion, teacher educators are certificated. In this project, the Standards for Teacher Educators presented by The Flemish Association of Teacher Educators (VELOV, 2012) were used as a reference point by the teacher educators who participated in the SPR project (Koster et al., 2008). The project included a research with 25 teacher educators that took part in the SPR project. Four of the participants had less than four years of experience, five of them had four to seven years of experience, 12 had seven to 18 years of experience and four of them had more than 18 years of experience. In terms of age, seven of them were 30-39 years old, 13 of them were 40-49 years old, and five of them were older than 49 years old. Since the aim of the project was to improve teacher educators' perceived weak areas as a teacher educator, at the beginning of the project they were asked to point out the areas they would want to improve, which constituted the goals of professional development area of each participant. After each participant identified their needs, the researchers classified those needs according to the first version of the Standards for Teacher Educators presented by the Dutch Association of Teacher Educators. In the first version of the Standards for Teacher Educators, the standards were categorized into two as the foundation area: basic attitudes and beliefs for teacher educators with six sub-categories, and general competencies with five sub-categories. After the participants marked their goals, researchers counted them according to the standards. It is found that 19 of the goals refer to the standards under basic attitudes and beliefs, and 51 refer to the standards under general competencies. Additionally, it should be mentioned that the competencies related to pedagogy and

organizational skills were the most frequently mentioned competencies, which are also taken as standards. In the study, the professional development activities taken up by the participants during the project were also included. Since the findings in this part of the project are not relevant to the current study, this project is not incorporated into this dissertation.

As it was mentioned before, there is a growing interest of research on the professional development of teacher educators (Ping, Schelling & Beijgaard, 2018). Even though most of those studies do not mention the competencies needed in teacher educators, since professional development is an act to contribute to enhancing the competencies, these studies are also taken into consideration for the present dissertation.

Asking questions such as ‘Do experienced teacher educators from different countries differ in their concerns, professional development activities and developmental goals?’, van der Klink, Kools, Avissar, White and Sakata (2017) conducted a study with 25 experienced teacher educators from 10 different countries. Since the result of this research gives a concrete example of how teacher educators contribute to their professional development, its outputs are presented in detail in this dissertation.

When the concerns of teacher educators were analyzed, it can be seen that their transformation starts from the beginning of their career and lasts until they become an experienced teacher educator. At the beginning of their career, the concerns of teacher educators mostly focus on how to become a teacher educator, manage student groups, instruct students, and get used to the university. While becoming more advanced in their career, their concerns shift towards their own identity, their students as individuals with different ambitions and needs, and how to create space for reflections to educate student-teachers. When it comes to professional development activities, almost all of the teacher educators state that conferences, courses, workshops or training as well as team meetings, collegial consultation and collaboration with colleagues contribute to their professional development. Besides,

they see themselves as mentors or coaches to the new teacher educators. Moreover, teacher educators also confirm the idea that conducting research also contributes to their professional development. Instead of having developmental goals, the participants have their own ideas for future developmental activities and most of them have clear plans about what they want to learn. However, even though they already have plans, they state that they are having difficulties in finding resources, time, and money for those activities.

There are some other institutes which works to improve teacher educators' professional development. One of them is MOFET Institute in Israel, which focuses on the research and development of programs in teacher education and teaching the colleges. This institute has a unique framework in Israel and worldwide for prospective teacher educators and for supporting teacher educators' professional development. Ben-Peretz, Kleeman, Reichenberg and Shimoni (2010) conducted a research with the teacher educators who participated in this institute's various professional development programs in planning, managing and implementing to understand their professional development. The participants of this research were 10 high-level and middle-level MOFET executives since they would have meta-knowledge concerning teacher educators' professional development. Interviews were conducted with those executives and grounded theory approach was preferred as a research design. All of the 10 interviewees mentioned the need for establishing communities of teacher educators as an essential part of their professional development. Besides, the participants stated that self-regulation has an important role as well as the personal developmental goals of professional development. Additionally, the result of the study revealed that the executives see self-study practices act as the most significant methods for personal development because it helps self-discovery, and they mentioned that it is almost impossible to teach a teacher educator how to teach.

From a different perspective Dengerink, Lunenberg and Kools (2015) conducted a study to identify in which areas and domains teacher educators prefer to learn, what

kind of learning activities they choose and with whom they prefer to learn, and whether the preferences change among school-based and university-based and experienced and less experienced teacher educators. The participants of this study included 268 teacher educators (112 school-based and 156 university-based teacher educators) in the Netherlands, as in this country, teacher educators should register to a program operated by VELON (2012) and fulfill the professional standards designed for teacher educators (Koster & Dengerink 2001, Koster & Dengerink 2008). For this study, the authors preferred to use a digital questionnaire. All of the research questions were also analyzed with the difference between school- or university-based teacher educators in consideration and their experience as a teacher educator. The result of this study revealed that the percentage of the participants who indicated that their vision on teacher education sharpened in the last 2 years was 72, who became more skillful in coaching students was 63, who became more skillful in teaching students was 42, who acquired more theoretical knowledge about teaching and/or coaching students was 53, who became more proficient in other tasks than teaching and coaching was 42 and who acquired more research skills was 40. In response to the question of what they wanted to learn in the next two years, the majority of the participants (73%) said that they want to acquire more skills in teaching, which is the most significant goal for professional development that had a higher score than the previous two years. Likewise strengthening the theoretical underpinning of their work remained important to them as well, increasing to 67% from 53%. When it comes to the differences among teacher educator groups (school-based and university-based) regarding the professional development goals, school-based teachers want much more to learn about the cooperation between schools and universities and educational policies. Interest in coaching was higher in school-based teacher educators, while improving teaching arouses more interest among university-based teacher educators. As an answer to the question of how they learned in the previous two years, 90% of the participants indicated that they learn by consulting their colleagues, 85% by reading scientific or professional literature about a specific subject, 81% by participating in seminars or conferences, 55% by experimenting on

their teaching, and 55% by participating in innovative educational projects. The learning source preferred for the next two years was almost similar with the answers given for the previous two years, but that there are also remarkable shifts in a few items. Learning by consulting colleagues decreased while learning by experimenting and carrying out research got higher scores. The final question for the study was related to the source preference for professional development. More than half of the teacher educators indicated that they want to improve their learning individually, followed by 46% within the context of regional cooperation and by 43% with the colleagues of their own institution or school.

As it was mentioned before, professional learning for teacher educators is a growing research area, especially in the European countries. To this end, Ping et al. (2018) conducted a systematic review to identify what, how and why teacher educators learn by reviewing 75 research studies. Those articles were selected with reference to two main criteria. The first criterion was the focus of the article content to be on the teacher educators who work in higher education institutes. The second criterion was involving one of the three aspects of professional learning, which are the content about which teacher educators learn, the activities through which they learn, and their reasons for engaging in professional learning. The results of this research showed that 46 of the articles were about the pedagogy of teacher education with three sub-categories: learning about teaching, teaching about teaching, mentoring and supervision. This was followed by 22 articles on research and reflection in the professional learning of teacher educators. Other areas were professional identity (20 articles) and knowledge base (15 articles). In addition to the content, the learning activities that teacher educators prefer to use were also analyzed by authors. It was found that in 33 of the articles, teacher educators prefer to learn through academic engagement. It was followed by 32 articles in learning through collaborative activity, 16 articles in learning through attending professional development programs, and 9 articles in learning through reflective activity. Additionally, the reason why teacher educators prefer to learn was also analyzed and it was found that in 12 of the articles,

teacher educators prefer to learn due to external requirements, 29 of the articles resulted that they are driven by personal ambition and only 5 of them reveal that the reason why teacher educators learn is professional role transition.

Abell et al. (2008) mentioned that the professional life of teacher educators starts at the beginning of doctoral programs. Therefore, doctorate education needs to be taken as a starting point for the competency development process of teacher educators. One of the most important research studies about doctorate students is conducted by Hollins, Luna and Lopez (2014) with the aim of identifying the practices of a cohort of traditionally appointed teacher educators with the responsibility for facilitating teacher learning and learning teaching. Practice-to-theory field experience (PTE), a reflective paper analyzing the PTE, and a shared set of readings on pedagogy for facilitating teacher learning and learning teaching with the PTE as context were used as involved approaches. 21 doctorate students were selected as participants of the study. Data from three sources were used, which included the journals kept by participants during the PTE, the reflective papers written by participants in conjunction with the PTE, and the dialogues on the electronic discussion board for the pedagogy course that followed the PTE. At the end of the study, the authors revealed three main conclusions. The first conclusion was that teaching competence is a necessary but insufficient condition for becoming a competent teacher educator. The second main conclusion was that several years of experience without formal guidance or preparation may not improve the knowledge, understanding, or performance of teacher educators. And the third conclusion was that the combined processes of documenting and analyzing one's own practice using the literature as an analytic tool, and interrogating documented and traditional practices through dialogue with peers, supported by a carefully selected and shared set of readings from the scholarly literature can facilitate the development of competence and deep knowledge for teacher educators.

Even if there is a consensus on professional development of teacher educators is a lifelong process, it cannot be said that there is a consensus for the appointment and

promotion of teacher education who work at universities. As it was mentioned in the report of Supporting Teacher Educators for Better Learning Outcomes (European Commission, 2013) entrance criteria of qualifications and prior experience is an useful tool to provide a minimum level of needed qualifications of teacher educators at the start of the teacher. Most of the European countries have specific criteria. Having academic degrees (master's degree or PhD) as well as having teaching experience at primary or secondary level is the most two common criteria among European countries. In the report it was criticized that the selection criteria focus on only some aspects of the professional roles of teacher educators. Even if those two criteria focus on teaching to students, who are at the level of primary and/or secondary education, and research, they do not cover any qualification for teaching to teachers.

In Turkish context appointment of teacher educators do not differentiate from other academic staff at different faculties. Those minimum criteria were set by Law on Higher Education (1981) and modification was done in 2018. According to the latest modifications, having a PhD degree is the only minimum criteria for all of the academic staff as well as teacher educators. In the regulation it was mentioned that universities can determine their own criteria in addition having the PhD degree. In the same modification promotion to associate professorship and professoriate is also determined for all of the academic staff as well as teacher educators. For applying to the promotion of being associate professorship, having a PhD Degree, sufficient score in foreign language exam, and sufficient amount and quality of research are determined as the minimal criteria. After the application when the candidate who is determined to have sufficient publications and studies by the Interuniversity Board, is given the title of associate professor. After this stage universities can set their own criteria for the appointment of associate professorship which can be additional criteria. The only legal limitation to the universities for implementation of those additional criteria is in case the oral examination is included among the additional conditions determined by higher education institutions, this examination is

conducted by juries to be formed by the Interuniversity Board. For the promotion to the professoriate working as an associate professor in the field of science for a period of at least five years with an open professorship, and after receiving the title of associate professor, original publications or studies in the related field of science are the minimal two criteria. Similarly, to the other titles universities can set their own criteria for the appointment of professorship. As a summary, for appointment and promotion of teacher educators there is not any minimal criteria towards having teaching experience or any other criteria related to teaching.

Similarly, to this differentiation at country level the studies on determination of qualifications of teacher educators or professional development of teacher educators are much more limited in number and narrower in scope in Turkey. These studies can be categorized into two: the studies aiming to identify the qualifications desired in teacher educators (Kavak, 1986; Şen & Erişen, 2002; Arslantaş, 2011; Gözalan Çiçek, 2016) and aiming to identify the demographic features and/or personal qualifications of teacher educators (Gençdoğan, 2004; Karakütük, Tunç, Özdem & Bülbül, 2008; Aslan & Yakar, 2012; Erişti, 2013; Yalçinkaya, Koşar & Altunay, 2014; Tunca, Alkın-Şahin, Oğuz & Güner, 2015).

One of the important research studies aiming to identify the qualifications desired in teacher educators was conducted by Gözalan Çiçek (2016) as a dissertation with the title “General Subject Area Competencies of Teacher Educators in Education Faculties” with the purpose of determining the general subject area competencies of teacher educators and evaluating their perceptions of owning those competencies. As a first step of the study, the researcher conducted interviews with 15 teacher educators from three different universities in Turkey to establish the item pool of competencies. At the end of these interviews and literature review, 276 items for competencies were formed. Then, all of those items were analyzed in collaboration with experts and were reduced to 144 items. All of those items were piloted with 212 teacher educators and after the analysis, 106 items were used for the scale to measure the perceptions of teacher educators’ general subject area competencies. Data were

collected from 789 teacher educators for the scale of perception about their general subject area competencies. The analysis of the study revealed that teacher educators view themselves highly competent in their general subject area. The perception of high competence was found in the items related to personal characteristics and values. On the other hand, foreign language competency had the lowest score in terms of perceived competence.

In addition to Gözalan Çiçek (2016), the first and most comprehensive study was conducted by Kavak (1986) for about three decades ago. In the study, two research questions were posed for investigation. The first research question was about teacher educators' and their students' perception of academic competencies. The perceptions of teacher educators related to their own professional development constituted the second research question. The population of the study consisted of 1029 academics from 14 education faculties and 8282 last grade pre-service teachers. The sample consisted of 711 teacher educators and 710 pre-service teachers, and the data were collected by the researchers through questionnaires. Assessment tools consisted of five scales: content knowledge, teaching methods, measurement and evaluation, research, and personal relations with 48 items. For different purposes, various statistical techniques were used, but pre-established or calculated ES, alpha or beta values were not cited. The findings of the study revealed that most of the teacher educators perceive themselves as somewhat competent in all subscales, while the perceived competencies in terms of research skills were relatively negative compared with the other subscales. Similarly, for teacher educators, pre-service teachers' perception about teacher educators' competencies on research were negative compared with the other subscales. But more importantly, there were significant differences between teacher educators and pre-service teachers' perception about the competencies of teacher educators, and pre-service teachers' perception on their teacher's competencies was negative in every subscale. There were no significant differences in both teacher educators' and pre-service teachers' perception among different fields or academic titles. However, teacher educator perceptions about

competencies tended to increase in accordance with seniority. Even though most of the teacher educators had a graduate degree, others cited that if they had the opportunity, they would like to attend a graduate program.

A similar study was conducted by Şen and Erişen (2002) with 82 teacher educators from Gazi University and 150 pre-service students on four research questions. The first research question was about finding the teacher characteristics that have an effect on teaching. The second and third research questions aimed to determine the opinions of teacher educators and pre-service teachers as to what extent teacher educators possess effective teacher characteristics. The last research question was about whether there is a significant difference between the opinions of teacher educators and pre-service teachers with regard to teacher educators' possession of these characteristics. The data were gathered in a questionnaire that was comprised of 95 questions in 9 subscales. These subscales were world knowledge, content knowledge, planning and preparing for lectures, learning and teaching strategies, teaching tools, communication, classroom management, measurement and evaluation and personal characteristics. Mostly, descriptive statistics were preferred throughout the analysis, while t-test was used to test the fourth research question. Additionally, the alpha level was reported as .05; and the effect size or power of the study was not mentioned. The result of the study revealed that teacher educators perceive themselves mostly competent in each subscale while pre-service teachers' perceptions about teacher educators' competencies in each subscale are significantly lower.

Although not as detailed as in the other studies, the study conducted by Arslantaş (2011) can be acknowledged as one of the studies aiming to identify the qualifications of teacher educators. In this study, Arslantaş (2011) researched the teaching methods and techniques, communication, measurement and evaluation skills of teacher educators from the point of view of their students. The questionnaire was developed by the researcher and was implemented to 568 pre-service teachers. The result of this study revealed that the skills of teaching methods and techniques,

communication, measurement and evaluation of 60% of teacher educators were not regarded sufficient by their students.

As it was mentioned before, there are also some studies that aim to reveal the demographic features and or personal qualifications of teacher educators. One of these studies was conducted by Erişti (2013) to determine the profiles of the academic staff at the Departments of Curriculum and Instruction at the universities in Turkey in terms of different variables such as their demographic characteristics, the universities where they are employed, where they come from, their scientific productivity, ability for scientific research and their information and technological competencies. The data of the study were derived from 105 academic staff in 28 universities with an instrument of 59 items developed by the researcher. Descriptive statistics of the study were given and inferential analyses were conducted with non-parametric tests. The research data were analyzed, and it was found that most of the academic staff was relatively young and the number of male academic staff was higher than women. More than half of the academic staff worked at other companies or institutions prior to being a faculty member, and almost all of the academic staff completed their undergraduate education at the Turkish universities. The proportion of academic staff that completed their graduate education at international universities was about %10, but more than half of the academic staff had an international research experience or education. The majority of the faculty members used pre-service teachers as the research group for their scientific studies. More than half of the academic staff preferred presenting papers in international meetings. On the other hand, almost none of the academic staff has any publications in SSCI-indexed journals.

One of the other study aims to identify the profile of teacher educators in the public university education faculties in Turkey based on demographic, socioeconomic variables, lifestyle and consumption habits was conducted by Karakütük, Tunç, Özdem and Bülbül (2008) as a study under Scientific and Technological Research Council of Turkey (TÜBİTAK). Additionally, this study aimed to identify teacher

educators' perceptions about social, economic, political and professional issues. For this study, the researchers developed a survey that consisted of 50 multiple choice and 18 Likert scale items. Yet, this study does not have any purpose of identifying teacher educator competencies, and for this reason only the findings related to this dissertation will be summarized. According to the results of the project, 54.5% of teacher educators had been working as teacher educators for 1-5 years. 75.6% of teacher educators knew at least one foreign language and 49.2% sometimes used technological equipment in their lectures. Additionally, 10 items were directed to the teacher educators to understand their perception about the quality of their education faculty and some of them are summarized. According to the study, 10.3% of the respondents did not agree with the item: "In my faculty, students are trained according to the teaching profession." 16.5% of teacher educators said that they did not agree with the item saying, "In my faculty, classes and laboratory are sufficient." 6.6% of teacher educators did not agree with the item: "In my faculty, qualified studies are conducted, which contribute to scientific development on education literature."

One of the other study which gives an understanding of the profile of teacher educators in Turkey was conducted by Gençdoğan (2004) with the purpose of analyzing the effect of reconstruction of faculty of education on the quality of professors. To this end, the study evaluated the relation with fieldwork and doctorate theses of professors in the faculty of education. Data that belong to 403 professors in 13 education faculties were collected from the university web sites and YOK (High Board of Education) database. The study revealed that more than half of the professors' doctorate theses are not related to their fieldwork, and the researchers concluded that there was no difference between the professors of faculty of education and the professors of faculty of arts and sciences.

One of the research focus to the prospective teacher educators was conducted by Yalçınkaya, Koşar and Altunay (2014) aimed to identify the views of prospective teacher educators about their education to become scientists. Data were collected

from 10 research assistants via semi-structured interviews. The result of the study revealed that the participants think that necessary importance is not given to their education and saw the lesson load, lack of financial support and promotion as the reasons behind this indifference. Even if this study is important for focusing on prospective teacher educators and can be evaluated as having secondary aim of education processes of prospective teacher educators at the level of PhD studies, the method and findings are still limited to give an idea about the satisfaction of teacher educators education processes compared to international level.

In addition to identification of the profile and general qualifications of teacher educators there are three important studies conducted in Turkey. One of them aimed to identify the ideal descriptions of teacher educators of pre-service teachers and conducted by Aslan and Yakar (2012). Data were collected from 40 pre-service teachers from 2 different universities by using repertory grid technique, a constructed interview method. It was found that the most common cognitive fictions of pre-service teachers for teacher educators were social sensitivity, communication, and academic competence.

Similarly, Tunca, Alkın-Şahin, Oğuz and Güner (2015) conducted a research in order to determine the perception of pre-service teachers about what makes an ideal teacher educator. One open-ended question was asked to 214 pre-service teachers from the departments of Science and Technology Teaching, Pre-School Teacher Education, Classroom Teacher Education, Social Studies Teaching and Turkish Language Teaching. Data were analyzed by making use of content analysis approach. The results of the research showed that the ideal qualifications of teacher educators can be gathered under five main themes, which are ‘professional roles and responsibilities, professional values, personal characteristics, professional ethic principles and social responsibilities’.

2.3. Conceptual Framework of Standards, Qualifications and Competencies

In the literature, there is no consensus for the usage of the term “standard or competency/qualification” to define the qualities of teacher educators. Some researchers who study on the quality of teacher educators prefer to use the term ‘standard’ and further their study on making more general definitions (ATE; 2006; ASTE, 1997; VELON, 2012; VELOV, 2012). There are researchers who prefer to use terms like competencies or qualifications, which are more detailed in definition, as well (Ingvarson, 1998; Spencer & Spencer, 1993). There are different perspectives on detailing the competencies in the literature (Eraut, 1994; Stoof et al., 2000). When the perspective is taken from the conceptual discussions and focus is on the practical implementations, it can be seen that the overall tendency in the world is to use the term ‘standard’. Even though there is a higher tendency of preferring ‘standard’ in defining the quality of teacher educators in the referenced studies, this produces a problem. Standards define the qualifications in a general perspective and this generalization of standards causes a barrier for assessment, measurement and evaluation processes. Korthagen (2004) criticized this issue and emphasized that preset standards cannot meet the needed definition for qualified teacher educator standards and cannot represent the depth of needed qualifications.

Thus, throughout this study, the term “competency” is preferred instead of standard. Another reason to prefer “competency” as a term is in Turkey is that teacher competencies are prepared by MoNE and there is no defined competency for any tertiary education graduates by The Council of Higher Education in Turkey. In other words, using the well-accepted competency term in the Turkish literature would contribute and lead to establish a link between teacher competencies and teacher educator competencies.

2.4. Summary of the Literature Review

The importance of identifying the desired competencies and qualifications of teacher educators has been emphasized by various researchers who are also teacher

educators. However, the number of research studies conducted to reveal the qualifications of teacher educators from a broad perspective is limited. Even though the standards for teacher educators are defined by different institutions and researchers, they are similar to one another and somehow abstract, which prevents them from being used by teacher educators to enhance their professional development, teacher education and teacher educator education. Another important criticism to the standards is that they define the qualifications in a general perspective, and this aspect causes a barrier for assessment, measurement and evaluation processes. This criticism indicates the need for a concrete definition of teacher educators' qualifications, which can be provided by using the competencies that are detailed by competency indicators.

Even though there are research studies that aim to identify who teacher educators are, how they gain their qualifications, and how they can improve their professional development, it is not possible to observe a clear pattern or establish meaningful relationships in this research area. This is taken as another sign for the need of defining concrete and detailed definitions of teacher educator competencies.

Additionally, teacher education as well as the responsibilities of teacher educators, differs from country to country. Since the roles, duties and responsibilities vary in each country, the competencies of teacher educators need to be defined in accordance with the requirements of applicable countries. Country-specific differences may bring about some other needs as well. In Turkey, the education of high school science teachers is held in different departments, which means teacher educators in biology education departments are the teacher educators who are mainly responsible for the education of biology teachers. When this is the case, the qualifications, therefore, the competencies of teacher educators differentiate from other teacher educators.

CHAPTER 3

METHOD

The purpose of this dissertation is to define the competencies desired in the biology teacher educators in Turkey. While presenting these competencies, the aim is to reveal the indicators of the competencies that are desired in biology teacher educators, as it is the second research question of the study. In the light of these objectives, the method of this dissertation is detailed below.

3.1. Research Design

The Delphi Method is preferred for the aim of defining the competencies and indicators of biology teacher educators in this study. The Delphi Method was developed by Rand Corporation to synthesize the most reliable consensus of opinion of a group of experts, by using a series of questionnaires with controlled feedback, (Dalkey & Helmer, 1962). According to Yousuf (2007), the Delphi Method is a useful method to use if the experts and practitioners' opinions are necessary. This method becomes more practical when the area of concern is a complex matter and there is no precise information available. Another reason for choosing the Delphi Method for the current study is the fact that it helps researchers gather expert opinions in any field in a systematic way (Dalkey, 1972) and it is effective in associating opposite and/or different opinions on the same content. The Delphi Method is the most reliable method to reach a consensus among the experts who have different opinions by using sequencing surveys (Landeta, 2006; Şahin, 2000). The most powerful aspect of this method is that it gives controlled feedback to the experts and enables them to reach a The Delphi Method has four features (Landeta, 2006). Firstly, the research process consists of repeated research. In other words, the opinions of participating experts are collected two or more times. The second feature of the method is the confidentiality of the experts. If an expert has a negative or

extremely positive attitude toward other experts, this does not influence their thoughts because the name or status of the participants is not shared. The third feature is the controlled feedback provided by the researchers. Lastly, the final feature is about sharing the results of the statistical analysis with the participants. Since these results are shared with the participants and lead them to make the final decision, all of the participants actively take part in this process.

Even though the Delphi Method has been frequently used especially in social research, there is also some criticism against the method and researchers may encounter problems in the implementation process. One critique is that using the opinions of experts as the only source of information can limit the sources that are used (Linstone, 1975). Even though non-interactivity among participants is seen as a positive feature of the method, this may prevent the formation of new ideas that can emerge thanks to the interactivity of participants (Van de Ven & Delbecq, 1974). The fact that the researcher is responsible for the coordination of the research leaves this process prone to manipulation. Costliness in time and effort is another critique towards the method (Welty, 1972). In addition to the method itself, there is also some criticism about the implementation process of the research. The possibility of not selecting proper experts, probability of loss of experts during the research process, and not selecting appropriate data analysis techniques are criticized with regard to internal validity (Rieger, 1986). In the implementation of the current research, these concerns are also taken into consideration and additional steps are included in order to prevent potential problems.

In the Delphi Method, the opinions of the experts are taken by using a series of questionnaires. Due to this natural characteristic of the method, data collection processes, participants and analysis of the data processes are linked to one another. Based on this feature of the method, all of these three research design steps are explained under the title of each round.

In the first round, one or two general open-ended questions that cover the whole aim of the study are asked to the participants. After the analysis of the first round, the data is transferred to a survey, and the participants are asked to mark their opinions for each item in a Likert scale survey. In the third round, the same items are directed to the participants. However, in this survey, the statistical results of the second round analysis are also presented in the survey and their new opinions are asked. After this stage, the agreed items are revealed with the help of a statistical analysis. As it was mentioned before, the Delphi Method was preferred for Koster et al.'s (2005) study, which has a similar purpose compared with the current study. In that study, the Delphi method was implemented in three rounds. In order to increase reliability and validity for the current study, the Delphi Method is designed in four rounds, as shown in Figure 3.1 and explained in the following subsections.

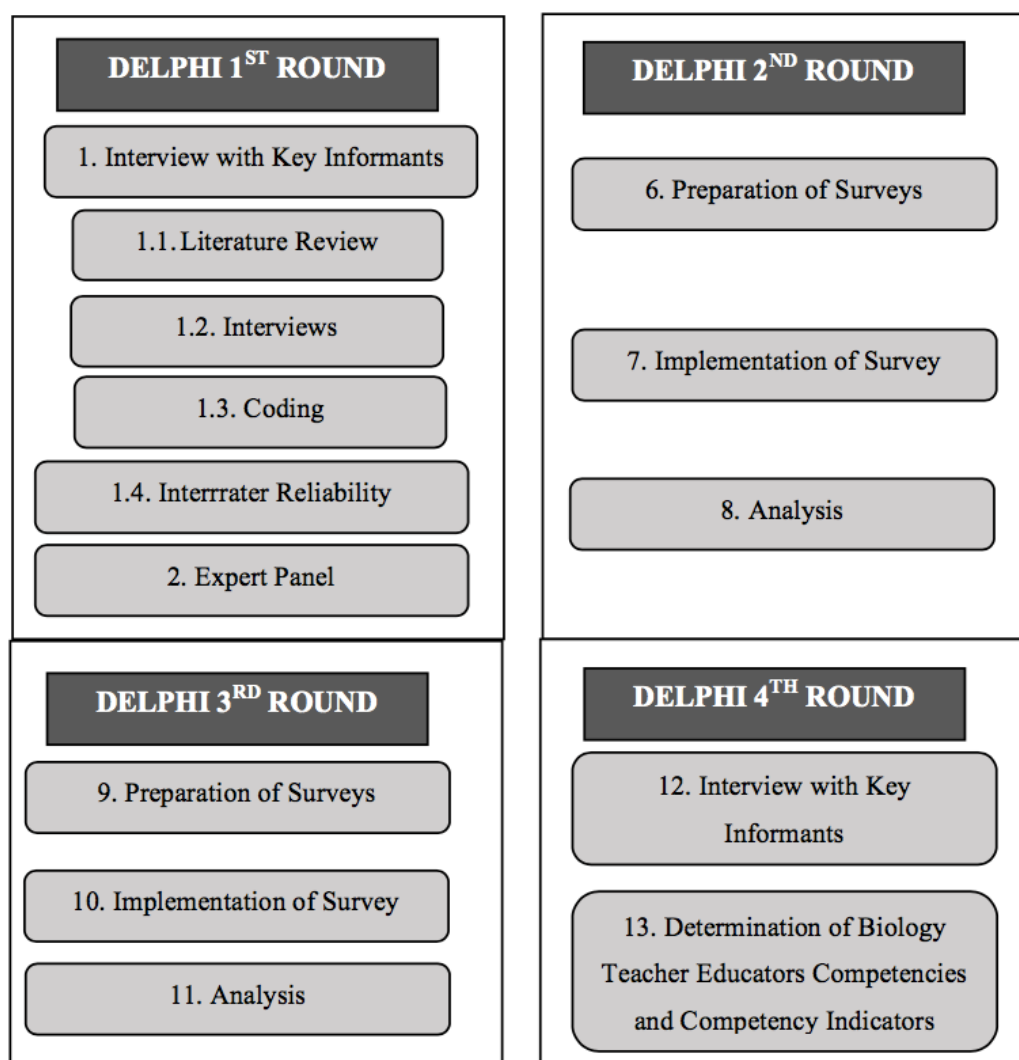


Figure 3.1. Summary of the Method of the Study.

3.1.1. Delphi 1st Round: Constitution of Draft Competency Document

3.1.1.1. Implementation of the Delphi 1st Round

The aim of the Delphi 1st Round in the current study is to constitute a draft competency document. For this process, the aforementioned critiques on the Delphi method were considered and reconstituted.

As it was mentioned before, there are some critiques on the Delphi method. Using the opinions of experts as the sole source of information can limit the sources that

are used (Linstone, 1975), which is the most frequent concern. Even though non-interactivity among experts is seen as a positive feature of the method, this may prevent formation of new ideas that can emerge thanks to the interactivity among participants (Van de Ven & Delbecq, 1974). For the current study, conducting interviews with experts or focus group interviews were the two possible solutions to prevent those limitations and increase the validity of the study. Since to have indeep information from experts were more critic for the study it was decided to conduct interviews with experts, who are named as key informants for the study, for Delphi 1st Round as a 1st phase. On the other hand, one more phase is added to identify whether there is any other opinion was left during the 1st phase of the Delphi 1st Round for competencies of biology teacher educators. Both of those phases are explained deeply as followed.

The first round was initially conducted in two phases while three stages were planed to conduct in the 1st phase of the Delphi 1st Round to minimize the effects of these critiques. After the pilot study was completed, one more stage was added to 1st phase of the Delphi 1st Round as summarized in Figure 3.1. According to the initial plan for the first stage, interviews would be conducted with four teacher educators from different backgrounds who specialized in teacher education biology and who are named as experts for the current study. Prior to the interviews, an interview protocol was piloted, which constitutes the first stage of the Delphi 1st Round, and it was observed that the questions were not sufficient to present an in-depth understanding of the competencies and indicators. Therefore, one more stage, a literature review, was added as a first step before the interviews. Due to the complexity of this nested structure of the method, this round will be explained in the following:

- Collecting data from the key informants (1st phase)
 - Literature review conducted during pilot study (1st stage)
 - Interview (2nd stage)
 - Coding (3rd stage)
 - Interrater reliability (4th stage)

- Expert panel opinions (2nd phase)

Since the purpose of the Delphi 1st Round is to find out what interviewees think about the competencies of biology teacher educators, the interviews were conducted by using the data collection method (Fraenkel & Wallen, 2006). According to Fraenkel and Wallen (2006), there are four types of interviews. Structured and semi-structured interviews consist of a series of questions designed to reveal specific answers. Structured interviews have strict application protocols. All of the questions are addressed in the same order to all of the interviewees. In semi-structured interviews, even though the questions are determined before the application of the interview protocol, they can be addressed in a flexible manner. Informal interviews are less formal than the other two types of interviews. They can be seen as casual conversations where questions are not addressed in a sequence. In retrospective interviews, the researcher poses the question to the interviewees to recall and then reconstruct from memory something that happened in the past.

In this study, a semi-structured interview is preferred, which consists of pre-determined questions. Although semi-structured interviews are flexible in terms of implementation, similar questions are addressed to each participant systematically. Although the way of addressing the questions may change during the interview, the focus of the interview should remain the same and the questions should be asked to each participant in a consistent manner (Berg, 2001).

Before conducting the interviews, an interview protocol was designed. During this design process, a pilot study was conducted by teacher educators. In the following section, this process and the formation of the interview protocol are explained in detail.

Two pilot studies were conducted before the interviews. For the first interview, two main questions were generated by using an unstructured interview type. The first question was: “*What are the duties and responsibilities of biology teacher educators?*” The aim of the first question was to warm up the participants and let

them focus on the duties of teacher educators and establish a connection between the duties and the competencies desired to meet these duties and responsibilities. At the end of the first question, the aim was to direct the second question to the participant, which was “*What are the knowledge and skills that a good biology teacher educator should have?*” The aim of the second question was to identify the competencies needed to fulfill the responsibility that they mentioned in the previous question.

The results obtained in the first interview showed that open-ended questions were not enough to determine the roles and responsibilities of teacher educators. The response of the interview was limited to pre-service teacher education. For this reason, the definition of biology teacher educator addressed within the scope of the research was reemphasized. However, in this case, it was seen that the responsibility of teacher educators was only included in the responsibility of research. When asked by the researcher whether in-service teacher education is among the responsibilities of teacher educators, the interviewee mentioned that in-service teacher training needs to be acknowledged as one of the responsibilities of teachers.

After the data were obtained from the first pilot interview, a semi-constructed interview type was preferred instead of an unconstructed interview type. To this end, the interview questions were detailed and the standards proposed by different institutions were used (ATE, 2006; AMTE, 2002; ASTE, 1997; VELOV, 2012). All of the standards proposed by these institutions are summarized in Table 3.1.

Table 3.1. *Summary of the standards proposed by ATE, VELOV, ASTE, AMTE*

ATE (2006)	VELOV (2012)	ASTE (2007)	AMTE (2002)
Teaching	The fundamentals of being a teacher educator	Knowledge of Science	Mathematics Content
Cultural Competence	T.E. as a supervisor of learning and development processes	Science Pedagogy	Research
Scholarship	T.E. as a supporter and supervisor of personal, social and interactive processes	Curriculum, Instruction, and Assessment	Historical, Social, Political, and Economic Context of Education
Professional Development	T.E. as an expert in teacher education	Knowledge of Learning and Cognition	Teaching and Teacher Education
Program Development	T.E. as a content expert	Research/Scholarly Activity	Technology
Collaboration	T.E. as an organizer	Professional Development Activities	Curriculum
Public Advocacy	T.E. as an innovator and researcher		Assessment
Teacher Education Profession	T.E. as a member of a teacher education team		
Vision	T.E. as a partner for external stakeholders and as a member of the educational community		
	T.E. as an involved and critical social participant		

The first question asked to the key informants was: “*What are the duties and responsibilities of biology teacher educators?*” When the key informant mentioned the themes in the list, s/he was asked to identify the answer to the following question: “*What are the knowledge and skills that a good biology teacher educator should have to satisfy proposed duty or responsibility?*” After the participants listed the duties and responsibility areas from their own perspective, the responsibility areas in this list were used to check whether they missed out that area or whether they do not think that is a responsibility of the biology teacher educator. The full list of the questions in the interview protocol is presented in Appendix A.

In summary, a literature review phase was added as to the 1st stage of the Delphi 1st Round and this was included during the pilot study as it was mentioned above. Then, the 2nd phase of the Delphi 1st Round, the interview stage, was implemented.

The interviews were planned to be conducted with four teacher educators from different backgrounds who specialized in teacher education biology. Since the Delphi Method is effective in associating opposite and/or different opinions on the same content, attention was given to choosing key informants from different backgrounds. Detailed information about the key informants is given in the following subsection.

After determining the key informants, they were contacted via telephone to explain the purpose of the study and their expected contribution. During the telephone calls, the key informants were also asked whether they wanted to participate in the study voluntarily. All of the biology teacher educators replied in the affirmative and the interview date and time were determined. Afterwards, the interviews were conducted in person.

After the data collection process, the interviews were transcribed. Data reduction strategy was generated in accordance with the study. The categories and codes were determined after analyzing the transcripts of the interviews. This stage of the Delphi 1st Round was named the coding stage and listed as the 3rd stage of the Delphi 1st Round. After this process, the transcripts and codes were shared with a biology teacher, who is also a PhD student in science education, in order to ascertain the consistency of the coding process done by the researcher. In other words, this 4th stage was conducted to identify the interrater reliability of interview coding.

As mentioned before in this chapter, the Delphi Method was criticized because the fact that the researcher is deemed responsible for the coordination of the research leaves this process prone to manipulation (Welty, 1972). Therefore, by adding this stage, this criticism regarding the Delphi Method was also eliminated. After this stage the 1st phase of the Delphi 1st Round was complicated.

Other two main concerns related to the Delphi method are using the opinions of experts as the only information source can limit sources that are used (Linstone, 1975) and that the non-interactivity among participants may prevent formation of new ideas which may emerge thanks to the interactivity of participants (Van de Ven & Delbecq, 1974). In order to prevent the effects of these two critiques, one more phase was added to the Delphi 1st Round.

As it can be seen in Figure 3.1., the 2nd phase of the Delphi 1st Round was having opinion of an expert group, who are named as expert panel. The determination of this expert panel was critical. They needed to have experience on working with teacher educators. One TUBITAK Project was held concurrently on the competencies of mathematics teacher educators in Turkey (Çetinkaya, 2014). The main research question of the project was “*What competencies should mathematics teacher educators possess from the perspective of mathematics teacher educators, graduate students in mathematics teacher education programs and mathematics teachers in Turkey?*”. As it can be seen from the research question main difference between the conducted project and current dissertation is the differentiation of the field of the teacher educators. The project was a three-yearlong project and similarly the Delphi method was also conducted for the project. The method of the project was also designed as a four-round Delphi. The only difference of the method was designing a workshops, instead of interviews, with 10 experts who work on mathematics education for Delphi 1st and 4th Rounds. The Delphi 2nd and 3rd Rounds of the project and current dissertation were similar. Three researchers and five project assistants were working on the project and the researcher of the current dissertation was also one of the research assistants in the project.

Besides timing of the current dissertation and the projects is also very important and needs to mentioning. The Delphi 2nd Round of the project was finalized by the time the interviews were being conducted for the Delphi 1st Round of the current dissertation. This gives an important aspect that the researchers and project assistants of the project are experienced on determining the competencies of teacher educators.

Besides, the experiences of teacher educators are more than 15 years for each of the researchers in the project meanwhile all of the project assistants were PhD students. Therefore, for the current dissertation, the draft framework was analyzed by this expert paneling order to increase the inclusiveness, and comprehensiveness of the competency areas and competencies and to clarify the statements in the draft framework.

3.1.1.2.Participants of the Delphi 1st Round

For the 1st stage of the Delphi 1st Round five criteria is determined for selecting key informants are having undergraduate degree is in biology education, having graduate degree (both master and doctorate level) on education, working at biology education departments at university level in Turkey, actively conducting research on biology education, being associate professor or professor. There were 11 biology education department 82biology teacher educators who are actively work in biology education departments. On the other hand, the other three criteria were satisfied with eleven biology teacher educators. Therefore, participants to the 1st phase of the Delphi 1st Round are selected from those eleven biology teacher educators.

All of the selected interviewees were working on biology education, had experience of at least five years lecturing both undergraduate and graduate students, graduated PhD students and had studies on biology education. Two of them were working in Istanbul at the same university, and the other two were working in Ankara at different public universities. One of them was a full professor, whereas the other three were associate professors. Two of the key informants earned their PhD degrees from two different universities in Turkey, while one of them graduated from a university in the United Kingdom and the other interviewee graduated from a university in the USA, as shown in Table 3.2.

Table 3.2. Demographic information about the key informants participated in the Delphi 1st Round

Key Informants (KI)	Academic Title	Undergraduate	PhD Graduation (Field)	Research Area	Years of Experience
KI 1	Associate Professor	Biology Education	Science Education (Turkey)	Biology Education	10
KI 2	Professor	Biology Education	School of Education (Abroad)	Biology Education	11
KI 3	Associate Professor	Biology Education	Science Education (Turkey)	Biology Education	8
KI 4	Associate Professor	Biology Education	Curriculum and Instruction (Abroad)	Biology Education	11

As it was mentioned before Delphi 1st Round is conducted via two phases. The participants of the 2nd stage, which is named as expert group opinion, are the researchers and research assistants of the TUBITAK Project conducted on the competencies of mathematics teacher educators in Turkey (Çetinkaya, 2014). Three researchers and five project assistants were working on the project and the researcher of the current dissertation was also one of the research assistants in the project. All of those eight researchers are the participants of 2nd stage of the Delphi 1st Round because of them expertize on competencies of teacher educators.

3.1.1.3. Analysis of the Delphi 1st Round

According to Miles and Huberman (1994); data reduction, data display, and conclusion drawing and verification are three main components of qualitative data analysis. Following the data collection process, the interviews were transcribed. Data reduction strategy was generated in accordance with the study. The categories and codes were determined after analyzing the transcripts of interviews.

Data coding needs to be used in the qualitative studies to have organized and manageable data. Category names can be originated by the researcher and participants or derived from the literature (Merriam, 1998). Therefore, data from all three sources were used in naming the categories.

After transcribing the interviews, firstly, it was decided that identifying competency areas would facilitate competency categorization. As mentioned in the Implementation of the Delphi 1st Round section of this chapter, 14 themes of competencies for biology teacher educators were constructed after the analysis of the literature. The themes that are not mentioned by the key informant were directed to the key informants as to determine whether they should be taken under the competency framework of biology teacher educators. During the interviews, these themes were coded into three main categories in line with the statements of the key informant: should be included in the competency framework, should be included partially, and should not be included. Additionally, the key informants stated during the interviews that these themes were taken as the potential competency areas of the biology teacher educators. Therefore, they explained whether that a theme should be taken as a single competency area or whether it should be associated with another theme or other themes or taken as a separate competency area. Thus, firstly the competency areas of the biology teacher educators were revealed.

In the second step, the transcripts were coded to identify the competencies and indicators under determined competency areas. To increase reliability, four principles were defined during the second and third rounds of the coding process, as given below:

1. When there are different opinions all opinions, they should be included in the document.
2. Different opinions of the interviewees for the same competency area of a competency or competency indicators of the same competency should be both included both.

3. To increase inclusiveness, at least three competencies should be presented under each competency area and similarly at least three indicators should be given under each competency.
4. Indicators should be concrete and measurable.

Additionally, it should be noted that for the first step of the analysis, interviews were coded by the researcher, and the transcripts and codes were shared with a doctorate student in science education. Then, the inter-rater reliability was calculated using the formula of $(\text{Total number of agreements}) / (\text{Total number of observations}) \times 100$ (Marques & McCall, 2005). The inter-rater reliability was found to be 92%, which covers the whole competencies and competency areas. For the items that couldn't be reached consensus, the raters decided the final version of the items together.

After coding all of the statements of the key informants, each of the identified competencies was grouped under the related competency area. Similarly, the indicators were grouped under the related competency. The indicators that were not categorized under any defined competency were grouped together. In that case an inclusive competency was directed by the researcher for the grouped competency indicators.

Finally, the comprehensiveness of the first Draft Competency Framework of the Biology Teacher Educators was analyzed by the expert panel on teacher educators. In this stage of the study, three main concerns were taken into consideration as in the following:

1. Comprehensiveness of competencies defined under the competency areas.
2. Comprehensiveness of indicators defined under the competencies.
3. Clarity of the stated competencies and indicators.

3.1.2. Delphi 2nd Round: Implementation of the Draft Competency Document

3.1.2.1. Implementation of the Delphi 2nd Round

After determining the first version of biology teacher educator competencies and indicators by using the interviews and expert panel opinion evaluation, the study proceeded to the Delphi 2nd Round. The aim of the Delphi 2nd Round was to get the opinions of the experts about the necessity of the listed competencies and indicators that biology teacher educators need to possess. To this end, the first version of the biology teacher educators' competency task was transferred to a Likert-type questionnaire.

In order to satisfy the validity and reliability of the data, three main features of Likert scales were examined. One of them was the number of scale points in the questionnaire. Even though there is no consensus on the optimal number of response categories for a rating scale, it is decided that the width of the Likert scale needs to be determined in accordance with the nature of the research. According to Cox (1980), the optimal scale width needs to be normally between five and nine in terms of capability of transmitting information, besides the marginal return from using more than nine scale points is minimal. According to Preston and Colman (2000), the scales with six or more response categories are most valid and discriminating, nine-point or more scales have the most intertertile discriminating power compared with the other scales. Additionally, the most reliable scores were found from the scales with between 7 and 10 response categories. Therefore, a nine-point scale was opted for the study with (1) absolutely unnecessary (3) slightly necessary, (5) somewhat necessary, (7) very necessary, and (9) absolutely necessary. Additionally, all respondents may not have any experience on each of the competencies or indicators. Therefore, "Don't Have an Opinion" option was also added to the scale for each competency and indicator to increase the reliability and validity of the scale. An example of the scale is given in Figure 3.2.

COMPETENCY AREA - A: Biology Teaching

	No Idea	Absolutely Unnecessary		Not Very Necessary		Slightly Necessary		Very Necessary		Absolutely Necessary
A.1 To be able to analyze the subjects and concepts in biology curriculum (secondary level)	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.1. Explain the theories, principles, generalizations and models which are the basis of the science of biology.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.2. Constructs experimental design processes for problem solving processes in biology.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.3. Approaches the science of biology from a point of view required by the nature of science.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐

Figure 3.2. An Example from the Survey Implemented in Delphi 2nd Round

In the questionnaire, an open-ended question was also added to identify whether the participants have any suggested competency and/or indicator to be added for the competencies of biology teacher educators.

One of the main critical concerns regarding the Delphi method is that the experts, for the current study they named as participants, are the only source of information, which may cause limitations for the data (Linstone, 1975). Although the lack of interaction between experts is a strong aspect of the method, this feature can cause some criticism in that it may prevent new ideas from forming by removing potential interactions (Van de Ven & Delbecq, 1974). In order to eliminate this limitation and avoid such criticism, the experts were diversified and opinions from three participant groups were received including teacher educators, graduate students and teachers who work/study in biology education. Additionally, attention is given to variety and diversity in terms of the demographic features of the participants in each group. These features are summarized in Table 3.3.

Table 3.3. Criteria looked in the selection of the groups

Teacher Educator	Graduate Student	Teacher
- Program graduated	- Program type	- Type of school
-Academic title	(master or PhD)	

For the group of teacher educators, two criteria were selected. Teacher educators who have undergraduate or graduate degrees in the field of education or biology can be employed in the biology education departments. For the current study, all of the participants were selected from biology teacher educators who have a PhD degree in

the field of education. The second criterion was the participants' diversity of academic titles. Attention was given to include teacher educators with different titles such as professors, associate professors and assistant professors among the participants.

For the group of graduate students, one criterion was determined, which was the type of the program. For the current study, biology teacher educator was defined as the provider of instruction to pre-service or in-service teachers both in undergraduate and graduate degree levels. In Turkey, there are two different graduate programs including one master's degree and a PhD degree. To this end, attention was given to include the participants who study in a master's and PhD program in the study.

For the group of teachers, two criteria were selected. In Turkey, there are two main school types at high school level: public and private schools. Even though the curriculums of two school types are not different, their experience of teaching and working conditions may vary. For this reason, the study aimed to incorporate both teachers' opinions into the current study. The other criterion was diversity in years of experience and was included in the study to have the opinions of the teachers who have less or more experience.

A one-page introduction text was prepared for each group (teacher educators, graduate students, teachers) to explain the study and what is expected from the participants. The main section of the survey, which includes the competencies and indicators, was identical except the questions about demographic information prepared individually for each group. As the study aims to reach the participants and collect data electronically, an electronic version of the survey was prepared.

The sample of the questionnaire presented to faculty members in the Delphi 2nd Round is presented in Appendix B, and the introduction page of the questionnaire presented to graduate students is included in Appendix C, while the introduction page of the questionnaire presented to teachers is given in Appendix D.

A sample of 12 to 16 participants from each group was expected to participate in this round of the study. However, the number of individuals contacted was higher than the expected number of participants, taking into account that there may be people who do not participate in the questionnaire after submitting the questionnaire. The participants who were communicated were determined by considering the distribution of the demographic information included in the questionnaires. The participants were asked whether they could participate in the study by providing information on the purpose of the project, the scope, the data collection process and the content of the questionnaire to be applied. In this context, the volunteers were sent the questionnaire.

The participants were asked to complete the questionnaire and send their responses within two weeks. If they did not complete and send the questionnaire back within two weeks, they were reminded. The participants who were unable to complete the questionnaire were given extra time. At the end of this data collection period, 13 teacher educators, 12 graduate students and 13 biology teachers completed the questionnaires. The data were transferred to MS Excel program and analyzed through the use of the SPSS program.

3.1.2.2. Participants of the Delphi 2nd Round

As mentioned before, this study aimed to collect data from three different groups which are biology teacher educators, graduate students in biology education and biology teachers. A sample of 12 to 16 participants from each group was expected to participate in this round of the study. The demographic information about the participants in the Delphi 2nd Round is given in Table 3.4, Table 3.5 and Table 3.6.

As can be seen in Table 3.4, data was collected from 13 teacher educators. 12 of the participants' field of research at PhD was biology education, while one of them graduated from the field of curriculum and instruction. Two of them were professors, three of them were associate professors, five of them were assistant professors, and three of them were research assistants who have a PhD degree for at least 4 years.

Only 5 of the participants had a teaching experience as a biology teacher. Teaching experience as a biology teacher was taken as a criterion of having a PhD degree and minimum experience as a teacher educator was 3 years among the participants.

Table 3.4. *Demographic information about the biology teacher educators in the Delphi 2nd Round*

Participant	Graduate Study	Academic Title	Age	Teaching Exp. as BT	Teaching Exp. as BTE
P1	B.E.	Professor	40-49	1 year	21 years
P2	B.E.	Research Assistant (PhD)	30-39	-	7 years
P3	B.E.	Assistant Professor	30-39	-	7 years
P4	B.E.	Associate Professor	40-49	8 years	3 years
P5	C&D	Associate Professor	40-49	1 year	8 years
P6	B.E.	Assistant Professor	30-39	-	10 years
P7	B.E.	Assistant Professor	40-49	3 years	11 years
P8	B.E.	Research Assistant (PhD)	30-39	1 year	10 years
P9	B.E.	Assistant Professor	40-49	-	9 years
P10	B.E.	Research Assistant (PhD)	30-39	-	5 years
P11	B.E.	Assistant Professor	30-39	-	8 years
P12	B.E.	Associate Professor	40-49	5 years	5 years
P13	B.E.	Professor	40-49	-	25 years

In the group of graduate students, data was collected from 12 graduate students. As can be seen in Table 3.5, all of them graduated from the field of biology education. 6 of them were PhD students while 6 of them were master students. 4 of them were assistants at the university, 2 of them were project assistants, 4 of them were working at school and 2 of them were unemployed at the time of this study. 5 of the participants had teaching experience as a biology teacher.

Table 3.5. Demographic information about the biology graduate students in the Delphi 2nd Round

Participant	Graduate study level	Undergraduate Degree	Institution	Teaching Experience
P1	PhD	Biology Education	School	6-10 years
P2	Master	Biology Education	Not working	-
P3	Master	Biology Education	School	2 years
P4	Master	Biology Education	Not working	-
P5	PhD	Biology Education	University	6-10 years
P6	PhD	Biology Education	School	1-5 years
P7	Master	Biology Education	Project Assist.	-
P8	Master	Biology Education	School	2 years
P9	Master	Biology Education	Project Assist.	-
P10	PhD	Biology Education	University	-
P11	PhD	Biology Education	University	-
P12	PhD	Biology Education	University	-

As can be seen in Table 3.6, data was collected from 13 biology teachers. 6 of the participants had 0-5 years of teaching experience, while 7 of them had 6-10 years of experience. 8 of them graduated from biology education at undergraduate level and 5 graduated from biology and completed pedagogical formation as a master's degree. 7 of the teachers were working at public schools and 5 of them were working at private schools.

Table 3.6. Demographic information about the biology teachers in the Delphi 2nd Round

Participant	Teaching experience	Undergraduate Degree	Institution
P1	0-5 years	Biology Education	Public school
P2	6-10 years	Biology	Public school
P3	6-10 years	Biology Education	Public school
P4	6-10 years	Biology Education	Public school
P5	0-5 years	Biology Education	Private school
P6	6-10 years	Biology Education	Public school
P7	0-5 years	Biology	Public school
P8	6-10 years	Biology Education	Public school

Table 3.6. (Continued)

Participant	Teaching experience	Undergraduate Degree	Institution
P9	0-5 years	Biology	Private school
P10	6-10 years	Biology	Private school
P11	0-5 years	Biology	Private school
P12	6-10 years	Biology Education	Private school

3.1.2.3. Analysis of the Delphi 2nd Round

The main purpose of the data analysis for the Delphi 2nd Round was not reaching a decision on excluding any competency or indicator item from the survey, but to determine the descriptive statistics to be included in the survey, which will be used in the Delphi 3rd Round. In this context, descriptive analyses were conducted for each item in the questionnaire. The percentage distribution of responses for each item was calculated. Then, separate forms were created for each participant. The distributions of all items in this survey and the previous responses of the participants were presented.

3.1.3. Delphi 3rd Round: Implementation of the Draft Competency Document

3.1.3.1. Implementation of the Delphi 3rd Round

According to Landeta (2006), the Delphi method provides consensus by implementing sequential questionnaires with people who have opposite and/or different opinions on a subject. Therefore, the Delphi 3rd Round is based on the data gathered in the Delphi 2nd Round.

In the questionnaire for the Delphi 3rd Round, all of the items (competencies and indicators) were included and questionnaires were prepared and arranged individually for each participant. In each questionnaire, scoring that the participant gave to the item in the Delphi 2nd Round and percentages of the responses of the relevant group (teacher educators, graduate students and teachers) were presented to

the participants. Thus, the participants were allowed to reevaluate their scoring after examining the distribution of other participants. Also, a separate column was added in each questionnaire to give new scoring in case they wish to change their previous scoring. The purpose of the new process is to make it easier for the participants (without dictation) to reach a consensus in accordance with the basic philosophy of the Delphi method. One of the sample items used in the 3rd round is presented in Figure 3.3.

	% of participants who marked 1	% of participants who marked 2	% of participants who marked 3	% of participants who marked 4	% of participants who marked 5	% of participants who marked 6	% of participants who marked 7	% of participants who marked 8	% of participants who marked 8	Your Previous Answer	If you want to change your answer, please write it here
Uses valid and reliable assessment tools to evaluate teachers' professional development and teacher candidates' learning.	-	-	-	-	6,3	-	18,8	12,5	62,5	9	

Figure 3.3. An Example of the Survey Implemented in the Delphi 3rd Round

The sample of the questionnaire presented to faculty members (teacher educators), graduate students and teachers in the Delphi 3rd Round is presented in Appendix F.

The participants who completed the questionnaire in the Delphi 2nd Round were contacted via telephone to confirm their continued attendance for the Delphi 3rd Round. They all agreed to attend the 3rd round. Individualized questionnaires were sent to each participant via e-mail. The participants were asked to complete and submit the questionnaire within two weeks. If they did not complete and submit the questionnaire within two weeks, they were reminded. Additional time was given to the participants who could not complete the questionnaire. Only one teacher educator who participated in the Delphi 2nd Round did not participate in the Delphi 3rd Round.

3.1.3.2. Participants of the Delphi 3rd Round

Since the aim of the Delphi 3rd Round was to reach a consensus among the participants, the participants for the Delphi 3rd Round needed to remain the same teacher educators, graduate students in biology education and biology teachers. Therefore, the previous participants were contacted and asked to participate in the Delphi 3rd Round. All of the participants accepted and the sample of the Delphi 3rd Round remained the same with the Delphi 2nd Round without any missing data.

3.1.3.2. Analysis of the Delphi 3rd Round

Since the purpose of the study is to reach a consensus among people who have opposite and/or different opinions on biology teacher educator competencies (Dalkey, 1972; Landeta, 2006), the first part of the study is built on a Delphi approach consisting of four rounds. Based on this aim and unlike the Delphi 2nd Round, the main goal of the Delphi 3rd Round is to build a consensus among the participants on the competencies of biology teacher educators.

To this end, first of all data gathered in the Delphi 2nd Round were analyzed using by the combination of three main criteria to identify whether a consensus was reached in each competency and indicator. These criteria were having a median (Mdn) higher than 7, interquartile range (IQR) and three dot pitch in which the median was located ([1-3], [4-6], [7-9]). Then the data gathered in the Delphi 3rd Round, which is the main goal of the study, was examined by using the same method. The details of the method used in both analyses are explained below.

In the Delphi Method, using median and interquartile range is recommended rather than mean and standard deviation (Murphy et al., 1998). According to von der Faherty (1979), a 9-point Likert scale interquartile range (IQR) of 2 or less gives the respective consensus criterion. Therefore, this criterion was preferred for the study. Besides, if the median (Mdn) is higher than 7, which is the lower end value of 7-9 points (very necessary-absolutely necessary), it is taken as a sign of significant consensus (von der Gracht, 2012). Additionally, 80% or more of the respondents in

the three-point range ([1-3], [4-6], [7-9]) in which the median is located have been accepted as a sign of consensus on the necessity and importance of the item (competency and indicator) (Diamond et al., 2014; Murphy et al., 1998). In summary, in Delphi 2nd and Delphi 3rd Rounds, the formation of high consensus on an item was taken as $IQR \leq 2 \wedge Mdn \geq 7 \wedge frequency [7-9] \geq 80\%$. It is accepted that there is no high consensus on the items that do not provide at least one of these three criteria.

Apart from this, consensus within the groups was also examined. The differences within the groups (teacher educators, graduate students and teachers) are also analyzed with three criteria; which are three points range (1-3, 4-6, 7-9) in which the median was located, interquartile range (IQR), and median. After this analysis, if one of the items was not able to satisfy any of the criteria, such item was taken to the 4th Delphi Round to present expert opinion.

3.1.4. Delphi 4th Round: Biology Teacher Educator Competency Framework

The aim of the Delphi 4th Round was to make a decision about items on which no consensus could be reached in the Delphi 3rd Round by means of a statistical analysis. Therefore, the interviews were conducted by the key informants who participated in the Delphi 1st Round. As in the Delphi 1st Round, the key informants were contacted via telephone about their expected contribution to the Delphi 4th which is the last Delphi Round. All of the biology teacher educators replied in the affirmative and the interview date and time were determined. Then, the interviews were conducted in person.

Before the interviews, a booklet was prepared to summarize the processes conducted and the results were obtained in the previous rounds. After the summary part, the items on which no consensus could be reached were presented with the detailed explanation of each item. Firstly, the items that could not bring about a consensus among all participants in the Delphi 3rd Round were presented item by item. Secondly, the items that could not bring about a consensus in different groups were

presented in the sequence of teacher educators, graduated students and teachers' groups. Lastly, the items obtained after the Delphi 1st Round and the statistical results of the Delphi 2nd and 3rd Rounds for each item were included in the booklet. The full version of the Interview Booklet is presented in Appendix H.

At the beginning of each interview, the previous processes of the study were explained in line with the sequence of the booklet. Since the purpose of this round was to arrive at a decision on all of the items, the final version of each item (competency and/or indicator) was discussed in the light of the key informants' opinions.

3.1.5. Overview of the Methodology

According to Dalkey and Helmer (1962) Delphi method is a research method to synthesize the most reliable consensus of opinion of a group of experts, by using a series of questionnaires with controlled feedback. Even though Delphi Method has been frequently used especially in social research, there is also some criticism against the method and researchers may encounter problems in the implementation process.

Since those critics affects the reliability and validity of the study, additional methodological precautions are taken to higher the reliability and validity of the study are explained in detailed in the previous subsections. It is important to note that by those additional methodological steps the methodology of the current study is differentiated from classical Delphi Method. Even if the method of the current study is mentioned throughout the study as Delphi Method, by those additional rounds, stages and steps to the current study the method of the study can be named as Modified Delphi Method.

CHAPTER 4

RESULTS

The theoretical background of the study, the reviews of the previous studies and the method of the present dissertation are presented in previous chapters. The results of the current study are presented in this chapter.

First of all, for the first part of the study includes the determination of biology teacher educators' competencies and the indicators of those competencies are presented in line with the sequence of the data gathering process. Firstly, the results of the Delphi 1st Round acquired from interviews with key informants and expert panel were presented. Secondly, the results of the Delphi 2nd and 3rd Rounds that are collected through questionnaires were presented altogether to enrich the harmony. Lastly, the results of the Delphi 4th Round were presented.

As mentioned in the previous chapter, the Delphi Method is preferred for the aim of defining the competencies of biology teacher educators, as it is designed to gather expert opinions in any field in a systematic way (Dalkey, 1972) and is effective in associating opposite and/or different opinions on the same content (Landeta, 2006). A four-round Delphi method is adopted for the present dissertation.

The objective of the current study was to constitute a task document for biology teacher educators. In order to achieve this goal, in Delphi 1st Round interviews were conducted with four biology teacher educators. After the analysis of these interviews, the competency areas, competencies and indicators were listed. Then, the comprehensiveness of the competencies and indicators was analyzed by the expert panel and these results were presented. The result of these phases are presented respectively in this chapter, respectively.

For the Delphi 2nd and 3rd Rounds, the questionnaires were implemented to three different participant groups (teacher educators, graduate students and teachers). The result of those descriptive statistics are also presented accordingly.

At the end of the Delphi 3rd Round there were still some competencies and indicators that did not reach a consensus; therefore, in the final round interviews were conducted with the key informants that participated in the 1st Delphi Round. The results of these interviews and the final version of the Competency Framework for Biology Teacher Educators are presented in this chapter.

4.1. Findings from the Delphi 1st Round: Generation of Biology Educator Competencies and Indicators

4.1.1. Identification of Competency Areas

As mentioned in the previous chapter, the interviews were conducted by key informants specialized in biology teacher education in the first stage of the 1st Delphi Round. After the implementation of the interviews, all of the interviews were transcribed and made ready for coding. After the transcription of the interviews, it was firstly decided that competency areas should be identified to facilitate the categorization of competencies and indicators.

An interview protocol was prepared from the literature and 14 potential competency areas were defined in this protocol. As the first step of establishing a competency framework of biology teacher educators, these competency areas were coded under six competency areas.

During the interviews, the experts were asked: “*What are the duties and responsibilities of biology teacher educators?*” When the expert mentioned the themes that are included in the list, s/he was asked to identify: “*What are the knowledge and skills that a good biology teacher educator should have to satisfy the proposed duty or responsibility?*” After the participants listed the duties and responsibility areas based on their own perspectives, the responsibility areas in this

list were used to check whether they missed out that area or if they think that the area in question is not a responsibility of a biology teacher educator. These 14 potential competency areas are listed in the left column of Table 4.1. Additionally, the opinions of the experts about the competency areas are summarized in Table 4.1.

Table 4.1. *Competency areas constructed for the interview protocol and summary of the opinions of key informant on the competency area*

	KI 1	KI 2	KI 3	KI 4
Teacher Education	✓	✓	✓	✓
Graduate Education	✓	✓	✓	✓
Content Knowledge	✓	✓	✓	✓
Pedagogical Content Knowledge	✓	✓	✓	✓
Program development, assessment and evaluation and other educational activities	✓	✓	✓	✓
Conducting research	✓	✓	✓	✓
Carrying out the professional development of oneself and other teacher educators	✓	✓	✓	✓
Following innovations in the field	✓	✓	✓	✓
Serving the society	☑	☑	☑	☑
Self-organization	×	✓	✓	✓
Collaborating with other teacher educators	☑	☑	☑	☑
Policies on biology education	✓	✓	✓	✓
Social outputs related to education	×	×	×	×
Vision and mission	☑	☑	✓	☑

* KI means “key informant”, ✓ means “should be”, ☑ means “should be” (when it is specifically asked), ✓ means “partially” and × means “should not be included in the duties and responsibilities of biology teacher educators”.

All of the key informants that participated in the Delphi 1st Round have mentioned that teacher educators should to possess competencies on teacher education, graduate education, content knowledge, pedagogical content knowledge, program

development, assessment and evaluation. educational activities, conducting research, and following innovations in the field.

In the theme of carrying out the professional development of oneself and other teacher educators, KI 3 have stated as in the below without asking her whether teacher educators should carry out professional development of oneself and other teacher educators.

KI 3: Again, you learn a lot from your own colleagues and those who are in your field. I have some friends that I believe are well-educated. I believe that they can make great contributions to me as a friend or colleague. There are people I contribute to. This is mutual. Even if I believe that I cannot contribute, I do my best.

During the interview with KI 2, KI 2 did not mention a competency about carrying out the professional development activities of oneself and other teacher educators. However, when he was asked whether this should be taken as a competency for a biology teacher educator, he mentioned that this should be taken as a competency. Additionally, he also indicated that this competency cannot be taken as a separate competency area but it should be taken together with other competencies taken as values. The statement of the KI 2 was:

KI 2: Yes, it should be. We always have to develop ourselves. We also educate teacher educators, which both contribute to us, and we contribute to them. Or if there is an area we don't know, we ask our friends, and they ask us. This is very, very important. But I'm not sure whether it should be required specifically for teacher educators. But individuals should be open to it. This is also a value. That is, there is not a competency area alone, but it can be located under a competency area along with other values.

Additionally, two of the other experts mentioned that professional development activities should be taken in the competency framework of biology teacher educators, even though they did not mention this before asking them specifically. Moreover, similar to KI 2, KI 4 emphasized that professional development activities should be taken under a broader competency area of values and attitudes. In this context, the statements from these two teacher educators are given below.

KI 1: Teacher educators should make an effort for their own professional development. They should continue research, should not give up researching. This is also about attitude. They need to be able to follow the developments and programs. They should be able to think and be active. Of course, it is important to support the development of other people. Self-improvement is not enough. As they evolve, so do you.

KI 4: One has to constantly improve oneself. For example, it is not mentioned much but I think every teacher educator must also give graduate courses. It is required to prepare a course for the graduate degree. When the educator thinks about how to guide these people, he improves himself. Guidance on a subject improves people very much. When you develop mutually, you develop yourself as well. You also develop yourself when someone else is developing. Moreover, we referee in journals, so we work to improve other people. But it's about value and attitude, so you're not talking about defining it as a single competency area, right? It should be under a larger competency area with other values and attitudes.

Another theme taken in the interview protocol that was not mentioned by the key informants was “Serving the public”. Even though this theme was not mentioned by the key informants when they were asked whether teacher educators need to have competencies in serving to the public, they all stated that this should be considered within the scope of the competencies of biology teacher educators. The statements of the experts on this theme are as follows:

KI 1: We do not have a lot of work on in-service teacher education. Last year, I was asked to implement a teacher education to the biology teachers who work in public schools about e-content development. Those kinds of tasks were very fun. Meeting biology teachers was a very enjoyable event. Surely, we need to have competencies on working with in-service teachers and it may be taken as serving the society.

KI 2: We should have. It is one of our main duties. But the scope of this duty is contradictive. Will we include in-service teacher education as serving to the society or is conducting research enough to satisfy this duty? I think all of them are included, but I also need to feel responsible to the society.

KI 3: I think in-service teacher education is also important, not as much as pre-service teacher training. Indeed, teachers in service have too many needs. They also need to be supported. Although they are not

directly in our area of responsibility now, we need to work with them also. I think we can see this as a service to society.

KI 4: Not only biology teacher educators but all academics have three main duties. Education, research development and service to the society. So it's very important. It should be.

None of the key informants mentioned the presence of self-organizing skills in teacher educators. When the key informants were asked whether self-organizing skills should be included among the competencies of biology teacher educators, KI 4 mentioned that this was not a competency to be sought in a biology teacher educator.

KI 4: This is a not a competency, skill, feature etc. that should be possessed by a biology teacher educator. We need to expect that from everyone who works professionally in any field. If you are going to deal with such a broad scope, you need to put in many more statements.

The other three key informants, who were interviewed, emphasized the need for self-organization as well as many other skills and attitudes. The statements of the key informants on this theme are given below.

KI 1: I think a teacher educator should possess it but it is not a competency area itself and maybe not even a competency. This needs to be taken in a more global set. Biology teacher educators should be able to organize themselves, but for example, motivation is an important concept... So yes, they must be able to organize themselves, but they also need to possess some other skills, attitudes or values too.

KI 2: It should, of course, but just getting it alone didn't make sense to me. It would be more appropriate to take this under a larger umbrella. When combined with other concepts, it would become a very important competency.

KI 3: There must be, of course, I was not sure whether it is a responsibility or competency alone.

Another theme taken as a result of the literature review and taken in the interview protocol was “Collaborating with other teacher educators. “Since none of the key informants expressed any opinion on this theme, whether this theme needs to be taken within the scope of the competencies of a biology teacher educator was specifically asked. Looking at the opinions received from the key informants, it is

concluded that this is rather a behavior that should be performed in order to fulfill their different duties and responsibilities. Although it cannot be expressed as a duty or responsibility, it is concluded that it should be included in the competencies within other competencies under a more general competency area.

KI 1: We're now writing projects, and there are issues related to physics. I need to know how biology is fed through chemistry, physics and even mathematics... Working together is not a duty, it is a necessity, and you have no other way to do your research. In this context, there should be a competency, but it should not be considered as a separate competency. It is one of the main attitudes and values and it coexists with different ones.

KI 2: We do, of course. We educate teachers. We should know about each other.

KI 3: It may be giving lessons, conducting research. We cross at many points. But there are also important issues here, which are combined with collaboration.

KI 4: We have to. It's not a duty. It's a must to reach your goal. How else can you do it?

In the first phase, no opinion was submitted from the key informants regarding the title of contributing to the policies on biology education. However, when they were asked about whether teacher educators should have competencies in this field, all of the key informants expressed that this should be taken among the competencies. However, considering the statements from the key informants, it is concluded that this is not a specific area of competency. For this reason, this field has been taken under serving to the society. The statements from the key informants in this context are presented below:

KI 1: They must possess. They (policy makers) should be in cooperation with the University. MoNE-education faculties, ÖSYM needs to cooperate with universities. It is healthier to improve policies by discussing and exchanging ideas at a common team meeting. So we need to possess some competencies about the policy-making processes.

KI 2: We say bad or good teacher educator, one of the criteria is to ask if you only work in your room, follow the literature, read books and use your knowledge only in the teaching process or do you share your rights

with the society, discuss them with the public and let people benefit from your knowledge or competencies. You need to express your opinions and suggestions. You can prepare documents. There are other ways. A good teacher educator is a person who makes his presence felt in the society.

KI 3: Even the opinions of the teacher educators are not taken seriously; I think we need to contribute to those processes. I think it should be done in order to give an idea at least. We don't just give lectures and do research.

KI 4: They should be, even though they need to be allowed to do. But this is a service to the community. This is one of the three basic duties and responsibilities of each academic.

One of the themes included in the scope of the competency areas in the interview protocol was “contributing to the social outputs related to education.” Key informants did not specify this theme. When the key informants were asked whether this theme should be taken within the scope of the competencies of the biology teacher educators, four key informants stated that this needs to be a responsibility of each adult and does not need to be taken as a professional competency for biology teacher educators. The statements of the key informants are as follows:

KI 1: This is a feature that we should already have as an individual... It does not need to be a written quality. This must already be a qualification in an individual. This has to be acquired in basic education. We don't need to show this as the nature of a biology teacher educator. This is a competency that needs to be taken out of professional competence.

KI 2: I think there should be no need to express this as a special situation. It is a need for every adult.

KI 3: These are the features that should be in every individual. Is there a need for a teacher or teacher educator? Or is it limited to this? As I said before, there needs to be a more general competency or competency area that covers this also. But if you ask whether we need to express this as a competency or competency area, I think we do not need this.

KI 4: Of course, this is a concept that we take into consideration while we are working, educating or researching. But this has much more complex fields. While working with a teacher, doing research etc., we must give attention to this each and every time. But don't you need a more general statement for a competency? Social output is a fancy word, but you need to broaden the expression.

One of the key informants expressed the responsibility of having a specific vision or mission during the interview without directing any further question.

KI 3: The basic duty of a biology teacher educator is to educate a good biology teacher. By saying this, I mean teachers who have a determined and meaningful vision and mission, and in the light of their vision and mission, they need to improve themselves in the field of biology and biology education, have good communication skills, know the students and their needs well, and attach importance to self-improvement and biology literacy... How these can happen, firstly we need to be competent in those fields. We must have a basic vision and mission that we should take all our work in this direction and reflect these to the teachers, the research we are conducting, or whatever we are doing.

Other key informants stated that the having a vision and mission should be taken as a responsibility, and for these reasons it needs to be taken under the competencies when they were asked. But, they all expressed that this need to be taken as a more general competency area. The statements of the key informants on this subject are as follows:

KI 1: How can anyone work without doing that? I wasn't sure if it should be included in the competency alone. It should be taken of course. But should be taken, as I said before, under a more general theme like values or attitudes and taken under this competency area.

KI2: Like the other themes we've just mentioned. In fact, we need to have a vision; we need to have a mission and to work accordingly with them. But this is not a separate title. Should we even look at the detail, but can it be combined with the other scopes that we talk about?

KI4: There should not be. Even though you are not aware of this, you have to have it. You can't work otherwise.

In addition to all these, many themes have been expressed by the key informants to be included in the competencies of biology teacher educators without any further questions. These themes are: Teacher Education, Graduate Education, Content Knowledge, Pedagogical Content Knowledge, Program Development, Assessment and Evaluation. On the other hand, when the statements of the participants were evaluated, it was determined that revisions were needed in these themes so as to take them as a competency area.

One of the main duties and responsibilities of biology teacher educators is teacher education as it was stated by all of the key informants. In the interview protocol both in-service teacher education and pre-service teacher education were taken in the same theme. Although the expressed competencies used in the teacher education processes are similar for both pre-service and in-service teacher education process, it is seen that in-service teacher education is taken within the scope of service to the society by two key informants. For this reason, the process of in-service teacher education has been taken under both in teacher education competency area and service to society competency area. The opinions of the key informants that may be included in this scope are as follows:

KI 1: We do not have a lot of duties for in-service teacher education. Last year, MoNE organized an in-service teacher training about e-learning and I attended to this organization as an educator. These kinds of duties are very enjoyable. As I met other biology teachers, it was a very efficient and enjoyable event. Teachers were selected very carefully by MoNE. Planning within the scope of the aim is much more difficult than pre-service teacher education, because we do not attend frequently. Such educational activities should be more often. In-service teacher education needs to be one of our responsibilities, but in a way they are taken as a contribution to the society. In fact, the need for knowledge and competencies overlap with pre-service teacher education, but there are still some parts that differ from both in theory and practice.

KI 3: I think in-service teacher education is also important, not as much as pre-service. Indeed, in-service teachers have too many needs. Their needs also need to be supported. Maybe pre-service teacher education is much more important but this does not make in-service teacher education less important. Although they are not under our responsibility, we can take it under service to the society.

Graduate education was taken as a separate theme in the interview protocol. When the opinions of the key informants were analyzed, it was seen that the key informants take graduate education as an education of prospective teacher educators. The opinions of the key informants that may be included in this scope are as follows:

KI 1: In fact, there is no critical difference (compared with undergraduate level). The main difference occurs in scientific research skills and following the literature. They need to know how to do research,

be careful for scientific steps and they need to be able to implement them, etc. I advise them on these topics. Sometimes it is necessary to teach them even how to quote. Even what is ethical and what is not can be an issue. They will be my colleagues after all.

KI 2: Many of the courses taken in the master's or doctorate degree are designed or need to be designed in the light of the qualities that a teacher educator should have. When you look at the structure of the courses, the field education courses are very weighted and there are method lessons such as literature review. There are courses that demonstrate the ability to make presentations, and for academic writing and academic publications. In essence, we educate a teacher educator. Of course, these are not enough to educate a good teacher educator. Educating teacher educators is not just about teaching or teaching people how to do research.

KI 3: We have responsibilities at graduate level. We teach lessons. These students have to follow scientific developments closely. In particular, they should be able to follow the literature related to the field where they will work. The teacher does not need to be aware of every new thing; of course, they also need to develop themselves to undertake scientific research. But it may not necessarily require a strict follow-up as much as a master or doctorate student. The aim of the doctor is to educate the teacher to teach. It seems limited to do research at some universities in Turkey, but we are covering both goals.

KI 4: We do not only educate teachers. We also have students at master's or doctorate levels. We give lessons to them, and more importantly, we try to make them researchers. We do not just look at the doctorate as a researcher. We need to make them one of us. In practice, I don't know what the result is.

The four themes, which are teacher education, content knowledge, pedagogical content knowledge, and program development, assessment and evaluation and other educational activities were taken as different themes in the interview protocol. When the opinions of the key informants were analyzed, it was seen that the needs of competencies for those duties and responsibilities were taken as interconnected competencies. On the other hand, it is seen that two KI 2 and KI 3 differentiate these competencies as biology teaching and educating of biology teachers. For this reason, it was decided to revise these areas as biology teaching and biology teacher education. The opinions of the three key informants who took this decision are as follows:

KI 1: We do not ask any content knowledge in the PhD Proficiency Exam. We think people come to a degree with cumulative knowledge. I assume that every pre-service teacher who takes teaching practice lesson knows biology enough to teach biology. That's the same for me. I can teach biology so I can educate a biology teacher.

KI 2: After all, as a teacher educator, you are trying to explain to a group of people how students are in different generations and how they learn. We're talking about two different things here. You have to be a good teacher. Therefore, you need to know your own student (pre-service teachers), as well as the students in the existing high schools, since at the same time you are educating teachers how to teach biology. These are interconnected competencies... You cannot separate the knowledge of a teacher as content knowledge, pedagogical content knowledge, etc. Fundamentally, they construct a whole.

KI 3: First of all, we are all biology teachers. Then, we teach how to teach biology. Measurement, assessment, teaching, planning and which content can be taught better by using a specific technique are linked to one another. Where do they get separated for us? We teach the student and we teach the teacher how to teach.

KI 4: The field educator is the person who contributes to the teacher's pedagogical content knowledge. First of all, we are all biology teachers but we don't teach biology but we use our knowledge of teaching biology to teach pre-service teachers.

In addition, following innovations in the field was taken as a separate theme in the interview protocol. However, the opinions of the KI 1, KI 2 and KI 3 indicated that this cannot be taken as a separate duty or responsibility for this reason cannot be taken as a separate competency area. The opinions of the key informants that can be included in this scope are as follows:

KI 1: You need to follow new innovations or new studies to reflect them to the students or to your own research.

KI 2: Following the literature is your academic responsibility. It's something that you should always renew to be in this profession. It is reflected onto everything you do.

KI 3: Following new scientific developments and technology is now very important in the field of education. We need to follow them too. We also should follow the innovations in the field of biology. I think we need to transfer them to our students so that individuals can be qualified.

As mentioned earlier, the main objective of this research is to determine the competencies of biology teacher educators. From this point of view, the study aims to determine the competency areas before determining the competencies and competency indicators of biology teacher educators. In line with this aim, the potential competency area themes of teacher educators were formed by using the literature. Following the interviews conducted with four key informants, first of all, the competency areas were defined. As summarized in Table 4.2, 14 task competency areas were converted into 6 which are: biology teaching, biology teacher education, educating biology teacher educators, research on biology education, positive attitudes and values for biology education, and supporting biology education in society.

Table 4.2. *The transformation of the competency area themes obtained from literature review into biology teacher educators' competency areas*

	Biology Teaching	Educating and Developing Biology Teacher	Educating Biology Teacher Educator	Research on Biology Education	Positive Attitudes And Values For Biology Education Supporting Biology Education In Society
Teacher Education		X			
Graduate Education			X		
Content Knowledge	X				
Pedagogical Content Knowledge	X	X			
Program development, assessment and evaluation and other educational activities		X			
Conducting research				X	
Carry out professional development of individual and other teacher educators					X
Following innovations in the field				X	
Serving the society					X
Self-organization					X
Collaborating with other teacher educators					X
Policies on biology education					X
Social outputs related to education					X
Vision and mission					X

4.1.2. Identification of Competencies and Competency Indicators

After the determination of competency areas, the competencies and competency indicators were defined in accordance with each competency area. This section of the dissertation includes the results of the 1st Delphi Round. As explained in the previous chapter, after determining the competency areas firstly, the competencies and indicators, which were obtained from the interviews with four key informants,

were coded and placed under the related competency area. This section constitutes the first stage of the analysis for the data obtained in the Delphi 1st Round interviews.

In the second phase of competency and competency indicator identification in the Delphi 1st Round, the constituted framework was analyzed by the expert panel to increase the inclusiveness and comprehensiveness of the competency areas and competencies and to clarify the statements the draft framework of the current study.

From this perspective, the results of the identification of competencies and competency indicators are presented in two sections. Firstly, the competencies and competency indicators gathered from the interviews with 4 key informants were presented for each of the competency area. Then, the results of the data gathered during the expert panel phase were presented.

4.1.2.1. Identification of Competencies and Indicators Obtained under Biology Teaching Competency Area

4.1.2.1.1. Identification of Competencies and Indicators Obtained from the Interview Phase of the Delphi 1st Round for the Competency Area of Biology Teaching

The analysis of the data collected via interviews was conducted with four key informants in the 1st Phase of the 1st Delphi Round and revealed that 3 competencies and 18 indicators can be placed under the competency area of Biology Teaching (see Table 4.3).

Table 4.3. *Competencies and competency indicators obtained after the interviews for the competency area of Biology Teaching*

Statement
Analyzing the concepts and subjects in the biology curriculum (high school level)
Has knowledge about the theories, principles, generalizations and models that underlie the science of biology.
Constructs the experiment design process for solving problems in the science of biology.
Approaches the science of biology from a perspective that is required by the nature of science.
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.

Table 4.3. (Continued)

Statement
Knows how biology benefits from closely related disciplines.
Knows the historical development processes of biology.
Knows the extent of biology curriculum.
Knows the relationship between the biology curriculum and related curricula (science, physics, chemistry).
Developing the biology literacy level of high school students
Has experience in teaching biology.
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.
Knows appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.
Constructs teaching processes within the framework of the properties of scientific knowledge.
Reflects knowledge about the historical development processes of biology on teaching practices.
Includes the relationship of biology with the society, humanity and environment in the teaching practices.
Implementing biology learning and teaching approaches
Identifies the needs of high school students and plans teaching process.
Knows the individual and group needs of high school students and integrates these needs into the teaching process.
Uses the laboratory activities in biology teaching effectively in teaching processes.
<u>Uses different measurement and evaluation approaches and methods in biology education.</u>
* Competencies are presented in bold; competency indicators are presented normally.

Three of the coded competency indicators from the statement of KI1, two of the coded competency indicators from the statement of KI 2 and three of the coded competency indicators from the statement of KI 3 were grouped together (see Table 4.4). All of these 8 competency indicators were about the content of high school biology curriculum. No coded competency was acquired from the interviews, therefore, the competency was determined by the researcher as “Analyzing the concepts and subjects in the biology curriculum (high school level)”, and these 8 indicators were placed under the determined competency.

The second competency of the competency area for Biology Teaching was gathered from the interview with KI 3, which was “Developing the biology literacy level of high school students.” Six of the coded competency indicators were placed under this competency. Two of these competency indicators were gathered from the

interview with KI 3, and two other competency indicators were gathered from the interview with KI 4. One of these competency indicators were coded from the interview with KI 2, and the last one was coded from the interview with KI 1 (see Table 4.4).

The three coded competency indicators gathered from KI 1 and one of the coded competency indicators gathered from KI 4 were directly related to the implementation of biology processes (see Table 4.4). No competencies were coded from the interviews with the key informants. Therefore, the competency named “Implementing biology learning and teaching approaches” was defined by the researcher as the 3rd competency of Biology Teaching competency area.

Table 4.4. *Competencies and competency indicators coded from the statements of the key informants for the competency area of Biology Teaching*

Coded competency / competency indicator	KI Number	Statement of the KI
Analyzing the concepts and subjects in the biology curriculum (high school level)	Researcher	-
Has knowledge about the theories, principles, generalizations and models that underlie the science of biology.	3	<i>“There should be general knowledge about biology. Biology teacher educators should have the knowledge to give lectures on general biology. S/he does not need to know in detail but needs to have core knowledge. Of course s/he needs to have knowledge about sub-disciplines, not in detail but in general manner. It is not as important as general biology. Essentially, s/he needs to know general models, principles and hypotheses. What is biology based on? S/he needs to have an answer to this.”</i>
Constructs the experiment design process for solving problems in the science of biology		

Table 4.4. (Continued)

Coded competency / competency indicator	KI Number	Statements of the KI
Approaches the science of biology from a perspective that is required by the nature of science	2	<i>"We teach biology in biology courses. Our students get those courses mostly at the faculty of arts and sciences. But to be literate in biology, you need to take the field from the perspective of nature of science. For example, there is no such course like this in the faculty of arts and sciences. Is the nature of science a course about biology education? We are forced to give this course as a biology teacher needs to know this. Or they get the course of general biology but do they know the historical developments in biology? Every biology teacher or teacher educator in this department needs to know the nature and history of biology."</i>
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.	2	<i>"In our field, someone can feel more knowledgeable in a specific biology content. For example, I feel more comfortable in evolution and genetics. But I am not good at cryptogamic plants or systematics. Description of having knowledge is not true. Anyone or I cannot know the whole field, but we are biology literate... I mean I can make connections with the subdisciplines of biology. Otherwise if you do not work or conduct research on that knowledge, that knowledge is temporary. The important thing is biology literacy here."</i>
Knows how biology benefits from closely related disciplines. Knows the historical development processes of biology	1	<i>"Disciplines cannot be separated from one another. There is nuclear distinction. They may also have some content benefit from biology. For example, environment is a multidisciplinary issue. Therefore, I don't think that there are clear lines between some disciplines. Think about a plant, water is everywhere. You cannot separate water into a discipline. We are working on a project. There are some issues about physics. I need to know how biology benefits from chemistry, and even how physics benefit from mathematics. I cannot know the whole physics or chemistry but I need to know how one benefits from another. This can be done thanks to my biology knowledge."</i>

Table 4.4. (Continued)

Coded competency / competency indicator	KI Number	Statements of the KI
Knows the extent of biology curriculum.	1	<i>“S/he needs to have knowledge about the curriculum, and know the high school biology curriculum. S/he needs to know the scope. What are the contents, what are the sequences of acquisitions? Teacher educator should have knowledge about it.”</i>
Knows the relationship between the biology curriculum and related curricula (science, physics, chemistry).	3	<i>“You also need to know the MoNE biology curriculum. Not only biology, you need to know science, physics, and chemistry curricula too. There are some contents that you need to make connection with. Those are important for us too. I am a biology teacher too.”</i>
Developing the biology literacy level of high school students	3	<i>“Not only teaching biology, of course. It should not be only that. There are rapid developments. You need to educate biology literate people, people who can understand and discuss them.”</i>
Has experience in teaching biology	2	<i>“To be a good teacher educator, we need to know the classroom. I think the most important problem among the teacher educators in Turkey is that they do not have any teaching experience.”</i>
Knows appropriate laboratory methods and techniques for the biology subjects in order to improve students biology knowledge.	3	<i>“Biology teachers’ knowledge of laboratory methods is also low. This can arise from us. We also possess high laboratory knowledge. We need to know biology to increase the biology literacy of students.”</i>
Reflects knowledge about the historical development processes of biology on teaching practices.	4	<i>“First, we should never forget that we are biology teachers. For example, there is historical development in science, like cell theory. I suggest teachers that they include the history of biology in their lessons. So I need to know them too. It seems so simple but most of the biology teacher educators do not know it.”</i>

Table 4.4. (Continued)

Coded competency / competency indicator	KI Number	Statements of the KI
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	3	<i>"For example, conducting experiments in biology is important. One needs to have the knowledge of how to prepare an experiment or implement an experiment. One can be able to implement some projects. Or how can you teach science process skills or research skills? Look, for example, this is an important example to reveal the connection between biology and biology education. If your knowledge is not enough, how can you conduct a research? You need to know biology. Science works on finding solutions to a problem, you need to know which experiment to use in order to identify a problem."</i>
Constructs teaching processes within the framework of the properties of scientific knowledge.	4	<i>"You cannot develop yourself without knowing biology, without knowing the properties of scientific knowledge. First, you need to know them and then, by means of this knowledge, you need to plan your lesson. You cannot know microbiology as an academic in biology. I said it before, but you need to know the characteristics of biology. This means that you need to be literate in biology. We expect this from teachers. Don't we? Isn't it a right to expect this from them?"</i>
Reflects knowledge about the historical development processes of biology on teaching practices.	4	<i>"First, we should never forget that we are biology teachers. For example, there is historical development in science, like cell theory. I suggest teachers that they include the history of biology in their lessons. So I need to know them too. It seems so simple but most of the biology teacher educators do not know it.".</i>
Includes the relationship of biology with the society, human and environment in the teaching practices.	1	<i>"We have a theme in our curriculum which is the relationship of biology in society, humanity and environment. This is an important perspective. I should include it in my teaching processes to biology teachers. Also, I need to know how to do this to include it in the lecture given to high school students as a biology teacher."</i>
Implementing biology learning and teaching approaches	Researcher -	
Identifies the needs of high school students and plans teaching process	1	<i>"I am a biology teacher, basically. Of course, I need to know the needs of high school students and prepare my lessons accordingly. Otherwise, how can I teach biology?"</i>

Table 4.4. (Continued)

Coded competency / competency indicator	KI Number	Statements of the KI
Knows the individual and group needs of high school students and integrates these needs into the teaching process.	4	<i>“All students are different, so all classes are different. We expect that biology teachers to know the needs of the students and integrate these into their teaching. So should I. No doubt about that.”</i>
Uses the laboratory activities in biology teaching effectively in teaching processes.	1	<i>“S/he needs to know what is need to be done in the laboratory. The importance of laboratory activities in biology teaching is very effective. A biology teacher needs to use them effectively, hence we.”</i>
Uses different measurement and evaluation approaches and methods in biology education	1	<i>“This is what I mean when I say we need to be a model. We need to be a good biology teacher to educate biology teachers. Teaching iOS, but we also need to be a model, for example, in measurement and evaluation processes. We need to use different types of approaches or techniques. This is the case especially in biology education courses, because we become sort of a biology teacher in there.”</i>

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.1.2. Competencies and Indicators Obtained from the Expert Panel

Phase of the Delphi 1st Round for the Competency Area of Biology Teaching

The main suggestion from the expert panel was the addition of a new competency. The competency indicator of “Knows the extent of biology curriculum” was suggested to be taken as a competency named as “Evaluating the biology curriculum.” Five competency indicators were suggested to be added under this competency. One competency indicator was added under the competency of “Analyzing the concepts and subjects in the biology curriculum (high school level).” Four competency indicators were added under the competency of “Implementing biology learning and teaching approaches.” Besides, 9 indicator statements were revised. All of these changes are summarized in Table 4.5.

Table 4.5. Revisions made by the expert panel on the competencies and competency indicators for the competency area of Biology Teaching

Previous Version	Revised Version
Analyzing the concepts and subjects in the biology curriculum (high school level)	No change
Has knowledge about the theories, principles, generalizations and models that underlie the science of biology.	Explains the theories, principles, generalizations and models that underlie the science of biology.
Constructs the experiment design process for solving problems in the science of biology.	No change
Approaches the science of biology from a perspective that is required by the nature of science.	No change
Added	Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.
Knows how biology benefits from closely related disciplines.	Explains how biology benefits from closely related disciplines.
Knows the historical development processes of biology.	Explains the historical development processes of biology.
Knows the extent of biology curriculum.	Statement was revised and taken as a competency.
Knows the relationship between the biology curriculum and related curricula (science, physics, chemistry).	Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).
Developing the biology literacy level of high school students	No change
Has experience in teaching biology.	No change
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	No change
Knows appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.	Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.
Constructs teaching processes within the framework of the properties of scientific knowledge.	No change
Reflects knowledge about the historical development processes of biology on teaching practices.	Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices

Table 4.5. (Continued)

Previous Version	Revised Version
Includes the relationship of biology with the society, humanity and environment in the teaching practices.	No change
Implementing biology learning and teaching approaches	No change
Identifies the needs of high school students and plans teaching process.	Identifies the individual and group needs of high school students and integrates these needs into the teaching process
Knows the individual and group needs of high school students and integrates these needs into the teaching process.	Identifies the individual and group needs of high school students and integrates these needs into the teaching process.
Added	Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches.
Added	Focuses on the development of scientific process skills in biology teaching.
Uses the laboratory activities in biology teaching effectively in teaching processes.	No change
Uses different measurement and evaluation approaches and methods in biology education.	No change
Added	Takes account of the challenges and misconceptions experienced by students in the biology teaching process.
Added	Uses different measurement and evaluation approaches and methods in biology education.
Taken from the 1st competency.	Evaluating the biology curriculum
Added	Questions the vision, philosophy, structure and scope of the biology curriculum.
Added	Questions the distribution and arrangement of the subject contents in the biology curriculum.
Added	Questions the contents and limitations of the acquisitions in the biology curriculum.
Added	Compares the biology curriculum with the biology curricula of different countries
Added	Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.

* Competencies are presented in bold; competency indicators are presented normally.

All of the competencies and competency indicators in the Biology Teaching competency area at the end of the Delphi 1st Round are given in Table 4.6.

Table 4.6. *Competencies and competency indicators in Biology Teaching competency area at the end of Delphi 1st Round*

Competencies and Indicators
Analyzing the concepts and subjects in the biology curriculum (high school level)
Explains the theories, principles, generalizations and models that underlie the science of biology.
Constructs the experiment design process for solving problems in the science of biology.
Approaches the science of biology from a perspective that is required by the nature of science.
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.
Has the biological literacy level to establish connections between the concepts in the subdisciplines of biology.
Explains how biology benefits from closely related disciplines.
Explains the historical development processes of biology.
Developing the biology literacy level of high school students
Has experience in teaching biology.
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.
Constructs teaching processes within the framework of the properties of scientific knowledge.
Includes the relationship of biology with the society, humanity and environment in the teaching practices.
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.
Implementing biology learning and teaching approaches
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.
Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches.
Focuses on the development of scientific process skills in biology teaching.
Uses the laboratory activities in biology teaching effectively in teaching processes.
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.
Uses different measurement and evaluation approaches and methods in biology education.

Table 4.6. (Continued)

Competencies and Indicators
Evaluating the biology curriculum
Questions the vision, philosophy, structure and scope of the biology curriculum.
Questions the distribution and arrangement of the subject contents in the biology curriculum.
Questions the contents and limitations of the acquisitions in the biology curriculum.
Compares the biology curriculum with the biology curricula of different countries
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.2. Identification of Competencies and Indicators Obtained under the Competency Area of Educating and Developing Biology Teachers

4.1.2.2.1. Identification of Competencies and Indicators Obtained from the Interview Phase of the Delphi 1st Round for the Competency Area of Educating and Developing Biology Teachers

After the analysis of the data collected via interviews conducted with four key informants during the Delphi 1st Round, 4 competencies and 26 competency indicators were placed under the competency area of Educating and Developing Biology Teachers (see Table 4.7).

Table 4.7. *Competencies and competency indicators obtained after the interviews for the competency area of Educating and Developing Biology Teachers*

Statement
Evaluating the biology teacher education program(s) and including it/them into the teacher education processes
Knows the structure and scope of the teacher education program in the department.
Compares the implemented teacher education program with other teacher education programs around the world.
Develops teacher education programs in the department.
Recommends revisions for improvement about the implemented teacher education program.
Knows the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.

Table 4.7. (Continued)

Statement
Supporting pre-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time
Provides examples to pre-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.
Includes in his/her courses to the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.
Develops the skills required for raising individuals with a high level of biology literacy of pre-service and in-service teachers.
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service teachers.
Provides appropriate assessment and evaluation examples to the pre-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.
Creates learning opportunities for the pre-service teachers for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.
Gives feedback to pre-service teachers about their course design and implementations, focusing on the various subjects and concepts in biology.
Includes in his/her courses research- and implementation-based learning implementations for the pre-service teachers on different subjects and concepts in biology education.
Supporting the pre-service biology teachers to select, design, use and develop teaching materials
Recommends appropriate resources to the pre-service teachers for enhancing their teaching material knowledge in biology education.
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service teachers.
Provides examples to the pre-service teachers for selecting up-to-date and appropriate materials about various subjects in biology education.
Determines the knowledge level of pre-service teachers regarding the technological tools used in biology education.
Recommends resources to the pre-service teachers to develop their knowledge of technological tools used in biology education.
Gives examples regarding the use of technological tools in biology education during the pre-service teacher education.
Being a role model for the pre-service teachers in teaching biology
Supports pre-service teachers to examine philosophy, scope, subject distribution, etc. of the biology program.
Pays attention to the thinking and learning styles of pre-service teachers during biology teaching practices.
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service teachers.
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service teachers.

Table 4.7. (Continued)

Statement
Uses reliable and valid assessment tools to evaluate the learning of pre-service biology teachers.
Makes use of practices that promote a higher level of biology literacy in pre-service biology teachers.
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service teachers for timely and on-site implementations.
* Competencies are presented in bold; competency indicators are presented normally.

The first competency of the Educating and Developing Biology Teachers competency area was gathered from the interview with KI 4. Five competency indicators were coded under this competency. The competency indicator of “Knows the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues” was gathered from both KI 1 and KI 2. One of the five competency indicators was coded from the interview with KI 1, and the other three were coded from the interview with KI 4 (see Table 4.8).

Nine competency indicators were grouped together for the second competency of Educating and Developing Biology Teachers competency area. No competency was coded from the interviews, therefore, the competency was determined by the researcher as “Supporting pre-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time” and these nine indicators were placed under the determined competency. The competency indicator of “Provides examples to pre-service teachers to illustrate the effective use of different learning and teaching approaches in biology education” was coded from the interviews with KI 2 and KI 3. Besides, the competency indicator of “Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service teachers” was coded from the interviews with both KI 1 and KI 3. Four of these nine competency indicators were acquired from the coded statements of KI 2, two of them were acquired from the coded statements of KI 3, and one of them was acquired from the coded statements of KI 1 (see Table 4.8).

Five competency indicators were grouped together for the third competency of Educating and Developing Biology Teachers competency area. Similarly, for the second competency, there was no coded competency acquired from the interviews, therefore, the competency was determined by the researcher as “Supporting the pre-service biology teachers to select, design, use and develop teaching materials.” Four of the competency indicators grouped under the third competency of Educating and Developing Biology Teachers competency area were gathered from the coded statements of KI 1 and the other competency indicator was gathered from the coded statements of KI 3 (see Table 4.8).

The fourth and the last competency taken under the competency area of Educating and Developing Biology Teachers was gathered from the interview with KI 1 and KI 2, which was coded as “Being a role model for the pre-service teachers in teaching biology.” six competency indicators were taken under this last competency. Three of these six competency indicators were coded from the statement of KI 1. Two of them were gathered from the statements of KI 2 and two of them were gathered from the statements of KI 4 (see Table 4.8).

Table 4.8. *Competencies and competency indicators coded from the statements of the key informants for the competency area of Educating and Developing Biology Teachers*

Coded competency / competency indicator	KI Number	Statements of the KI
Evaluating the biology teacher education program(s) and including it/them into the teacher education processes	4	<i>“If you speak to teachers about the things that they will not use, such lessons would not have any benefit. We have changed the name of the course for teachers to be able to have knowledge about the construct, philosophy, content, etc. of the biology curricula so that biology teacher educators can give those lessons. We saw the needs of the pre-service biology teachers; we made our suggestions and revised the program. We firstly evaluated the program, and by making revisions, we integrated this evaluation into our process of teaching. We must do it all the time, it is a must.”</i>
Recommends revisions for improvement about the implemented teacher education program.		

Table 4.8. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Knows the structure and scope teacher education program in the department.	1	<i>"If s/he is a teacher educator of biology, then s/he should have knowledge about general biology and how to teach it. Also should know the curriculum. S/he should know the secondary education program, as s/he needs to know the undergraduate program or the graduate education program. S/he should know their extent and structure."</i>
Knows the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	1	<i>"S/he should know the secondary education program, as s/he needs to know the undergraduate program or the graduate education program. S/he should know their extent and structure."</i>
	2	<i>"For example, technopedagogical knowledge is not my specialty, but I should be aware of what kind of education it is, the content of the lessons, and what it targets to teach so that I can have an idea about the needs of the students, what they know and what they need to harmonize. We should be in the same line with other teacher educators. I need to follow."</i>
Compares the implemented teacher education program with other teacher education programs around the world.	4	<i>"When I teach the assessment and evaluation course, I normally prefer a book called classroom assessment. This book is the best source taught at the best universities in the world. I teach this book with students weekly. We follow what is taught in the world. We compare. If there is a book, or a course at other successful universities, we try to integrate them."</i>
Develops teacher education programs in the department.	4	<i>"We can open different courses which were not given before. We also believe that the content of the courses given every year should also change. We need to develop the teacher education program."</i>
Supporting pre-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time	Researcher	-

Table 4.8. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Provides examples to pre-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.	2	<i>“What we do in four years of education is presenting different examples of different teaching styles, e.g. which method is effective and which is not, which approach is ideal as different teacher educators. We help pre-service teachers. We try to provide examples to our students about how to teach effectively.”</i>
	3	<i>“The most important thing is that they (teacher educators) need to know different teaching and learning approaches, and implement them in their lessons since they will inform their students (pre-service teachers) about those methods and techniques. We need to provide examples. They should be able to say that you can implement them and should be able to present examples.”</i>
Give place in his/her courses to the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	2	<i>“What are the basic learning theories, where do they originate from, what are their connections and what are the connections of learning theories and teaching strategies? What are the main research fields and which fields are important in biology/science education? I should know them and apply them in my lessons. Isn't it so?”</i>
Develops the skills required for raising individuals with a high level of biology literacy of pre-service and in-service teachers.	2	<i>“Biology literacy is the key point for me. Knowing the basic concepts and how they are related to one another. Then, being able to search in deep knowledge when one needs or has the ability to learn. What makes us different from a physics teacher educator? They have nonrecourse when they are asked to prepare a presentation about cryptogamic plant systematics. They don't know where to look. But you can should know where to find, how to present it, you have to know at what depth you will explain it as a person who has been educated in this field, who is a literate.”</i>

Table 4.8. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Creates learning opportunities for the pre-service teachers for identifying the scientific thinking skills and learning styles of students on diverse subjects and concepts.	3	<i>"We should inform both pre-service and in-service that there are those kinds of misconceptions that students have, be careful when you are teaching them. We should present opportunities to them so they can learn."</i>
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service teachers.	1	<i>"Assessment and evaluation is a different field. Evaluating them appropriately. Maybe being a model to them in one sense. Helping them gain different perspectives about the question types. Or using different types of assessment methods. I mean I should be a model for them. I should assess and evaluate them with different methods in my lessons so that they can do it on their own."</i>
Provides examples to the pre-service teachers for selecting up-to-date and appropriate materials about various subjects in biology education.	3	<i>"For example, if there is a new material, I transfer it to my students, teach them where or in which subject they can use it. It is the same for assessment and evaluation methods as we cannot implement each of them. They cannot be aware of something they have not put into practice."</i>
Provides appropriate assessment and evaluation examples to the pre-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	1	<i>"Whether you will assess a concept or a skill, you should include it in your lessons. Assessing knowledge is important. OK, but what about scientific process skills? Some people give grade by 2-3 oral exams. We cannot think that it is objective. I will assess them differently. I will present them examples in some way. They will see, then they will implement."</i>
Gives feedback to pre-service teachers about their course design and implementations focuses on the various subjects and concepts in biology.	2	<i>"To identify whether a pre-service teacher makes mistakes in special teaching method courses or in lesson observations, general biology knowledge can be sufficient. There are various subjects and concepts in biology. If you are biology literate, you can understand whether someone explains the content correctly or makes mistakes. I am a biology literate person who can give feedback to pre-service teachers about the courses they teach."</i>

Table 4.8. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Includes in his/her courses research- and implementation-based learning implementations for the pre-service teachers on different subjects and concepts in biology education.	2	“Basically, I conduct research studies on how high school students can learn. And I will transfer these to my students. I use both my academic identity and implementer identity while teaching high school students how they can learn biology concepts and subjects.”
Supporting the pre-service biology teachers to select, design, use and develop teaching materials	Researcher -	
Recommends appropriate resources to the pre-service teachers for enhancing their teaching material knowledge in biology education.	1	<i>“I both need to know the appropriate examples to be used in the lessons and present them to be used and guide students to be able to find them by themselves. They should also know how to find appropriate resources. I can only guide them how to find.”</i>
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service teachers.	1	<i>“The knowledge of preparing a presentation or using Excel is limited. Especially computing percentages can be difficult for a biology teacher. To help them acquire these, we should often provide them such activities. First, we should understand their level of knowledge. Then, we should guide them to access those resources maybe by recommending them.”</i>
Determines the knowledge level of pre-service teachers regarding the technological tools used in biology education.		
Recommends resources to the pre-service teachers to develop their knowledge of technological tools used in biology education.		
Gives examples regarding the use of technological tools in biology education during the pre-service teacher education.	3	<i>“They should exemplify which technologies they can use, what kind of tools can be used in biology teaching and which tool is suitable for different contents. We should create opportunities for biology teacher candidates to be informed about the recent developments.”</i>

Table 4.8. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Be a role model for the pre-service teachers in teaching biology	1	<i>“Assessment and evaluation is a different field. Evaluating them appropriately. Maybe being a model to them in one sense. Helping them gain different perspectives about the question types. Or using different types of assessment methods. I mean I should be a model for them. I should assess and evaluate them with different methods in my lessons so that they can do it on their own.”</i>
	2	<i>“If we look at the perspective of teacher education, everyone in this field should first be a good role model. We should be good role models, because we do not learn from what other people say; we learn from behavior.”</i>
Supports pre-service teachers to examine philosophy, scope, subject distribution, etc. of the biology curriculum.	4	<i>“There are some people who are actually biologists or chemists, but they see themselves as field education specialists. Also, there are some field education specialists who are seen as biologists or physicists. This is an important problem in Turkey. For example, can a biologist discuss whether a curriculum content or arrangement of the acquisition is correct or not? Can they say that the philosophy of the curriculum is this, the content is presented like that or the distribution of the content is this?”</i>
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service teachers.	4	<i>“Even though they are students now, they will be teacher’s tomorrow. I am trying to say that you can use this tool in your lessons too. I am trying to be a model by implementation. We are implementing them in our lessons so that they can use it with their own students when they become teachers.”</i>
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of in-service teachers.	1	<i>“Using technology is important too. It cannot be avoided nowadays. First of all, we should lead it. We should know which technological tool would be effective where and when. We should observe them in our lessons.”</i>

Table 4.8. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Uses reliable and valid assessment tools to evaluate the learning of pre-service biology teachers.	1	<i>"I really believe that objective evaluation should be at universities too. We should be models in this sense. We should prepare questions that have high content validity and reliability. We should try to assess in this way."</i>
Makes use of practices that promote a higher level of biology literacy in pre-service biology teachers.	2	<i>"Our aim is to raise biology literate people. Biology literacy, of course, involves biology knowledge, but we also try to educate people who can show empathy and who can discuss on a topic. We do this by including these activities in our lessons."</i>
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service teachers for timely and on-site implementations.	1	<i>"It is important for teachers as well as students, I mean undergraduate students, because you become a model. After a while you can see, they take you as an example. If you use the same method or technique, they use the same method or technique in their lessons too. They do not know any other if you do not use different methods for teaching the same or different subjects, they cannot see which technique can be used when or appropriately."</i>

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.2.2. Competencies and Indicators Obtained from the Expert Panel

Phase of the Delphi 1st Round for the Competency Area of Educating and Developing Biology Teachers

The statement of the first competency acquired at the end of the interviews was suggested to be revised by the expert panel as "Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes." The statements of the five competency indicators under this competency were also suggested to be revised by the expert panel (see Table 4.9).

The second competency was coded as "Supporting pre-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time" with nine competency indicators as per the analysis resulting from the

interviews conducted with the key informants. The statement of this competency was suggested to be revised as “Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time,” and two more competencies were suggested to be added, which are “Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education,” and “Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students” (see Table 4.9).

For the competency of “Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time,” the statements of three competency indicators were revised and three more competency indicators were added. For the competency of “Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education,” the statements of the two previous competency indicators were revised, and three more competency indicators were added. Likewise, for the competency of “Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students,” the statements of three competency indicators were suggested to be revised by the expert panel (see Table 4.9).

The previously coded competency was “Supporting the pre-service biology teachers to select, design, use and develop teaching materials” with five competency indicators. The expert panel suggested revising this competency as “Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials” and added one more competency, which was “Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education.”

For the competency of “Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials,” the statements of three previous

competency indicators were revised and two more competency indicators were added. For the competency of “Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education,” the statements of three competency indicators were suggested to be revised and three more competency indicators were added by the expert panel (see Table 4.9).

Additionally, the expert panel suggested revising the statement of the competency, “Being a role model for the pre-service teachers in teaching biology” as “Being a role model for the pre-service and in-service teachers in teaching biology.” The statements of the seven competency indicators taken under this competency were revised and one more competency indicator was suggested to be added (see Table 4.9).

One of the main suggestions made by the expert panel for the competency area of Educating and Developing Biology Teachers was the addition of two new competencies. The first suggested competency was “Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education” and six new competency indicators were suggested to be added. The other competency suggested to be added was “Guiding supervising teachers for effective mentoring of pre-service biology teachers.” Five new competency indicators were suggested to be added under this competency (see Table 4.9).

Table 4.9. *Revisions made by the expert panel on the competencies and competency indicators for the competency area of Educating and Developing Biology Teachers*

Previous Version	Revised Version
Evaluating the biology teacher education program(s) and including it/them into the teacher education processes	Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes
Recommends revisions for improvement about the implemented teacher education program. Knows the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues. Compares the implemented teacher education program with other teacher education programs around the world. Develops teacher education programs in the department.	Identifies the issues in the implemented teacher education program and recommends revisions for improvement. Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues. Compares the implemented teacher education program with other teacher education programs at national and international level. Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)
Supporting pre-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time	Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time.
Knows the structure and scope of the teacher education program in the department. Added Provides examples to pre-service teachers to illustrate the effective use of different learning and teaching approaches in biology education. Added	Explains the structure, scope, philosophy and approach of the teacher education program in the department. Creates learning opportunities for the pre-service and in-service teachers to develop their knowledge and skills related to teaching methods and techniques. Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education. Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.

Table 4.9. (Continued)

Previous Version	Revised Version
Includes in his/her courses to the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.
Develops the skills required for raising individuals with a high level of biology literacy of pre-service and in-service teachers.	Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12 th grade level).
Supporting the pre-service biology teachers to select, design, use and develop teaching materials	Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials
Recommends appropriate resources to the pre-service teachers for enhancing their teaching material knowledge in biology education.	Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service teachers.	Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.
Added	Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing diverse scientific thinking and learning styles in students.
Added	Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.
Added	Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.
Added	Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.
Added	Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.

Table 4.9. (Continued)

Previous Version	Revised Version
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service teachers.	Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.
Provides appropriate assessment and evaluation examples to the pre-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.
Added	Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.
Added	Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.
Added	Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.
Added	Guiding the pre-service and in-service biology teachers forth appropriate use of technology in biology education
Determines the knowledge level of pre-service teachers regarding the technological tools used in biology education.	Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.
Recommends resources to the pre-service teachers to develop their knowledge of technological tools used in biology education.	Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.
Gives examples regarding the use of technological tools in biology education during the pre-service teacher education.	Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.
Added	Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.

Table 4.9. (Continued)

Previous Version	Revised Version
Added	Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education
Added	Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students
Creates learning opportunities for the pre-service teachers for identifying the scientific thinking skills and learning styles of students on diverse subjects and concepts.	Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.
Gives feedback to pre-service teachers about their course design and implementations, focusing on the various subjects and concepts in biology.	Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.
Added	Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education
Added	Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.
Added	Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.
Added	Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.
Added	Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.
Added	Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.
Added	Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.

Table 4.9. (Continued)

Previous Version	Revised Version
Added	Guiding supervising teachers for effective mentoring of pre-service biology teachers
Added	Identifies the areas of development in the supervising teachers with regard to mentoring.
Added	Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.
Added	Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.
Added	Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.
Added	Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.
Being a role model for the pre-service teachers in teaching biology	Being a role model for the pre-service and in-service teachers in teaching biology
Includes in his/her courses research- and implementation-based learning implementations for the pre-service teachers on different subjects and concepts in biology education.	Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.
Supports pre-service teachers to examine philosophy, scope, subject distribution, etc. of the biology curriculum.	Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.
Pays attention to the thinking and learning styles of pre-service teachers during biology teaching practices.	Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service teachers for timely and on-site implementations.	Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service teachers.	Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of in-service teachers.	Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.

Table 4.9. (Continued)

Previous Version	Revised Version
Uses reliable and valid assessment tools to evaluate the learning of pre-service biology teachers.	Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.
Makes use of practices that promote a higher level of biology literacy in pre-service biology teachers.	Makes use of practices that promote a higher level of biology literacy in pre-service and in-service biology teachers.
Added	Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.

* Competencies are presented in bold; competency indicators are presented normally.

All of the competencies and competency indicators in Educating and Developing Biology Teachers competency area at the end of the Delphi 1st Round are given in Table 4.10.

Table 4.10. *Competencies and competency indicators in Educating and Developing Biology Teachers competency area at the end of the Delphi 1st Round*

Statements
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes
Explains the structure, scope, philosophy and approach of the teacher education program in the department.
Compares the implemented teacher education program with other teacher education programs at national and international level.
Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.
Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time.
Creates learning opportunities for the pre-service and in-service teachers to develop their knowledge and skills related to teaching methods and techniques.
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.

Table 4.10. (Continued)

Statements
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.

Table 4.10. (Continued)

Statements
Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.
Guiding supervising teachers for effective mentoring of pre-service biology teachers
Identifies the areas of development in the supervising teachers with regard to mentoring.
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.

Table 4.10. (Continued)

Statements
Being a role model for the pre-service and in-service teachers in teaching biology
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.
Makes use of practices that promote a higher level of biology literacy in pre-service and in-service biology teachers.
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.3. Identification of Competencies and Indicators Obtained under the Biology Teacher Educator Education Competency Area

4.1.2.3.1. Identification of Competencies and Indicators Obtained from the Interview Phase of the Delphi 1st Round for the Competency Area of Biology Teacher Educator Education

Under the competency area of Biology Teacher Educator Education 2 competencies and 15 indicators are placed under the competency area of Biology Teacher Educator Education after the analysis of the data collected via interviews conducted with four key informants during the Delphi 1st Round (see Table 4.11).

Table 4.11. *Competencies and competency indicators obtained after the interviews for the competency area of Biology Teacher Educator Education*

Statements
Supporting the prospective teacher educators in the education and training of biology teachers
Involves the prospective biology teacher educators in the educational processes of pre-service teachers.
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.
Educating researcher with the aim of improving the biology education
Improves the knowledge of prospective biology teacher educators on research methods and techniques.
Improves the prospective teacher educators' knowledge and skills of following and contributing to the literature.
Gives lectures on biology education at graduate level.
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.
Guides the prospective teacher educators to support their development in the field of education that they want to specialize in.
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.
Participates in the juries and commissions for the graduate studies in biology education.
Supports the prospective teacher educators to develop their understanding of scientific ethics.
Develops graduate education programs in biology education.
Improves the knowledge of the prospective teacher educators on conducting research independently.

* Competencies are presented in bold; competency indicators are presented normally.

The first competency of the Biology Teacher Educator Education competency area was gathered from the interview conducted with KI 4 and three competency indicators were coded under this competency. One of these competency indicators was also gathered from the interview with KI 4 and two others were coded from the interview with KI 1 (see Table 4.12).

The competency coded as “Educating researchers with the aim of improving biology education” was coded from KI 1’s statements during the interview and 13 competency indicators were placed under this competency. One of these competency indicators was gathered from the interviews with KI 1 and KI 3. In addition to this

competency indicator, 3 competency indicators were gathered from the interview with KI 1. From the interview conducted with KI 2, three coded competency indicators were taken under this competency. Three other competency indicators were coded from the interview with KI 3. Lastly, three competency indicators were gathered from the interview with KI 4 (see Table 4.12).

Table 4.12. *Competencies and competency indicators coded from the statements of the key informants for the competency area of Biology Teacher Educator Education*

Coded competency / competency indicator	KI Number	Statements of the KI
Supporting the prospective teacher educators in the education and training of biology teachers	4	<i>“Ahmet and I wrote an article in addition to the courses. So, I know that he has knowledge on quantitative research and is good at that. There were some complaints about the course of biostatistics. We asked to change the lecturer. Ahmet will give that course next year. He did not give any courses till today but he has a strong background. We encourage him to do this, include him to the courses. This is just an example that we need to support them how to teach biology teachers”</i>
Involves the prospective biology teacher educators in the educational processes of pre-service teachers.		
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	1	<i>“PhD assistants are luckier but it should be everyone’s right. They will be teacher educators eventually; they need to know undergraduate students. They should know how to educate pre-service teachers. We face a lot of problems at the beginning of our careers. Prospective teacher educators need to learn and experience them. This is the least we can do. We can help them if they are research assistants.”</i>
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	1	<i>“PhD assistants are luckier but it should be everyone’s right. They will be teacher educators eventually; they need to know undergraduate students. They should know how to educate pre-service teachers. We face a lot of problems at the beginning of our careers. Prospective teacher educators need to learn and experience them. This is the least we can do. We can help them if they are research assistants.”</i>

Table 4.12. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Educating researcher with the aim of improving the biology education	1	<i>"We expect them to develop knowledge on research on field education. They need to follow the literature, know how to conduct research and implement them. We need to improve their knowledge."</i>
Higher the knowledge of prospective biology teacher educators on research methods and techniques.		
Higher the prospective teacher educators' knowledge and skills of following and contributing to the literature.		
Higher the prospective teacher educators' knowledge and skills of following and contributing to the literature.	3	<i>"They need to know how they can contribute to the biology education via their research. This can be done with our consultancy first. Then they can conduct it independently."</i>
Gives courses in biology education at graduate level.	2	<i>"Giving lectures at undergraduate level is not enough. We should be able to give lectures at the master's and PhD levels."</i>
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	3	<i>"We have responsibilities at graduate level too. For example, we have courses. These students should follow the recent literature closely. Especially, they should have knowledge on general research areas and current research developments. They should be focused on them."</i>
Guides the prospective teacher educators to support their development in the field of education that they want to specialize in.	4	<i>"I wish a student came to me with a thesis idea, I would guide her/him on that idea, direct her/him to our other colleagues who are much more knowledgeable on that topic. They do not come with an idea. At the end, we generally find a research topic and we try to figure out the topic that s/he wants to get specialized in."</i>
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	2	<i>"During PhD, you shouldn't isolate yourself from the field but you need to focus on field education. What I mean by field education is that you need to know everything including all the methods, approaches and theories in line with your academic career. The important thing in PhD is field education. This is what we do during PhD education. We support you to conduct innovative and effective researches as an academic consultant fundamentally."</i>

Table 4.12. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	2	<i>"You educate people who can conduct research in science education and write theses and articles during their master's studies. When it comes to the master's or PhD, everything changes. You don't see them as teacher candidates."</i>
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	3	<i>"For example, we want our master's or PhD students to attend conferences. Following literature or writing your own thesis cannot be enough. We certainly support undergraduate students too, but we encourage graduate students more."</i>
Participates in the juries and commissions for the graduate studies in biology education.	3	<i>"This can be a jury duty in any thesis defense. I believe these jury attendances contribute to our self-development. In the end, we participate in juries too. We don't only contribute to the students there, we also contribute to one another."</i>
Supports the prospective teacher educators to develop their understanding of scientific ethics.	1	<i>"Learning scientific ethics should also be thought at graduate level."</i>
Develops graduate education programs in biology education.	4	<i>"If there are PhD students in this department, then I need to have the knowledge of constructing a curriculum for them. Giving courses are OK, but you are a part of the program in the end."</i>
Improves the knowledge of the prospective teacher educators on conducting research independently.	4	<i>"To be honest, our PhD students do not have ability to work or study independently. I wish they had. This is something that needs to be developed. This can be done by learning the literature deeply. They need to learn things with no help from their advisors. In one sense, we try to develop their independence."</i>

Table 4.12. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Develops graduate education programs in biology education.	1	<i>“As s/he needs to know biology curriculum or biology teacher education curriculum, s/he should have comprehensive knowledge of biology teacher educator curriculum. Moreover, s/he should be able to develop this curriculum. S/he needs to know the scope and content of the curriculum, especially the PhD curriculum. Someone who got a PhD can be teacher educator at the university. So, we need to think what we teach them at their PhD program. For which purpose we educate this person, and what do we need to develop?”</i>

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.3.2. Competencies and Indicators Obtained from the Expert Panel Phase of the Delphi 1st Round for the Competency Area of Biology Teacher Educator Education

The main suggestion made by the expert panel was the addition of a new competency. The competency indicator named “Develops graduate education programs in biology education” was suggested to be taken as a competency named “Developing graduate education programs in biology education.” Three competency indicators were suggested to be added under this competency. Additionally, the statements of one competency and 5 competency indicators were revised. All of these changes are summarized in Table 4.13.

Table 4.13. *Revisions made by the expert panel on the competencies and competency indicators for the competency area of Biology Teacher Educator Education*

Previous Version	Revised Version
Supporting the prospective teacher educators in the education and training of biology teachers	No changes
Involves the prospective biology teacher educators in the educational processes of pre-service teachers.	Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	No changes
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.
Educating researchers with the aim of improving biology education	Managing and supporting the researcher education processes with the aim of improving biology education
Improves the knowledge of prospective biology teacher educators on research methods and techniques.	Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to research methods and techniques.
Improves the prospective teacher educators' knowledge and skills of following and contributing to the literature.	Consults the prospective teacher educators for developing their skills of following and contributing to the literature.
Gives courses in biology education at graduate level.	No changes
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	No changes
Guides the prospective teacher educators to support their development in the field of education that they want to specialize in.	No changes
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	No changes

Table 4.13. (Continued)

Previous Version	Revised Version
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	No changes
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	No changes
Participates in the juries and commissions for the graduate studies in biology education.	No changes
Supports the prospective teacher educators to develop their understanding of scientific ethics.	No changes
Develops graduate education programs in biology education.	Taken as a new competency
Improves the knowledge of the prospective teacher educators on conducting research independently.	Consults the prospective teacher educators to develop their skills for conducting research independently.
Revised from a competency indicator	Developing graduate education programs in biology education
Added	Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education.
Added	Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.
Added	Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.

* Competencies are presented in bold; competency indicators are presented normally.

All of the competencies and competency indicators in the Biology Teacher Educator Education competency area obtained at the end of the Delphi 1st Round are given in Table 4.14.

Table 4.14. *Competencies and competency indicators in the Biology Teacher Educator Education competency area at the end of the Delphi 1st Round*

Competencies and Indicators
Supporting the prospective teacher educators in the education and training of biology teachers
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education. Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers. Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.
Managing and supporting the researcher education processes with the aim of improving biology education
Gives courses in biology education at graduate level. Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education. Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques. Consults the prospective teacher educators for developing their skills of following and contributing to the literature. Consults the prospective teacher educators to support their development in the field of education that they want to specialize in. Consults the prospective teacher educators to develop their skills for conducting research independently. Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies. Consults the prospective teacher educators in the process of reporting and presenting finalized research studies. Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields. Supports the prospective teacher educators to develop their understanding of scientific ethics. Participates in the juries and commissions for the graduate studies in biology education.
Developing graduate education programs in biology education
Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education. Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues. Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.4. Identification of Competencies and Indicators Obtained Under Being a Researcher and Innovativeness Competency Area

4.1.2.4.1. Identification of Competencies and Indicators Obtained from the Interview Phase of the Delphi 1st Round for the Competency Area of Being a Researcher and Innovativeness

Three competencies and 19 competency indicators were placed under the competency area of Being a Researcher and Innovativeness, after the analysis of the data collected via interviews conducted with four key informants during the Delphi 1st Round (see Table 4.15).

Table 4.15. *Competencies and competency indicators obtained after the interviews for the competency area of Being a Researcher and Innovativeness*

Statements
Following the efficient and effective scientific developments related to biology education
Follows the current approaches, theories, research methods and techniques. Follows the national and international scientific research studies on his/her field. Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields. Reads articles about biology and related fields. Follows the qualified publications via the knowledge of indexes and properties of journals.
Conducting innovative, effective and efficient research to improve biology education
Conducts efficient and qualified research about biology education, which will contribute to the area of specialization. Has a research agenda to maintain continuity and deepens on the research area of interest, which is based on his/her own educational vision. Bases his/her research studies on social needs. Uses appropriate quantitative, qualitative or mixed research methods for his/her research. Analyzes the collected data through appropriate methods and techniques. Associates his/her own research with the current studies in the literature. Has a foreign language proficiency to be able to follow and contribute to the international literature. Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations. Reflects his/her acquired experiences as an educator to his/her research studies. Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.
Working effectively and efficiently in research groups by collaborating with colleagues

Table 4.15. (Continued)

Statements
Collaborates with other researchers from the field of biology education and/or different disciplines.
Communicates with colleagues in a constructive and development-oriented manner.
Solves problems faced with colleagues while conducting studies.
Participates projects as executive/researcher/consultant.
* Competencies are presented in bold; competency indicators are presented normally.

The first competency of Being a Researcher and Innovativeness competency area was gathered from the interview KI 3. Five competency indicators were taken under this competency. Two of those competency indicators were gathered from the interviews with two different key informants. The competency indicator of “Follows the current approaches, theories, research methods and techniques” was gathered from both KI 2 and KI 3, while the competency indicator of “Follows the qualified publications via the knowledge of indexes and properties of journals” was gathered from the interviews with KI 1 and KI 3. In addition to these, three of the competency indicators were gathered from the interview conducted with KI 2 (see Table 4.16).

The competency of “Conducting innovative, effective and efficient research to improve biology education” taken as the second competency of the competency area named Being a Researcher and Innovativeness was gathered from the statement of KI 3. 10 competency indicators were taken under this competency. From the interview conducted with KI 1, three coded competency indicators were taken under this competency. Four of these competency indicators were coded from the interview with KI 3. Three coded competency indicators were gathered from the interview with KI 4. None of the coded competency indicators obtained from the interview with KI 2 was placed under this second competency (see Table 4.16).

“Working effectively and efficiently in research groups by collaborating with colleagues” was the third competency taken under the competency area of Being a Researcher and Innovativeness, which was gathered from the interview with KI 1. Four competency indicators were listed under this competency. The competency indicator of “Communicates in a constructive and development-oriented manner

with colleagues” was gathered from the interviews with KI 1 and KI 3. Additionally, two of these competency indicators were gathered from the interview with KI 1. Lastly, one was coded from the interview with KI 4 (see Table 4.16).

Table 4.16. *Competencies and competency indicators coded from the statements of the key informants for the competency area of Being a Researcher and Innovativeness*

Coded competency / competency indicator	KI Number	Statement of the KI
Following the efficient and effective scientific developments related to biology education	3	<i>“Following literature especially in the area of interest is a necessity. New research studies should be built on other recent research and links should be generated with them. I need to know important scientific developments. But you cannot only focus on your research topic and stop following other areas. Even research methods are changing. You can come across new methods that you haven’t heard about. Of course, you cannot follow all of the areas in biology education; you need to be a superhuman. You need to follow the productive and convenient ones. For example, an article I read before helped me a lot. Its method was very interesting. I have a research in a different field but I will use that method. There was another method in my mind but I think the other method will be more effective. This is because I need to use the appropriate research method. I should use the current ones.”</i>
Follows the current approaches, theories, research methods and techniques.	3	
Follows the current approaches, theories, research methods and techniques.	2	<i>“Where are we in the field, where does it go and, what are new research studies? I think the answers to those questions are fundamental. Then, you should keep on researching. This does not mean I learnt everything and my work is done. You cannot focus on your area of interest and stop following the other dimensions of your field. You need to know current approaches, theories research methods and so on. As well as not isolating yourself from biology, you need to focus on biology education. You can keep reading about biology but you need to follow biology education closely.”</i>
Follows the national and international scientific research studies on his/her field.	2	<i>“Being a researcher means following the literature in the best way. With each research you learn new things. You also learn by reading other researchers’ studies. What they are doing in Turkey or abroad, there are lots of things we can learn this way.”</i>

Table 4.16. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Follows the qualified publications via the knowledge of indexes and properties of journals.	1	<i>“Following the literature is certainly important. We should now how and where to follow the research studies. You cannot follow each journal but you should be able to know how to follow research effectively. For example, journals have indexes. This helps you see the research field and makes it easier to decide where to publish your research.”</i>
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields	2	<i>“Universities have budgets for everyone to attend conferences. If you go to a conference, you can widen your network or get rest, you can try to improve yourself or take this as a vacation. You are the only person who will directly be influenced from this. But anyway, you need to participate in those organizations.”</i>
Reads articles about biology and related fields.	2	
Follows the qualified publications via the knowledge of indexes and properties of journals.	3	<i>“You need to know which journals you need to follow. You need to know the basic criteria of the journals and follow them. If I want to contribute to the literature, then I need to know the current studies.”</i>
Conducting innovative, effective and efficient research to improve biology education	3	<i>“Our main aim is to improve biology education. We should be aware of this aim all the time. We must conduct effective and innovative research. Also these should be applicable, I mean efficient.”</i>
Conducts efficient and qualified research about biology education that will contribute to the area of specialization.	3	<i>“Of course, you should conduct research which can contribute to biology education, and these need to be applicable. You need to bring innovations to the field you are specialized in. What does this mean? It needs to be effective and productive. There should be some studies that will contribute to students, teachers, MoNE and everyone. Mostly we use research studies for academic assignments. But, the main aim is to improve the teaching and learning processes at schools.”</i>
Has a research agenda to maintain continuity and deepens on the research area of interest that is based on his/her own educational vision.	4	<i>“Every researcher should have a research agenda. Related to his/her dissertation or not. S/he should calculate how to deepen on the interested area step by step from his/her own point of view.”</i>

Table 4.16. (Continued)

Coded competency / competency indicator	KI Number	Statement of the KI
Bases his/her research studies on social needs.	1	<i>"We should be connected to schools. There should be collaboration between schools and universities. A MoNE-university collaboration. We need to provide them. These are our common grounds. We should be connected to these common grounds and base our researches on them."</i>
Uses appropriate quantitative, qualitative or mixed research methods for his/her research.	3	<i>"Following literature especially in the area of interest is a necessity. New research should be built on other recent research studies and links should be generated with them. I need to know important scientific developments. But you cannot only focus on your research topic and stop following other areas. Even research methods are changing. You can come across new methods that you haven't heard about. Of course, you cannot follow all of the areas in biology education; you need to be a superhuman. You need to follow the productive and convenient ones. For example, an article I read before helped me a lot. Its method was very interesting. I have a research in a different field but I will use that method. There was another method in my mind but I think the other method will be more effective. This is because I need to use the appropriate research method. I should use the current ones."</i>
Analyzes the collected data by appropriate methods and techniques.	4	<i>"We have mentioned teacher educator education but there are some researchers who use incorrect statistical techniques. I do not mean that everyone should know advance research techniques but they should know at least as well as a master's student. Because of this they cannot analyze the data correctly."</i>
Associates his/her own research with the current studies in the literature.	3	<i>"You need to know which journals you need to follow. You need to know the basic criteria of the journals and follow them. If I want to contribute to the literature, then I need to know the current studies."</i>
Reflects his/her acquired experiences as an educator to his/her research studies.	1	<i>"Research also feeds the teacher education processes. There is a direct relationship. You can follow new research studies and reflect these to your students. You can differentiate the content but you still reflect them. Or it also works the other way. You can follow the new studies and reflect these to your students."</i>

Table 4.16. (Continued)

Coded competency / competency indicator	KI Number	Statements of the KI
Has a foreign language proficiency to be able to follow and contribute to the international literature.	3	<i>“There are some teacher educators who do not have proficiency in a foreign language. I don’t know how we can tackle with them. They already cannot follow the research conducted in other countries. We need to have the proficiency to follow up the international literature and following shouldn’t be enough. We also should be able to contribute to the international literature.”</i>
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	4	<i>“Attending conferences encourages academicians to conduct research. You should conduct research so as you will present it. There is no need to always write articles. Conferences have different contributions.”</i>
Reflects his/her acquired experiences as an educator to his/her research studies.	1	<i>“Research also feeds the teacher education processes. There is a direct relationship. You can follow new research studies and reflect those to your students. You can differentiate the content but you still reflect them. Or it also works the other way. You can follow new studies and reflect these to your students.”</i>
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	1	
Working effectively and efficiently in research groups by collaborating with colleagues	1	<i>“You cannot be the expert of all knowledge. Working with a colleague who works on some other topic develops you too and the research itself. I only do not mean working with the people who are experts on biology education; researchers from other fields should be involved in the study. I think this kind of researches more effective. We should work with other researchers to conduct effective research. Communication is very important. We need to communicate constructively and development should be the main aim of working together.”</i>

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.4.2. Competencies and Indicators Obtained from the Expert Panel

Phase of the Delphi 1st Round for the Competency Area of Being a Researcher and Innovativeness

Addition of the competency named “Sharing research results with different stakeholders effectively and efficiently” was the main suggestion made by the expert panel. Three competency indicators were added under this newly constructed competency, and one competency indicator was taken from another competency under this newly added competency. Moreover, four more competency indicators were added under two of the previously constructed competencies. Two competency indicators were combined and rewritten as one competency indicator. Additionally, the statements of 16 competency indicators were revised. All of these changes are summarized in Table 4.17.

Table 4.17. *Revisions made by the expert panel on the competencies and competency indicators for the competency area of Being a Researcher and Innovativeness*

Previous Version	Revised Version
Following the efficient and effective scientific developments related to biology education	No changes
Follows the current approaches, theories, research methods and techniques.	Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.
Follows the national and international scientific research studies in his/her field.	No changes
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.	Follows the national and international scientific research studies in the academic areas of interest.
Reads articles about biology and related fields.	Reads about the topics in education and related fields to attain higher general knowledge.
Follows the qualified publications via the knowledge of indexes and properties of journals.	Follows the qualified publications via the knowledge of indexes and properties of journals.

Table 4.17. (Continued)

Previous Version	Revised Version
Added	Reads articles about biology to attain higher general knowledge.
Added	Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.
Conducting innovative, effective and efficient research to improve biology education	No changes
Conducts efficient and qualified research about biology education that will contribute to the area of specialization.	No changes
Has a research agenda to maintain continuity and deepens on the research area of interest that is based on his/her own educational vision.	Has a research plan to maintain continuity and deepens on the research area of interest that is based on his/her own educational vision.
Bases his/her research studies on social needs.	No changes
Uses appropriate quantitative, qualitative or mixed research methods for his/her research.	Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.
Analyzes the collected data through appropriate methods and techniques.	Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.
Associates his/her own research with the current studies in the literature.	No changes
Has a foreign language proficiency to be able to follow and contribute to the international literature.	No changes
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	Taken under the new competency
Reflects his/her acquired experiences as an educator to his/her research studies.	No changes
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	No changes
Added (competency)	Sharing research results with different stakeholders effectively and efficiently

Table 4.17. (Continued)

Previous Version	Revised Version
Added	Reads articles about biology to attain higher general knowledge.
Added	Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.
Conducting innovative, effective and efficient research to improve biology education	No changes
Conducts efficient and qualified research about biology education that will contribute to the area of specialization.	No changes
Taken from another competency	Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.
Added	Publishes the results of completed scientific research in books, book chapters or articles.
Added	Selects the most appropriate journals that publish research in the related area of biology education to reach appropriate target audience with his/her research.
Added	Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.
Working effectively and efficiently in research groups by collaborating with colleagues	No changes
Collaborates with other researchers from the field of biology education and/or different disciplines.	No changes
Solves problems faced with colleagues while conducting studies.	
Participates in projects as executive/researcher/consultant.	No changes
Added	Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.

* Competencies are presented in bold; competency indicators are presented normally.

All of the competencies and competency indicators in Being a Researcher and Innovativeness competency area obtained at the end of the Delphi 1st Round are given in Table 4.18.

Table 4.18. *Competencies and competency indicators in Being a Researcher and Innovativeness competency area at the end of the Delphi 1st Round*

Competencies and Indicators
Following the efficient and effective scientific developments related to biology education
Follows the national and international scientific research studies in the academic areas of interest.
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.
Reads about the topics in education and related fields to attain higher general knowledge.
Reads articles about biology to attain higher general knowledge.
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.
Follows the qualified publications via the knowledge of indexes and properties of journals.
Conducting innovative, effective and efficient research to improve biology education
Has a research plan to maintain continuity and deepens on the research area of interest that is based on his/her own educational vision.
Conducts efficient and qualified research about biology education that will contribute to the area of specialization.
Bases his/her research studies on the literature and social needs.
Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.
Uses the latest technologies (web-based data collection tools, qualitative and quantitative data analysis software, etc.) in conducting scientific research.
Associates his/her own research with the current studies in the literature.
Has a foreign language proficiency to be able to follow and contribute to the international literature.
Reflects his/her acquired experiences as an educator to his/her research studies.
Sharing research results with different stakeholders effectively and efficiently
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.
Publishes the results of completed scientific research in books, book chapters or articles.
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.

Table 4.18. (Continued)

Competencies and Indicators
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.
Working effectively and efficiently in research groups by collaborating with colleagues
Demonstrates conflict resolution skills while working in collaboration with colleagues. Collaborates with other researchers from the field of biology education and/or different disciplines.
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.
Participates in international projects as executive/researcher/consultant.
* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.5. Identification of Competencies and Indicators Obtained Positive

Attitudes and Values for Biology Education Competency Area

4.1.2.5.1. Identification of Competencies and Indicators Obtained from the Interview Phase of the Delphi 1st Round for the Competency Area of Positive Attitudes and Values for Biology Education

Three competencies and 16 competency indicators were placed under the competency area of Positive Attitudes and Values for Biology Education after the analysis of the data collected via interviews conducted with four key informants during the Delphi 1st Round (see Table 4.19).

Table 4.19. *Competencies and competency indicators obtained after the interviews for the competency area of Positive Attitudes and Values for Biology Education*

Statement
Having an attitude toward open to innovation
Has an individual education philosophy and vision that are supported by professional experience and are open to development
Enhances self-learning to develop his/her biology teaching methods.
Updates teaching processes by making use of his/her professional experience.
Regards improving field knowledge as an academic responsibility.
Follows the qualified scientific studies related to the field of expertise closely.
Prioritizes professional development to improve biology education.
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.

Table 4.19. (Continued)

Statement
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education
Motivates pre-service biology teachers to teach biology.
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economic and physical environments.
Has a high motivation to guide the pre-service and in-service teachers on biology teaching.
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.
Demonstrating collaboration skills for the aim of developing biology education
Communicates in a constructive and development-oriented manner with teacher educators.
Constructs healthy, efficient and effective communication with group members to improve their skills that are open to improvement.
Shares work among group members within the scope of his/her competencies and proficiencies.
Fulfills the responsibilities undertaken within the division of work.
Contributes to the national and international educational research groups by prioritizing biology education.

* Competencies are presented in bold; competency indicators are presented normally.

Seven competency indicators were grouped together for the first competency of Positive Attitudes and Values for Biology Education competency area. There was no coded competency acquired from the interviews, therefore the competency was determined by the researcher as “Having an open attitude toward innovation” and these seven indicators were placed under the determined competency. The competency indicator of “Updates teaching processes by making use of his/her professional experience” was coded from the interviews with KI 1, KI 2 and KI 4. Similarly, the competency indicator of “Demonstrates self-regulation skills to balance different roles of being a researcher and an educator” was coded from the interviews with both KI 1 and KI 2. Two of the competency indicators were coded from the statement of KI 2, two of the coded competency indicators from the statement of KI 3 and one coded competency indicator from the statement of KI 4 were taken under the competency of “Having an open attitude toward innovation” (see Table 4.20).

Four of the competency indicators were grouped together for the second competency of Positive Attitudes and Values for Biology Education competency area. The competency was determined by the researcher as “Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education” because there was no coded competency acquired from the interviews. Three of these coded competency indicators were acquired from the interview with KI 1 and one of them was acquired from the interview with KI 4 (see Table 4.20).

The competency of “Demonstrating collaboration skills for the aim of developing biology education” was coded from the statements of KI 3 during the interview. Five competency indicators were placed under this competency. The competency indicator of “Fulfills the responsibilities undertaken within the division of work.” was coded from the interviews of KI 1, KI 2 and KI 3. Three of these five competency indicators were acquired from the statement of KI 3 and one of them was acquired from the statement of KI 1 (see Table 4.20).

Table 4.20. *Competencies and competency indicators coded from the statements of the key informants for the competency area of Positive Attitudes and Values for Biology Education*

Coded competency / competency indicator	KI Number	Statements of the KI
Having an open attitude toward innovation	- Researcher	
Has an individual education philosophy and vision that are supported by professional experience and are open to development.	4	“(Having an education philosophy) <i>This is not a “should have”; everyone has it already. Even though they are not aware of it, they all have it. We say it as a statement of purpose. Since in Turkey the habit of writing a curriculum vita is not prevalent, even most academicians do not have it. In there, we try to answer the question of who we are, for what purpose we work.</i> ”
Enhances self-learning to develop his/her biology teaching methods.	2	“ <i>Your researcher identity is important both for being a good teacher educator and a researcher. To improve my courses and my teaching, I should improve my self-learning.</i> ”

Table 4.20. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Updates teaching processes by making use of his/her professional experience.	2	<i>"My other role in this occupation is reading, searching and researching. I should do this as a responsibility. I must update my classes and courses in accordance with whatever I have acquired as an academician."</i>
	4	<i>"One of our articles will be published about the perception of genetics in high school students. So we can discuss the experience we obtain here in our courses with teacher candidates."</i>
	1	<i>"Teacher education is our main responsibility but we should not leave aside our researcher identity. We should keep the two in balance. The opposite is possible too. You translate what you learn from literature to your courses."</i>
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.	2	<i>"Our lives have two pieces actually. Till 5.00 pm we are teachers. After 5.00 pm we turn back to our researcher identity. Courses are over. I can turn back to my research after 5.00 pm. This is the tough part... Teacher educator has two worlds. The toughest part is to keep them in balance. You can abandon yourself to one side. You may not be able to keep the balance."</i>
Prioritizes professional development to improve biology education.	3	<i>"S/he should conduct research by following technological developments, studies in different societies, cultures, disciplines related to biology education to improve self-development. But whatever s/he done priority should be to improve biology education. This is matter of ethics."</i>
Supporting the pre-service teachers to develop positive attitudes and values for biology education	Researcher	-

Table 4.20. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economical and physical environments.	4	<i>“We try to form the basis of our education as much as possible by thinking the needs of today’s biology teachers. We don’t worry whether s/he will work in a rural or urban area or in a private or public school... We try to equip them as much as we can in line with current issues. We know that they go to different places... We cannot show them each of the potential difficulties or how they can be their best when teaching biology in different circumstances. It is not possible to show them all of the possibilities. But we can create diversity and let them find the best solution. They should be able to evaluate any situation. If there is an opportunity they would use it, it is easy. How can they overcome challenges? To find a way, they should be familiar with different circumstances.”</i>
Demonstrating collaboration skills for the aim of developing biology education Constructs healthy, efficient and effective communication with group members to improve their skills that are open for improvement	3	<i>“Communication is important. Mainly collaboration is a must for us. While collaborating we should look from the perspective of improving education, biology education. S/he should be someone I like, work together who I can collaborate... S/he should be someone who can contribute to the research, to me or to the course. I should be able to improve her/his knowledge too. This is two-sided. If I say s/he has deficiency about something, I need to work to improve her/his experience. I mean we should not take it as single-side.</i>
Motivates pre-service biology teachers to teach biology.	1	<i>“With the help of various projects, teacher candidates should be encouraged to bring materials into the class which are proper for the field. Teacher candidates’ motivation for being a teacher needs to be higher.”</i>
Has a high motivation to guide the pre-service teachers on biology teaching.	1	<i>“At this point our motivation needs to be high too. Sometimes we may get tired. We need to remind ourselves that we are the guides of pre-service teachers.”</i>

Table 4.20. (Continued)

Coded competency / competency indicator	KI Number	Expression of the KI
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	1	<i>"We try to consider their differences, their attitudes or actual beliefs toward teaching or education as much as possible. We pay attention to them in our courses."</i>
Communicates in a constructive and development-oriented manner with teacher educators.	3	<i>"In the end, I come together with other academicians to do a good job. To improve my self-development and theirs too. Therefore, we should not forget it while we are communicating. We need to prioritize our development while communicating."</i>
Contributes to the national and international educational research groups by prioritizing biology education.	1	<i>"As I said before, I think research studies conducted by a single researcher are not effective and realistic. I feel more useful when I take part in research projects at other universities in Turkey or abroad. Even my contribution</i>
		<i>"You may not be interested as a researcher but you should read new findings and improvements. You can closely follow your field of interest. This balance is important too. But you should also follow the studies of other people in your general field."</i>
Shares work among group members within the scope of his/her competencies and proficiencies	3	<i>"Our perception of work or responsibility can be different. I usually prefer working with colleagues whose perception of work is similar to mine and who are potentially good at work. If I take responsibility and if we share the work, I prefer to take a part in the work where I think I am good at. I do my best at other areas, but if I believe that I am not good at a specific area, I do not take responsibility. One should know her/his strong side and take responsibility in that area. Then, we need to fulfill our responsibilities."</i>

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.5.2. Competencies and Indicators Obtained from the Expert Panel

Phase of the Delphi 1st Round for the Competency Area of Positive Attitudes and Values for Biology Education

Firstly, it was suggested that the competency named “Having an open attitude toward innovation” could be taken as two competencies, which were “Demonstrating a vision that is open to professional development” and “Acting in accordance with professional ethics” by the expert panel. For the competency of “Demonstrating a vision that is open to professional development,” four of the competencies from the competency of “Having an open attitude toward innovation” were suggested to remain without changes while the statement of one of these competency indicators is enhanced. Also, twelve new competency indicators were added (see Table 4.21). For the competency of “Acting in accordance with professional ethics,” two competency indicators from the previous competency were suggested to remain without changes, and five new competency indicators were suggested to be added (see Table 4.21).

Additionally, the second competency was suggested to be revised as “Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education.” Four of the competency indicators taken under this competency were suggested to remain without changes while the statements of two of those competency indicators were suggested to be revised. Two new competency indicators were proposed to be added by the expert panel (see Table 4.21).

Addition of one more competency was suggested by the expert panel, which was “Supporting prospective biology teacher educators to develop positive attitudes and values for biology education.” Four new competency indicators were indicated for this newly constructed competency (see Table 4.21).

The last competency for this competency area was “Demonstrating collaboration skills for the aim of developing biology education.” All of the previously mentioned

competency indicators were suggested to remain without changes, while the statements of these two competency indicators were revised (see Table 4.21).

Table 4.21. *Revisions made by the expert panel on the competencies and competency indicators for the competency area of Positive Attitudes and Values for Biology Education*

Previous Version	Revised Version
Having an open attitude toward open to innovation	Removed
Added	Demonstrating a vision that is open to professional development
Added	Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.
Has an individual education philosophy and vision that are supported by professional experience and are open to development.	No changes
Added	Associates the current developments in biology education with his/her educational practices and research.
Added	Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.
Enhances self-learning to develop his/her biology teaching methods.	No changes
Added	Attaches importance to improving teacher training and education in the light of advanced practices and developments.
Added	Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his/her colleagues in biology education.
Added	Plans professional development by identifying strengths and weaknesses through self-assessment.
Updates teaching processes by making use of his/her professional experience.	No changes
Regards improving field knowledge as an academic responsibility.	No changes

Table 4.21. (Continued)

Previous Version	Revised Version
Follows the qualified scientific studies related to the field of expertise closely. Added	Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely. Actively participates in the learning communities focusing on innovation and change in biology education.
Added	Respects different views about biology education.
Added	Is open to innovations in biology teacher education.
Added	Supports research-based innovation in biology education.
Added	Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.
Added	Acting in accordance with professional ethics
Prioritizes professional development to improve biology education. Added	No changes
Added	Has a heightened awareness of ethical violation issues such as plagiarism, salami slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.
Added	Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.
Added	Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.
Added	Follows codes of conduct in jury duty and refereeing.
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator. Added	No changes
	Distinguishes the qualities of journals, indexes and activities in biology education and related fields.
Supporting the pre-service teachers to develop positive attitudes and values for biology education	Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education
Added	Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops that may contribute to their professional development.

Table 4.21. (Continued)

Previous Version	Revised Version
Motivates pre-service biology teachers to teach biology.	Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.
Has a high motivation to guide the pre-service teachers in biology teaching.	Has a high motivation to guide the pre-service and in-service teachers in biology teaching.
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	No changes
Added	Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.
Added	Supporting prospective biology teacher educators to develop positive attitudes and values for biology education
Added	Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.
Added	Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.
Added	Gives feedback to the prospective teacher educators to improve their competencies.
Added	Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.
Demonstrating collaboration skills for the aim of developing biology education	No changes
Constructs healthy, efficient and effective communication with group members to improve their skills that are open to improvement.	No changes
Communicates in a constructive and development-oriented manner with teacher educators.	Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.

Table 4.21. (Continued)

Previous Version	Revised Version
Fulfills the responsibilities under taken within during the division of work.	No changes
Shares work among group members within the scope of his/her competencies and proficiencies	No changes
Contributes to the national and international educational research groups by prioritizing biology education.	Contributes to the local, national and international educational research groups by prioritizing biology education.

* Competencies are presented in bold; competency indicators are presented normally.

All of the competencies and competency indicators in Positive Attitudes and Values for Biology Education competency area obtained at the end of the Delphi 1st Round are given in Table 4.22.

Table 4.22. *Competencies and competency indicators in Positive Attitudes and Values for Biology Education competency area at the end of the Delphi 1st Round*

Statements
Demonstrating a vision that is open to professional development
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.
Has an individual education philosophy and vision that are supported by professional experience and are open to development.
Associates the current developments in biology education with his/her educational practices and research.
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.
Attaches importance to improving teacher training and education in the light of advanced practices and developments.
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his/her colleagues on biology education.
Plans professional development by identifying strengths and weaknesses through self-assessment.
Updates teaching processes by making use of his/her professional experience.
Regards improving field knowledge as an academic responsibility.
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.
Actively participates in the learning communities focusing on innovation and change in biology education.
Respects different views about biology education.
Supports research-based innovation in biology education.
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teachers and prospective teacher educators.

Table 4.22. (Continued)

Statements
Acting in accordance with professional ethics Has a heightened awareness of ethical violation issues such as plagiarism, salami slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc. Informs people and/or institutions about the ethical violations faced within the area of his/her duties and responsibilities. Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research. Follows codes of conduct in jury duty and refereeing. Distinguishes the qualities of journals, indexes and activities in biology education and related fields. Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops that may contribute to their professional development. Is open to innovation in biology teacher education.
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy. Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economic and physical environments. Has a high motivation to guide the pre-service and in-service teachers in biology teaching. Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices. Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education. Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops. Gives feedback to the prospective teacher educators to improve their competencies. Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.
Demonstrating collaboration skills for the aim of developing biology education Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators. Constructs healthy, efficient and effective communication with group members to improve their skills that are open to improvement.

Table 4.22. (Continued)

Statements
Shares work among group members within the scope of his/her competencies and proficiencies.
Fulfills the responsibilities undertaken within the division of work.
Contributes to the local, national and international educational research groups by prioritizing biology education.
* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.6. Identification of Competencies and Indicators Obtained Under Supporting Biology Education in Society Competency Area

4.1.2.6.1. Identification of Competencies and Indicators Obtained from the Interview Phase of the Delphi 1st Round for the Competency Area of Supporting Biology Education in Society

Three competencies and 15 competency indicators were placed under the competency area of Supporting Biology Education in Society after the analysis of the data collected via interviews conducted with four key informants during the Delphi 1st Round (see Table 4.23).

Table 4.23. Competencies and competency indicators obtained after the interviews for the competency area of Supporting Biology Education in Society

Statements
Organizing effective in-service teacher education programs for biology teachers
Participates in the in-service teacher education programs for biology teachers.
Takes into account the individual differences of teachers in the implementation of in-service teacher education programs.
Takes into account both theoretical and practical implementations in the in-service teacher education practices s/he participated.
Plans the in-service teacher educational practices based on the needs of biology teachers.
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)
Conducts research to improve local, national and global education policies in order to increase the quality of education by prioritizing biology education.
Contributes to the document preparation processes of institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.
Participates in the content and curriculum development of biology education.
Follows the local, national and global education policies by prioritizing biology education.

Table 4.23. (Continued)

Statements
Working for the development of biology education in the society
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.
Determines the requirements of biology education and engages in action (meeting, workshop, etc.) to fulfill them.
Contributes to qualified resource production processes related to biology education.
Develops textbooks and/or instructional materials that can be used in biology education.
Supports professional development of her/his colleagues.
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops, etc.).

* Competencies are presented in bold; competency indicators are presented normally.

Five competency indicators were grouped together for the first competency of Supporting Biology Education in Society competency area. There was no coded competency acquired from the interviews, therefore the competency was determined by the researcher as “Organizing effective in-service teacher education programs for biology teachers” and these five competency indicators were taken under this determined competency. One of the competency indicators coded as “Plans the in-service teacher educational practices based on the needs of biology teachers” was acquired from the interviews with KI 1 and KI 3. Two other competency indicators were coded from the statement of KI 1 and two of the coded competency indicators were coded from the statement of the KI 3 (see Table 4.24).

The second competency of Supporting Biology Education in Society competency area was gathered from the interview with KI 2, which was coded as “Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)” and four competency indicators were taken under this competency. One of those competency indicators was “Contributes to the document preparation processes of institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field” and it was acquired from the interviews with KI 1, KI 2 and KI 4. Similarly, the competency indicator is acquired from the interview with KI 2 and KI 4, which was coded as “Participates in the content and curriculum development of biology education.” One of these four competency indicators under

the second competency was acquired from the interviews with KI 2 and KI 4 (see Table 4.24).

The third competency was coded from the interview with KI 4, which was “Working for the development of biology education in the society. “Under this competency, six competency indicators were coded. Three of these competency indicators were gathered from the statements of KI 3, two of them were gathered from the statements of KI 2, and one of them was gathered from the statements of KI 4 (see Table 4.24).

Table 4.24. *Competencies and competency indicators coded from the statements of the key informants for the competency area of Supporting Biology Education in Society*

Coded competency / competency indicator	KI Number	Statement of the KI
Organizing effective in-service teacher education programs for biology teachers	Researcher -	
Participates in the in-service teacher education programs for biology teachers.	1	<i>“Reaching teachers at schools should also be among our duties. There should be collaboration and every teacher educator welcomes the offers positively. This is also a duty. There can be some project duties in private schools. This does not have any contribution to your academic development, but we should not refuse such offers. This is a service and each academicians must attend these kinds of activities. We need to know their needs. They become glad too, if we know their needs and work in line with these needs. We need to take this as a base.”</i>
Plans the in-service teacher educational practices based on the needs of biology teacher.		
	3	<i>“Not even as much as pre-service teachers, in-service teacher has too many needs. They should be supported too... We should take care of their needs too but we should design our education considering the theory, practice should also be involved but not enough. Both are needed... I say them but they are also differentiating in themselves. I am not sure whether it is possible but we need to take into consideration of those differentiations too.”</i>
Takes into account the individual differences of teachers in the implementation of in-service teacher education programs.		
Takes into account both theoretical and practical implementations in the in-service teacher education practices s/her participated.	3	

Table 4.24. (Continued)

Coded competency / competency indicator	KI Number	Statement of the KI
Plans appropriate in-service teacher education models and programs.	1	<i>"There are not some duties specific to the in-service teacher education... Of course it is much harder than to plan in line with one's purpose compared with pre-service teacher education. Maybe it is because we do not do it often. These kinds of duties should be more common."</i>
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	2	<i>"I think as much as the universities, teacher educators should make their presence felt in society and provide support. This can be done in various ways. Teacher educator actually acts as an opinion leader on such issues."</i>
Contributes to the document preparation processes of institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	1	<i>"Teacher educator becomes distanced from the developments happening at schools because MoNE cannot ensure coordination. If they give a task you can be included. Otherwise if you are not interested especially you may be unaware of the changes. If they ask our opinion about something, we can reflect on it and do some research. Academicians should be able to express their opinions easily on their topics of specialty."</i>
	2	<i>"We say bad or good teacher educators, one of the criteria is do you only work in your room, follow the literature, read books and use your knowledge only in the teaching process or do you share your rights with society, discuss them with the public and let people benefit from your knowledge or competencies? You need to express your opinions and suggestions. You can prepare documents; there are other ways. A good teacher educator is a person who makes his/her presence felt in society."</i>
	4	<i>"We support some institutions and take it as a part of service to society. We contribute their documents, present our opinions by writing reports. We support like that. Our opinions and recommendations should be taken into consideration. We are the ones who know the field."</i>

Table 4.24. (Continued)

Coded competency / competency indicator	KI Number	Statement of the KI
Plans appropriate in-service teacher education models and programs.	1	<i>“There are not some duties specific to the in-service teacher education... Of course it is much harder than to plan in line with one’s purpose compared with pre-service teacher education. Maybe it is because we do not do it often. These kinds of duties should be more common.”</i>
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	2	<i>“I think as much as much as the universities, teacher educators should make their presence felt in society and provide support. This can be done in various ways. Teacher educator actually acts as an opinion leader on such issues.”</i>
Participates in the content and curriculum development of biology education.	4	<i>“I should communicate with the authorities here. I should work with teachers. For example, every teacher educator should be able to develop biology curriculum. They should be competent to do that. Yet the processes in Turkey are quite obvious.”</i>
	2	<i>“If civil society gets involved, teacher educators can develop different biology programs and most efficient ones can be appreciated and selected. Only we can know the issues in biology education and how to solve them. This is our job. We should enlighten the society.”</i>
Conducts research to improve local, national and global education policies in order to increase the quality of education by prioritizing biology education.	2	<i>“NGOs which work on curriculum design should organize the planning of biology curriculum. Teacher educators should be involved in curriculum development processes. This can be done only if you include NGOs in these processes. In Turkey, you may be asked or not. We should conduct research to develop educational policies locally, in our country or even globally. Then, everyone must have a chance to the right of access.”</i>
Follows the local, national and global education policies by prioritizing biology education.	4	<i>“Teacher educators should contribute to teacher education policies and they should be allowed for them... We do not only follow local policies or policies in our country, we also follow the international context in biology education.”</i>

Table 4.24. (Continued)

Coded competency / competency indicator	KI Number	Statement of the KI
Plans appropriate in-service teacher education models and programs.	1	<i>“There are not some duties specific to the in-service teacher education... Of course it is much harder than to plan in line with one’s purpose compared with pre-service teacher education. Maybe it is because we do not do it often. These kinds of duties should be more common.”</i>
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	2	<i>“I think as much as much as the universities, teacher educators should make their presence felt in society and provide support. This can be done in various ways. Teacher educator actually acts as an opinion leader on such issues.”</i>
Working for the development of biology education in the society.	4	<i>“Not only biology teacher educators, all of the academicians have three main duties. Teaching, researching and serving the public. I must support biology education in public. I must improve my studies to this end.”</i>
Determines the requirements of biology education and engage in action (meeting, workshop, etc.) to fulfill them.	2	<i>“To represent our thoughts, it is effective for us to get out of the school. This can be done in various ways like the NGOs. You can attend meetings or workshops. This is a different skill of course. You need to see the need in biology education and find ways to solve them.”</i>
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	2	<i>“The bureaucrats in the ministry cannot be expected to lead the appropriate policies and should not. These kinds of things should be done by the NGOs. And NGOs should be in collaboration with universities and teacher educators... This is our job. We should enlighten the society. This can be done in various ways; we can write reports and give speeches etc.”</i>
Contributes to qualified resource production processes related to biology education.	4	<i>“I see documents or lesson contents we constitute for our research as qualified resources and we are open to share them. Not only we have our research studies, but also our books also at service for the development of biology education.”</i>

Table 4.24. (Continued)

Coded competency / competency indicator	KI Number	Statement of the KI
Plans appropriate in-service teacher education models and programs.	1	<i>“There are not some duties specific to the in-service teacher education... Of course it is much harder than to plan in line with one’s purpose compared with pre-service teacher education. Maybe it is because we do not do it often. These kinds of duties should be more common.”</i>
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	2	<i>“I think as much as the universities, teacher educators should make their presence felt in society and provide support. This can be done in various ways. Teacher educator actually acts as an opinion leader on such issues.”</i>
Develops textbooks and/or instructional materials that can be used in biology education.	3	<i>“I think there are just a few research studies in Turkey which have practical contribution or are carried into practice. Most studies are conducted for academic concerns... But here it is, there are some materials or contents I have developed for my studies. We hope everyone can use them somehow. But they shouldn’t be prioritized for the research. The process brings it. We should write lesson books or design materials that can be used at schools. This must be our priority actually.”</i>
Supports the professional development of colleagues.	3	<i>“This can be a jury duty in any thesis defense. I believe jury attendances contribute our self-development. In the end, we participate in juries too. We don’t only contribute to the students there, we also contribute to each other.”</i>
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.).	3	<i>“The most effective thing for a teacher educator is to work with qualified colleagues. We need to share and transfer our experiences. There are also things that other teacher educators need to learn. We need to find appropriate settings and talk to them about in-service teacher education practices or programs.”</i>

* Competencies are presented in bold; competency indicators are presented normally.

4.1.2.6.2. Competencies and Indicators Obtained from the Expert Panel Phase of the Delphi 1st Round for the Competency Area of Supporting Biology Education in Society

For the first competency, it was suggested by the expert panel that two more competency indicators be added. The statements of the previously coded four competency indicators were suggested to be revised (see Table 4.25).

Four competency indicators were coded under the second competency that was coded as “Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)”. All of the statements for these four coded competency indicators were suggested to be revised and two more competency indicators were suggested to be added under the second competency by the expert panel (see Table 4.25).

One of the two main suggestions made by the expert panel was the revision of the statement of the third competency indicator as “Leading the development of biology education in the society.” Six competency indicators were placed under this competency. The expert panel suggested to take one of those competency indicators as a competency, which was the second main suggestion made by the expert panel. For the defined competency of “Leading the development of biology education in the society” three of the competency indicators remained without any changes, while the statement of one of the competency indicators was suggested to be revised. One of the competency indicators was removed and two more competency indicators were added by the expert panel. The competency indicator of “Supports professional development of her/his colleagues” was suggested to be taken as a competency and it was named “Supporting the professional development of colleagues” by the expert panel. Under this competency, one of the previously coded competency indicators remained without any changes and three more competencies were suggested to be added under this newly constructed competency (see Table 4.25).

Table 4.25. *Revisions made by the expert panel on the competencies and competency indicators for the competency area of Supporting Biology Education in Society*

Previous Version	Revised Version
Organizing effective in-service teacher education programs for biology teachers	No changes
Participates in the in-service teacher education programs for biology teachers.	Actively participates in the in-service teacher education programs for biology teachers.
Takes into account the individual differences of teachers in the implementation of in-service teacher education programs.	Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.
Added	Takes into account the characteristics of adult education in the in-service teacher education practices.
Takes into account both theoretical and practical implementations in the in-service teacher education practices s/he participated.	Takes into account both theoretical and practical implementations in the in-service teacher education practices.
Plans appropriate in-service teacher education models and programs.	Plans the in-service teacher educational practices based on the needs of biology teachers.
Plans the in-service teacher educational practices based on the needs of biology teacher.	Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.
Added	Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	No change
Follows the local, national and global education policies by prioritizing biology education.	Follows the local, national and international education policies by prioritizing biology education.
Conducts research to improve local, national and global education policies in order to increase the quality of education by prioritizing biology education.	Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.
Contributes to the document preparation processes of institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.	Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.

Table 4.25. (Continued)

Previous Version	Revised Version
Participates in the content and curriculum development of biology education. Added	Actively participates in the content and curriculum development of biology education. Organizes professional meetings / seminars / conferences for the stakeholders in biology education.
Added	Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.
Working for the development of biology education in the society	Leading the development of biology education in the society
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	No changes
Determines the requirements of biology education and engage in action (meeting, workshop, etc.) to fulfill them. Added	No changes
Added	Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders. Brings the developed implementations and materials to the use of relevant stakeholders.
Contributes to qualified resource production processes related to biology education.	Removed
Develops textbooks and/or instructional materials that can be used in biology education. Added	Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education. Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).
"Supports professional development of her/his colleagues" taken as a competency	Supporting the professional development of colleagues
Added	Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.
Added	Develops course materials to support professional development and shares them with colleagues.

Table 4.25. (Continued)

Previous Version	Revised Version
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.). Added	No change Takes an active role in providing professional development in different environments (social sharing, panels, workshops etc.).

* Competencies are presented in bold; competency indicators are presented normally.

All of the competencies and competency indicators in Supporting Biology Education in Society competency area obtained at the end of the Delphi 1st Round are given in Table 4.26.

Table 4.26. *Competencies and competency indicators in Supporting Biology Education in Society competency area at the end of the Delphi 1st Round*

Statements
Organizing effective in-service teacher education programs for biology teachers.
Actively participates in the in-service teacher education programs for biology teachers.
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.
Takes into account the individual differences of teachers (knowledge, beliefs, experience, etc.) in the implementation of in-service teacher education programs.
Plans the in-service teacher educational practices based on the needs of biology teachers.
Takes into account the characteristics of adult education in the in-service teacher education practices.
Takes into account both theoretical and practical implementations in the in-service teacher education practices.
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)
Follows the local, national and international education policies by prioritizing biology education.
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.

Table 4.26. (Continued)

Statements
Actively participates in the content and curriculum development of biology education. Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.
Leading the development of biology education in the society
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education. Determines the requirements of biology education and engages in action (meeting, workshop, etc.) to fulfill them. Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders. Brings the developed implementations and materials to the use of relevant stakeholders. Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education. Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).
Supporting the professional development of colleagues
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education. Develops course materials to support professional development and shares them with colleagues. Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.). Takes an active role in providing professional development in different environments (social sharing, panels, workshops etc.).
* Competencies are presented in bold; competency indicators are presented normally.

4.2. Findings from the Delphi 2nd and 3rd Rounds: Getting Opinions from Biology Teachers, Graduate Students and Teacher Educator

As detailed in the previous chapter, the Delphi method is preferred for the current study to synthesize the most reliable opinions that build consensus among the participants of the study by using a series of questionnaires with controlled feedback, (Dalkey & Helmer, 1962). For the current study, the Delphi method is constructed in four rounds. Due to the complexity of the method, the main sections are also summarized before presenting the results of the 2nd and Delphi 3rd Rounds.

After determining the first version of biology teacher educator competencies and indicators by using the interviews and evaluation of expert panel opinions, the study proceeded to the Delphi 2nd Round. The aim of the Delphi 2nd Round is to get the

opinions of the key informants about the necessity of the listed competencies and indicators that biology teacher educators need to possess. For this aim, the first version of biology teacher educators' competency task was transferred to a 9 point-Likert type questionnaire. The participants of the Delphi 2nd Round were composed of three main groups: biology teacher educators (13), graduate students in biology education (12) and biology teachers (13).

The main aim of data analysis for the Delphi 2nd Round was not to reach a decision by excluding items (competencies or competency indicators), but to determine the descriptive statistics to be included in the survey for use in the Delphi 3rd Round. In this context, descriptive analyses were conducted for each item in the questionnaire. The percentage distribution of responses for each item was calculated. Then, separate forms were created for each participant. The distributions of all items in this survey and the previous responses of the participants were presented.

For the Delphi 3rd Round questionnaire, all of the items (competencies and indicators) were included, and each questionnaire was prepared and arranged for each participant. In each questionnaire, the score that a participant give to an item in the Delphi 2nd Round and the percentages of the responses of the belonged group (teacher educators, graduate students or teachers) were presented to the participants. Thus, the participants were allowed to reevaluate their scores after examining the distribution of the other participants. Also, in each questionnaire a separate column was added to give new scores in case they want to change their previous scoring. The purpose of the new process is to make it easier for the participants (without dictation) to reach consensus in accordance with the basic philosophy of the Delphi method.

In order to identify whether a consensus is reached for an item, three main criteria were identified. These criteria were: having a median (Mdn) higher than 7, an interquartile range (IQR) lower or equal to 2 and having more than 80% items loaded in [7-9] in three dot pitch of [1-3], [4-6], [7-9]. Even though these analyses were not conducted for constructing the Delphi 3rd Round questionnaire, analyses for all of

the three criteria were conducted to identify the differentiation between the 2nd and Delphi 3rd Rounds. Additionally, all of the criteria were also crosschecked among the three groups to deepen the analysis.

The results obtained from the 2nd and Delphi 3rd Rounds are summarized in Table 4.27, and detailed analyses are provided in Appendix E and Appendix G, respectively. The items are given in the first column of each table. In the second and third columns, whether a consensus is reached for a specific item is indicated with “+”. If no criterion is reached for any of the items, the item is given numbers. For not satisfying the median higher than 7, then that item is coded with 1 in the related round. Similarly, for not satisfying the criterion for having less than 2 interquartile range, the item is coded with 2 and for not satisfying the criterion of having more than 80% of the respondents loaded in [7-9] dot pitch, it is coded with 3.

Table 4.27. The summary of the results obtained from the Delphi 2nd and Delphi 3rd Rounds

ITEMS	2 nd	3 rd	BTE	BG	BT
COMPETENCY AREA A: BIOLOGY TEACHING					
Analyzing the concepts and subjects in the biology curriculum (high school level)	+	+	+	+	+
Explains the theories, principles, generalizations and models that underlie the science of biology.	+	+	+	+	+
Constructs the experiment design process for solving problems in the science of biology.	+	+	+	+	+
Approaches the science of biology from a perspective that is required by the nature of science.	+	+	+	+	+
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.	+	+	+	+	+
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.	+	+	+	+	+
Explains how biology benefits from closely related disciplines.	+	+	+	+	+
Explains the historical development processes of biology.	2,3	2,3	2,3	+	1,3
Developing the biology literacy level of high school students	2,3	+	+	+	+
Has experience in teaching biology.	2,3	+	+	+	+
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	+	+	+	+	+
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Constructs teaching processes within the framework of the properties of scientific knowledge.	+	+	+	+	+
Includes the relationship of biology with the society, human and environment in the teaching practices.	+	+	+	+	+
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	2,3	+	+	+	3
Implementing biology learning and teaching approaches	+	+	+	+	+
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.	2,3	+	+	+	+
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.	+	+	+	+	+
Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches.	+	+	+	+	+
Focuses on the development of scientific process skills in biology teaching.	+	+	+	+	+
Uses the laboratory activities in biology teaching effectively in teaching processes.	+	+	+	+	+
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.	+	+	+	+	+
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.	+	+	+	+	+
Uses different measurement and evaluation approaches and methods in biology education.	+	+	+	+	+
Evaluating the biology curriculum	+	+	+	2,3	+
Questions the vision, philosophy, structure and scope of the biology curriculum.	+	+	+	+	+
Questions the distribution and arrangement of the subject contents in the biology curriculum.	+	+	+	+	+
Questions the contents and limitations of the acquisitions in the biology curriculum.	+	+	+	+	+
Compares the biology curriculum with the biology curricula of different countries.	3	3	2,3	3	+
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	3	+	+	2	+
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	2,3	3	+	3	+
COMPETENCY AREA B: BIOLOGY TEACHER EDUCATION					
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes	+	+	+	+	+
Explains the structure, scope, philosophy and approach of the teacher education program in the department.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Compares the implemented teacher education program with other teacher education programs at national and international level.	+	+	+	+	+
Supports the development of teacher education programs in the department (recommending courses, updating the contents of existing courses, etc.).	+	+	+	+	+
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.	+	+	+	+	+
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	3	+	+	+	+
Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time.	+	+	+	+	+
Creates learning opportunities for the pre-service and in-service teachers to develop their knowledge and skills related to teaching methods and techniques.	+	+	+	+	+
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.	+	+	+	+	+
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.	+	+	+	+	+
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	+	+	+	+	+
Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12th grade level).	+	+	+	+	+
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.	+	+	+	+	+
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials	+	+	+	+	+
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.	+	+	+	+	+
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.	+	+	+	+	+
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.	+	+	+	+	+
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.	+	+	+	+	+
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education	+	+	+	+	+
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.	+	+	+	+	+
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.	+	+	+	+	+
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.	+	+	+	+	+
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	+	+	+	+	+
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.	+	+	+	+	+
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education	+	+	+	+	+
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.	+	+	+	+	+
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	3	+	+	3	+
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.	+	+	+	+	+
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.	+	+	+	+	+
Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.	+	+	+	+	+
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students	+	+	+	+	+
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.	+	+	+	+	+
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.	+	+	+	+	+
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.	+	+	+	+	+
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education	+	+	+	+	+
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.	3	+	+	+	+
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.	+	+	+	+	+
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.	+	+	+	+	+
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.	3	+	+	+	+
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.	+	+	+	+	+
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.	+	+	+	+	+
Guiding supervising teachers for effective mentoring of pre-service biology teachers	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Identifies the areas of development in the supervising teachers with regard to mentoring.	+	+	+	+	+
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.	+	+	+	+	+
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.	+	+	+	+	+
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.	+	+	+	+	+
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.	+	+	+	+	+
Being a role model for the pre-service and in-service teachers in teaching biology	+	+	+	+	+
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.	+	+	+	+	+
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.	+	+	+	+	+
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.	+	+	+	+	+
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.	+	+	+	+	+
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.	+	+	+	+	+
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.	+	+	+	+	+
Makes use of practices that promote a higher level of biology literacy in pre-service and in-service biology teachers.	+	+	+	+	+
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	+	+	+	+	+
COMPETENCY AREA C: BIOLOGY TEACHER EDUCATOR EDUCATION					
Supporting the prospective teacher educators in the education and training of biology teachers	+	+	+	+	+
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 ^r _d	BT E	B G	BT
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	+	+	+	+	+
Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.	+	+	+	+	+
Managing and supporting the researcher education processes with the aim of improving biology education	+	+	+	+	+
Gives courses in biology education at graduate level.	+	+	+	+	+
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	+	+	+	+	+
Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques.	+	+	+	+	+
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.	+	+	+	+	+
Consults the prospective teacher educators to support their development in the field of education that they want to specialize in.	+	+	+	+	+
Consults the prospective teacher educators to develop their skills for conducting research independently.	+	+	+	+	+
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	+	+	+	+	+
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	+	+	+	+	+
COMPETENCY AREA D: BEING A RESEARCHER AND INNOVATIVENESS IN BIOLOGY EDUCATION					
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	+	+	+	+	+
Supports the prospective teacher educators to develop their understanding of scientific ethics.	+	+	+	+	+
Participates in the juries and commissions for the graduate studies in biology education.	2,3	+	+	3	+
Developing graduate education programs in biology education	+	+	+	2	+
Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education.	+	+	+	+	+
Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.	+	+	+	+	+
COMPETENCY AREA D: BEING A RESEARCHER AND INNOVATIVENESS IN BIOLOGY EDUCATION					
Following the efficient and effective scientific developments related to biology education	+	+	+	+	+
Follows the national and international scientific research studies in the academic areas of interest.	+	+	+	+	+
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.	+	+	+	+	+
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.	+	+	+	+	+
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.	+	+	+	+	+
Reads about the topics in education and related fields to attain higher general knowledge.	+	+	+	+	+
Reads articles about biology to attain higher general knowledge.	+	+	+	+	+
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	2,3	+	2,3	+	+
Follows the qualified publications via the knowledge of indexes and properties of journals.	+	+	+	+	+
Conducting innovative, effective and efficient research to improve biology education	+	+	+	+	+
Has a research plan to maintain continuity and deepens on the research area of interest that is based on his/her own educational vision.	+	+	+	+	+
Conducts efficient and qualified research about biology education that will contribute to the area of specialization.	+	+	+	+	+
Bases his/her research studies on the literature and social needs.	+	+	+	3	+
Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.	+	+	+	+	+
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2nd	3rd	BTE	BG	BT
Uses the latest technologies (web-based data collection tools, qualitative and quantitative data analysis software, etc.) in conducting scientific research.	+	+	+	+	+
Associates his/her own research with the current studies in the literature.	+	+	+	+	+
Has a foreign language proficiency to be able to follow and contribute to the international literature.	+	+	+	+	+
Reflects his/her acquired experiences as an educator to his/her research studies.	+	+	+	+	+
Sharing research results with different stakeholders effectively and efficiently	+	+	+	+	+
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	+	+	+	+	+
Publishes the results of completed scientific research in books, book chapters or articles.	+	+	+	+	+
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.	+	+	+	+	+
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.	2,3	+	+	+	+
Working effectively and efficiently in research groups by collaborating with colleagues	+	+	+	+	+
Demonstrates conflict resolution skills while working in collaboration with colleagues.	+	+	+	+	+
Collaborates with other researchers from the field of biology education and/or different disciplines.	+	+	+	+	+
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.	+	+	+	+	+
Participates in international projects as executive/researcher/consultant.	+	+	+	+	+
COMPETENCY AREA E: POSITIVE ATTITUDES AND VALUES TOWARD BIOLOGY EDUCATION					
Demonstrating a vision that is open to professional development	+	+	+	+	+
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.	+	+	+	+	+
Has an individual education philosophy and vision that are supported by professional experience and are open to development.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Associates the current developments in biology education with his/her educational practices and research.	+	+	+	+	+
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.	+	+	+	+	+
Enhances self-learning to develop his/her biology teaching methods.	+	+	+	+	+
Attaches importance to improving teacher training and education in the light of advanced practices and developments.	+	+	+	+	+
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his / her colleagues in biology education.	+	+	+	+	+
Plans professional development through identifying strengths and weaknesses through self-assessment.	+	+	+	+	+
Updates teaching processes by making use of his/her professional experience.	+	+	+	+	+
Regards improving field knowledge as an academic responsibility.	+	+	+	+	+
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.	+	+	+	+	+
Actively participates in the learning communities focusing on innovation and change in biology education.	+	+	+	+	+
Respects different views on biology education.	+	+	+	+	+
Is open to innovations in biology teacher education.	+	+	+	+	+
Supports research-based innovation in biology education.	+	+	+	+	+
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.	+	+	+	+	+
Acting in accordance with professional ethics	+	+	+	+	+
Prioritizes professional development to improve biology education.	+	+	+	+	+
Has a heightened awareness of ethical violation issues such as plagiarism, salami-slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.-	+	+	+	+	+
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.	+	+	+	+	+
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Follows codes of conduct in jury duty and refereeing.	+	+	+	+	+
Distinguishes the qualities of journals, indexes and activities in biology education and related fields.	+	+	+	+	+
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.	+	+	+	+	+
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education	+	+	+	+	+
Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops that may contribute to their professional development.	+	+	+	+	+
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.	+	+	+	+	+
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economic and physical environments.	3	+	+	2,3	+
Has a high motivation to guide the pre-service and in-service teachers in biology teaching.	+	+	+	+	+
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	2,3	+	+	+	+
Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.	+	+	+	+	+
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education	+	+	+	+	+
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.	3	+	+	+	+
Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.	+	+	+	+	+
Gives feedback to the prospective teacher educators to improve their competencies.	+	+	+	+	+
Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.	+	+	+	+	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Demonstrating collaboration skills for the aim of developing biology education	+	+	+	+	+
Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.	+	+	+	+	+
Constructs healthy, efficient and effective communication with group members to improve their skills that are open to improvement.	+	+	+	+	+
Shares work among group members within the scope of his/her competencies and proficiencies.	+	+	+	+	+
Fulfills the responsibilities undertaken within the division of work.	+	+	+	+	+
Contributes to the local, national and international educational research groups by prioritizing biology education.	+	+	+	+	+
COMPETENCY AREA F: SUPPORTING BIOLOGY EDUCATION IN SOCIETY					
Organizing effective in-service teacher education programs for biology teachers.	3	+	2,3	3	+
Actively participates in the in-service teacher education programs for biology teachers.	+	+	+	+	+
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.	+	+	+	+	+
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.	3	+	+	+	+
Takes into account the individual differences of teachers (knowledge, beliefs, experience, etc.) in the implementation of in-service teacher education programs.	2,3	2,3	+	+	1,3
Plans the in-service teacher educational practices based on the needs of biology teachers.	3	+	+	+	+
Takes into account the characteristics of adult education in the in-service teacher education practices.	+	+	+	+	+
Takes into account both theoretical and practical implementations in the in-service teacher education practices.	+	+	+	+	+
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	3	+	+	+	+
Follows the local, national and international education policies by prioritizing biology education.	3	+	+	+	+
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	3	3	+	1,3	+

Table 4.27. (Continued)

ITEMS	2 nd	3 rd	BTE	BG	BT
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.	3	3	3	1,3	+
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	3	3	2,3	3	+
Actively participates in the content and curriculum development of biology education.	3	+	2,3	3	+
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.	3	+	+	+	+
Leading the development of biology education in the society	+	+	+	+	+
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	+	+	+	+	+
Determines the requirements of biology education and engages in action (meeting, workshop, etc.) to fulfill them.	+	+	+	+	+
Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders.	+	+	+	+	+
Brings the developed implementations and materials to the use of relevant stakeholders.	+	+	+	+	+
Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education.	+	+	+	+	+
Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).	+	+	+	+	+
Supporting the professional development of colleagues	3	+	+	+	2,3
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	2,3	2,3	1,2,3	+	+
Develops course materials to support professional development and shares them with colleagues.	2,3	+	+	+	+
Takes an active role in providing professional development in different environments (social sharing, panel, workshop etc.).	+	+	+	+	+
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.).	+	+	+	+	+

Six competency areas were defined at the end of the Delphi 1st Round in the draft Competency Framework for Biology Teacher Educators. Under these competency areas, there were 209 items composed of 29 competencies and 180 competency indicators were defined. As can be seen from Table 4.27, consensus is richer for 177 items in the Delphi 2nd Round and 201 items in the Delphi 3rd Round. As a summary, 24 of the items which did not reach a consensus in the Delphi 2nd Round were successfully reconciled in the Delphi 3rd Round. On the other hand, there were still 8 items that did not bring about a consensus in the Delphi 3rd Round in the overall group analysis.

As mentioned before, for the Delphi 3rd Round all of the criteria were also crosschecked among the three groups to deepen the analysis. In the group of biology teacher educators, there were 7 items which did not reach a consensus at the end of Delphi 3. The number of items that did not reach a consensus for the group of graduate students and teachers were 14 and 4, respectively. The detailed results of these analyses are given under two subheadings. In the first subheading, the results of the items that did not reach a consensus are given. In the second subheading, the results of the items that reached consensus and were remarkable are given by comparison of the groups.

4.2.1. Findings from the Delphi 2nd and 3rd Rounds: Items in No Consensus

As explained in detail in the previous chapter, the criteria for reaching a consensus on an item (competencies and indicators) were: having a median (Mdn) higher than 7, having an interquartile range (IQR) of 2 or less, and 80% or more of the respondents to be loaded in [7-9] dot pitch.

The mean (M), standard deviation (SD), median (Mdn), interquartile range (IQR), first quartile (Q1), third quartile (Q3) and percentage of the respondents loaded in [7-9] dot pitch for all item results in the 2nd and Delphi 3rd Rounds are presented in Appendix E and Appendix G, respectively. In Table 4.28, the items that do not meet

at least one of the above criteria and that are not as strong as others at the level of consensus on the necessity are shown and related statistics are provided.

Accordingly, there were 32 items that did not meet at least one of the criteria in Delphi 2. 13 out of 32 items had an interquartile range (IQR) of over 2. None of the items satisfied the requirement of at least 80% of respondents loading in [7-9] dot pitch. However, all of the items had 7 or higher median.

Table 4.28. *Items that could not reach a consensus in the Delphi 2nd Round*

ITEMS	MDN	IGR	%
Explains the historical development processes of biology.	7.0	3.00	65.79
Developing the biology literacy level of high school students	8.0	2.50	75.76
Has experience in teaching biology.	9.0	3.00	71.43
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	7.0	3.00	72.97
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.	8.0	3.00	72.97
Compares the biology curriculum with the biology curricula of different countries.	7.0	2.00	68.42
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	8.0	2.00	78.95
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.0	3.00	71.05
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	8.0	2.00	77.78
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	8.0	2.00	78.38
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.	8.0	2.00	79.41
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.	8.0	2.00	79.41
Participates in the juries and commissions for the graduate studies in biology education.	7.0	3.00	71.43

Table 4.28. (Continued)

ITEMS	MDN	IGR	%
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	7.0	3.00	70.27
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.	7.0	3.50	70.27
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economical and physical environments.	8.0	2.00	78.95
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	7.0	2.50	75.68
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.	7.0	1.00	78.38
Organizing effective in-service teacher education programs for biology teachers	7.0	1.25	68.18
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.	8.0	2.00	77.78
Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.	7.0	3.00	60.00
Plans the in-service teacher educational practices based on the needs of biology teacher.	8.0	2.00	77.14
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	7.0	2.00	72.00
Follows the local, national and international education policies by prioritizing biology education.	7.5	2.00	77.78
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	7.0	2.00	72.97
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	7.0	2.00	61.11
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	7.0	2.00	67.57
Actively participates in the content and curriculum development of biology education.	7.0	1.50	75.68
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.	7.0	2.00	78.38

Table 4.28. (Continued)

ITEMS	MDN	IGR	%
Supporting the professional development of colleagues	7.0	2.00	70.00
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	7.0	3.00	64.86
Develops course materials to support professional development and shares them with colleagues.	7.5	2.25	76.32

* Competencies are presented as bold; competency indicators are presented normally

On the other hand, as shown in Table 4.29, in Delphi 3rd Round it seems that consensus was reached in 24 of these items. However, it was revealed that 8 of those items still did not meet at least one of the needed criteria. Accordingly, none of these 8 items satisfied the requirement of at least 80% of respondents located in [7-9] dot pitch. On the contrary, all of the items had 7 or higher median. 3 of the 8 items had an interquartile range (IQR) of over 2.

Table 4.29. Items that could not reach a consensus in the Delphi 3rd Round

ITEMS	MDN	IGR	%
Explains the historical development processes of biology.	7.0	2.75	66.67
Compares the biology curriculum with the biology curricula of different countries.	7.0	1.00	77.78
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.5	2.00	77.78
Takes into account the individual differences of teachers (knowledge, beliefs, experience, etc.) in the implementation of in-service teacher education programs.	7.0	3.00	72.22
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	7.0	1.75	75.00
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.	7.0	2.00	66.67
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	7.0	1.00	77.78
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	7.5	2.75	75.00

* Competencies are presented as bold; competency indicators are presented normally

After the Delphi 2nd Round, the number of items that was not considered to be a consensus was 32, while Delphi dropped to 8 in the Delphi 3rd Round. This can be

seen as a sign that the participants have a broad consensus in their views on the qualifications of biology teacher educators as targeted within the study.

As mentioned earlier, within the scope of the research, data were collected from three different groups: teacher educators, graduate students and teachers. The data gathered in the Delphi 3rd Round were analyzed for the presence of a consensus among the groups and within the groups.

As explained in detail previously, the criteria for reaching a consensus on an item (competencies and indicators) were: having a median (Mdn) higher than 7, having an interquartile range (IQR) of 2 or less, and at least 80% of respondents located in [7-9] dot pitch.

The mean (M), standard deviation (SD), median (Mdn), interquartile range (IQR), first quartile (Q1), third quartile (Q3) and at least 80% of respondents located in three dot pitch of 7-9 for the results of each group participating in Delphi 3 in all items are presented in Appendix G.

Accordingly, there were 8 items that did not meet at least one of the criteria in Delphi 3 among teacher educators. 7 of the 8 items had an interquartile range (IQR) of over 2. None of the items satisfied the requirement of at least 80% of respondents located in [7-9] dot pitch. However, only one of these items had a median lower than 7 as shown in Table 4.30.

Table 4.30. *Items that could not reach a consensus among teacher educators in the Delphi 3rd Round*

ITEMS	MDN	IQR	%
Explains the historical development processes of biology.	7.0	2.50	75.00
Compares the biology curriculum with the biology curricula of different countries.	7.0	2.50	75.00
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	7.0	3.50	75.00
Organizing effective in-service teacher education programs for biology teachers	7.0	2.50	75.00

Table 4.30. (Continued)

ITEMS	MDN	IGR	%
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	7.0	2.00	66.67
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	8.0	2.50	75.00
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	8.0	2.50	75.00
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	6.0	2.75	41.67

* Competencies are presented in bold; competency indicators are presented normally.

As conducted for the teacher educator group, the same analyses were conducted for the group of graduate students. 14 items did not meet at least one of the criteria in Delphi 3 among graduate students. 4 of the items had an interquartile range (IQR) of over 2. 13 of these items did not satisfy the requirement of at least 80% of respondents located in [7-9] dot pitch. Additionally, 2 of these items had a median lower than 7 as shown in Table 4.31.

Table 4.31. Items that could not reach a consensus among graduate students in the Delphi 3rd Round

ITEMS	MDN	IGR	%
Evaluating the biology curriculum	7.0	2.25	70.00
Compares the biology curriculum with the biology curricula of different countries.	7.0	2.00	72.73
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	7.0	3.00	72.73
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.0	2.00	63.64
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	7.0	1.00	72.73
Participates in the juries and commissions for the graduate studies in biology education.	7.0	2.00	72.73
Developing graduate education programs in biology education	7.5	2.25	80.00
Bases his/her research studies on the literature and social needs.	7.0	1.00	72.73
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social , economical and physical environments.	7.0	3.00	72.73

Table 4.31. (Continued)

ITEMS	MDN	IGR	%
Organizing effective in-service teacher education programs for biology teachers	7.0	1.25	70.00
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	6.0	2.00	27.27
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	6.0	2.00	36.36
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	7.0	2.00	54.55
Actively participates in the content and curriculum development of biology education.	7.0	1.00	63.64

* Competencies are presented in bold; competency indicators are presented normally.

As conducted in the other groups, the same three criteria were crosschecked for the teachers' data. Among the teachers, only 4 items did not reach a consensus. Only one of the items had an interquartile range (IQR) of over 2. None of the items satisfied the requirement of at least 80% of respondents in the third dot pitch of [7-9]. Besides, 2 of these items had a median lower than 7 (see Table 4.32).

Table 4.32. Items that could not reach a consensus among teachers in the Delphi 3rd Round

ITEM	MDN	IGR	%
Explains the historical development processes of biology.	6.0	1.50	46.15
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	7.0	1.00	69.23
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	6.0	1.50	38.46
Supporting the professional development of colleagues	7.0	3.50	69.23

* Competencies are presented in bold; competency indicators are presented normally.

As described in detail above, various analyses were conducted on the data obtained in the Delphi 3rd Round. In summary, the data obtained in this round was not considered as a whole in the first place. Then, statistical differences among the teacher educator, graduate student and teacher groups were analyzed. Finally, these three groups of data were examined separately. All of the obtained results are summarized in Table 4.33

Table 4.33. *Items that did not reach consensus in the Delphi 3rd Round*

ITEM	3 rd	BTE	BG	BT
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.			✓	
Participates in the juries and commissions for the graduate studies in biology education.			✓	
Developing graduate education programs in biology education			✓	
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.		✓		
Bases his/her research studies on the literature and social needs.			✓	
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economical and physical environments.			✓	
Organizing effective in-service teacher education programs for biology teachers	✓	✓	✓	
Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.	✓			✓
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	✓		✓	
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	✓	✓	✓	
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	✓	✓	✓	
Actively participates in the content and curriculum development of biology education.		✓	✓	
Supporting the professional development of colleagues				✓
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	✓	✓		

* Competencies are presented in bold; competency indicators are presented normally.

**Symbol of ✓ shows that consensus cannot be reached in groups.

4.2.2. Findings from Delphi the 2nd and 3rd Rounds: Items in Consensus

As mentioned before, the study aims to identify the items that reach a consensus and show remarkable results. To this end, the items that satisfied three of the criteria with high scores in the Delphi 3rd Round were examined. In other words, the items that had a median value of 9, IGR of 0 and 100% of respondents in the third dot pitch of [7-9] were examined. It was found that in the Delphi 3rd Round, there were 3 items, 2

of which were the competencies which had a median value of 9, IGR of 0 and 100% of respondents in the third dot pitch of [7-9]. These items are given in Table 4.34.

Table 4.34. *Items that showed high scores for the defined criteria in the overall group*

ITEM
Approaches the science of biology from a perspective that is required by the nature of science.
Implementing biology learning and teaching approaches
Following the efficient and effective scientific developments related to biology education

* Competencies are presented in bold; competency indicators are presented normally.

As seen in Table 4.35, there were 8 items which had a median value of 9, IGR of 0 and 100% of respondents were in the third dot pitch of [7-9]. 5 of these items were competencies and 5 of them were competency indicators.

Table 4.35. *Items that showed high scores for the defined criteria in the biology teacher educator group*

ITEM
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.
Implementing biology learning and teaching approaches
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials
Supporting the prospective teacher educators in the education and training of biology teachers
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.
Following the efficient and effective scientific developments related to biology education
Acting in accordance with professional ethics

* Competencies are presented in bold; competency indicators are presented normally.

Among the graduate students there was only one item, which is “Approaches the science of biology from a perspective that is required by the nature of science,” that had a Median value of 9, IGR of 0 and 100% of respondents were in the third dot pitch of [7-9].

There were 23 items that had a Median value of 9, IGR of 0 and 100% of respondents were in the third three-point range (7-9) among biology teachers. 7 of these 23 items were competencies and 16 of them were competency indicators, as shown in Table 4.36.

Table 4.36. *Items that showed high scores for the defined criteria in the biology teacher group*

ITEM
Analyzing the concepts and subjects in the biology curriculum (high school level)
Implementing biology learning and teaching approaches
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.
Creates learning opportunities for the pre-service and in-service teachers to develop their knowledge and skills related to teaching methods and techniques.
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.
Being a role model for the pre-service and in-service teachers in teaching biology
Managing and supporting the researcher education processes with the aim of improving the biology education
Following the efficient and effective scientific developments related to biology education
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.
Regards improving field knowledge as an academic responsibility.
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.
Is open to innovations in biology teacher education.
Acting in accordance with professional ethics
Prioritizes professional development to improve biology education.
Has a heightened awareness of ethical violation issues such as plagiarism, salami-slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.-
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.
Follows codes of conduct in jury duty and refereeing.
Demonstrating collaboration skills for the aim of developing biology education
Fulfils the responsibilities under taken within during the division of work.

* Competencies are presented in bold; competency indicators are presented normally.

When the results of the biology teacher educator, graduate student in biology education and biology teacher groups are compared, there is no item which has a Median value of 9, IGR of 0 and 100% of respondents are in the third dot pitch of [7-9].

4.3. Findings from the Delphi 4th Round: Reaching a Consensus on Biology Teacher Educators Competencies

For reaching a consensus on the framework of biology teacher educators' competencies the Delphi 4th Round is the last step of the research. For this aim, the interviews were conducted with the key informants who participated in the Delphi 1st Round on the items that could not reach a consensus in the Delphi 3rd Round by statistical analysis. As explained in the previous chapter, a booklet was prepared to summarize the processes and the results of each Delphi round previously conducted.

Before the interviews, all of the previous processes were explained in detail in the following order:

- Selected criteria and points considered during preparation of the survey used in the Delphi 2nd Round.
- Selection of the participants and demographic information of the participants in the Delphi 2nd Round.
- Selected criteria and points considered during preparation of the survey used in the Delphi 3rd Round.
- Criteria used to decide whether a consensus is reached on each competency and indicator.

After this explanation, the aim of the Delphi 4th Round was explained. The participants were asked to present their opinions based on the statistical results of the 2nd and Delphi 3rd Rounds. They were informed that they could state if an item needs to be removed or remain in the competency framework. Additionally, they were also asked whether the items at hand need any revision.

For each item the statistical results of all of the three criteria for the 2nd and Delphi 3rd Rounds of the overall group and the Delphi 3rd Round within the groups were presented, and the participants were asked to provide their opinions in the interviews. During the discussion of each item, the list of the items in the same competency area or competency, which depends on the item category, is also presented to the interviewee.

In order to keep the competencies in perspective, the items are provided in accordance with the competency area. As mentioned previously, all of the competencies and their indicators were categorized under six competency areas: Biology Teaching, Biology Teacher Education and Development, Biology Teacher Educator Education, Research in Biology Education, Positive Attitudes and Values for Biology Education and Supporting Biology Education in Society.

4.3.1. Results of the Delphi 4th Round in the First Competency Area

In the first category, Biology Education, four competencies with 26 indicators were defined. In the statistical analysis it was found that no consensus was reached in one competency and five indicators in the overall group and/or within one of teacher educator, graduate student or teacher groups. These items, statistical results obtained from the Delphi 3rd Round of these items, views of the key informants and the final decision about each item are explained in detail below.

The first item was an indicator expressed as “Explains the historical development processes of biology” which was under the competency named “Analyzing the concepts and subjects in the biology curriculum (high school level).” This item did not satisfy two of the criteria in the overall group analysis (IQR=2,75; [7-9] %=66,67) and in the groups of teacher educators (IQR=2,50; [7-9] %=75,00) and teachers (Mdn=6,00; [7-9] %=46,15) in the Delphi 3rd Round. The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: Framework should include this item. Knowing history. How should biology education become inquirable? This is a subject given in our

courses too. Knowing historical processes has an important role in the formation of academic consciousness.

KI 2: If I take the competency in accordance with pedagogical content knowledge, I may suggest a change of place for this item. But no, both competencies include this. Whether we take this is biology teaching or biology knowledge, I believe that a teacher should include the history of biology in biology teaching. Contexts can be very different. It can be social-scientific issues or STEM. History of science is one of the important issues.

KI 3: Should have knowledge of some scientists' contribution to historical development. But should have comprehensive knowledge? I am not sure but we think it in the context of biology teacher educators, so this item is necessary.

KI 4: This indicator should be included. Teachers are the ones who know the reality and graduate students are idealists.

Since all of the key informants suggested that this item be taken in the biology teacher educator competency framework, it was kept without any changes to the first draft.

The second item taken into the Delphi 4th Round in the Biology Teaching competency area was an indicator stated as “Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices” which was listed under the competency named “Implementing biology learning and teaching approaches. “The statistical analysis of this item showed that all of the three criteria were satisfied with the data derived from the overall group, whereas the requirement of at least 80% of respondents locating in [7-9] was not satisfied in the group of teachers. The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: Should know the history and reflect it to teaching practices. Of course it should be.

KI 2: As I explained before, yes, they should know and use it in their teaching practices. A biology teacher educator should know the historical processes, like the content of photosynthesis, and how to begin the teaching processes in the light of history.

KI 3: The underlying cause of knowing the historical developments is to reflect and use it during teaching practices.

KI 4: This item should be included. Again, teachers give low scores because they don't use it.

In brief, all key informants mentioned that this indicator should be kept in the framework of biology teacher educator competencies; therefore, it was kept without any changes to the first draft.

There was only one competency on which consensus could not be reached in the competency area of Biology Teaching, which was stated as “Evaluating the biology curriculum.” For this competency, all of the criteria were met in the analysis conducted with all participants. However, this item did not satisfy two criteria in the group of graduate students (IQR=2,25; [7-9] %=70,00). The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: Of course, s/he should possess.

KI 2: Evaluating means determining the needs. This is it and should be.

KI 3: What does this mean? Do they say that evaluation of the program is not a necessity? They are wrong. I think they are not very familiar with the importance of biology curriculum. They graduate without having this knowledge. We have a selective course. Half of the students take it but the other half doesn't. Mostly they graduate without having an adequate knowledge about the curriculum. They find it unnecessary.

KI 4: This item should be included. What are we arguing about?

All of the participants stated that this competency had to be kept in the competency framework. Therefore, it is decided that this competency be included in the final version of the Competency Framework for Biology Teacher Educators without any revisions.

The fourth item which did not satisfy the criteria for reaching a consensus in the Biology Teaching competency area was an indicator named “Compares the biology curriculum with the biology curricula of different countries” under the competency of “Evaluating the biology curriculum.” This item did not satisfy one criterion in the

overall group analysis ([7-9] %=77,78) and in the group of graduate students ([7-9] %=72,73) in the Delphi 3rd Round. Also, two criteria were not met within the group of teacher educators (IQR=2,50; [7-9] %=75,00). The opinions of the key informants in Delphi 4th Round areas follows:

KI 1: This is an item that should be included.

KI 2: This is a very broad thing. I don't like uncertain things. What do different countries mean? There are more than 200 countries in the world. There is no possibility to do this in practice... This item also holds unnecessary. What different countries mean should come into prominence? Besides, their depths are also different. In fact, I don't think that this is realizable. Of course having knowledge of what is happening in other countries is very important. But the level of this knowledge is not certain. This is the problem. The word of comparing. Having knowledge enriches an individual, but I couldn't be sure whether this is a necessity or not. Having some knowledge does not give you any harm. But if we take it as a criterion, this is not easy. But if I have a necessity, I should be able to compare. Maybe this item can be revised this way.

KI 3: I think this is a necessity. It should be. They should be able to.

KI 4: I think it should be included. Teachers know the popular ones. Maybe a teacher educator or a graduate student has problems with language proficiency. Their inabilities get involved. But this item should be included.

The aim of the study was to concretize the competencies through the use of indicators. Since the criticism of the second key informant did not provide the intended conception in the indicative statements, the indicator was revised as “Compares the biology curriculum with the biology curricula of different countries when needed.”

The fifth item taken into the Delphi 4th Round, which was again under the same competency with the fourth item, was stated as “Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.” The statistical analysis of this item in the overall group satisfied all of the three criteria. On the other hand, this item could not lead to a consensus within the group of graduate students since the IQR of the item was 3,00 and only 72,73 of

the responses of the graduate students fell into the 7-9 point range. The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: Definitely should be.

KI 2: This should be. Teacher educators are the first people who are asked for the curricula.

KI 3: As I said before they don't have adequate knowledge about the curricula. They are only interested in conducting research and educating teacher candidates. They say why teacher educators should think about the biology curriculum. Actually they are important. They are important indicators. There is no problem for this item.

KI 4: This item looks like a repetition of "Questions the distribution and arrangement of the subject contents in the biology curriculum." They can be combined.

All participants stated that the item should remain. KI 4 mentioned that this indicator coincides with another indicator and two indicators can be combined. The indicator (Questions the distribution and arrangement of the subject contents in the biology curriculum) that KI 4 indicated can be combined with the current one since the current indicator is also related to curricula content. Since one of the indicators emphasized content distribution and the order of learning outcomes and the other emphasized finding solutions for potential problems that may emerge in curricula content, both of the indicators were included in the final version of the biology teacher educator competency framework.

The final item stated as given in the first draft of the competency framework was "Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry)." This indicator was also included in the Delphi 4th Round and it was also under the same competency named "Evaluating the biology curriculum" with the two previous items. This item did not satisfy one criterion in the overall group analysis ([7-9] %=77,78) and in the group of graduate students ([7-9] %=63,64) in the Delphi 3rd Round. The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: This is an item that should be included. There are lots of interdisciplinary subjects. Especially we should have knowledge about the subjects that are connected to biology. I do not understand this as knowing chemistry or physics content as a whole. For example, water. This is a subject that is connected to various disciplines. This item should be possessed.

KI 2: This “explaining relationship” is not explanatory. I would prefer another word like having knowledge. There is a relationship between animals and plants. This is natural. Curricula are not in this structure. It doesn’t mean that I think this is not important. I think a biology teacher educator should possess knowledge of physics, chemistry and science curricula. Their needs and relationships. I have experienced this a few times. While we were working on the curriculum, organic chemistry was the last chapter of the 10th grade, but in biology energy change unit was at the beginning of the 10th grade. Therefore, a content requiring knowledge of organic chemistry was given without learning organic chemistry. Therefore, it is important. The answer of why we cannot teach photosynthesis or some other subjects is this. Students did not learn the chemical bond structure. I think this item should be included but the statement needs some revision. Instead of explaining the relationship, the level of the skill needs to be elaborated such as identifying or knowing.

KI 3: Graduate students gave low scores because they are not engaged in. Or they may not know the curricula. They may think after they learn biology, why they should be related. This might be unnecessary for them. This is an understandable and required item. I use this in my courses too. Students come here for the knowledge of biology. To explain its relationship with high school biology we use curricula. But instead of explaining the relationship, I would prefer a narrower phase such as having knowledge.

KI 4: This item should be included. Groups are important. Especially science curriculum is important.

As stated earlier, the main purpose of the indicators is to concretize the competency statements. The statement of the indicator was revised due to the fact that the second and third key informants mentioned that the indicators were not explanatory. Therefore, this indicator was included with the statement of “Has knowledge about the relationship between the biology curriculum and related curricula (science, physics, chemistry)” in the final version of the competency framework.

4.3.2. Results of the Delphi 4th Round in the Second Competency Area

The second competency area of the biology teacher educator competency framework was named Biology Teacher Education and Development. In this competency area, there were 9 competencies and 49 indicators in the first version of the framework. Accordingly, in the statistical analysis conducted in the Delphi 3rd Round there was only one indicator which did not bring about a consensus and was included in the Delphi 4th Round.

The indicator expressed as “Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education” was included in the competency of “Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education.” For this indicator, all of the criteria were meting the analysis conducted with all participants. However, this item did not satisfy one criterion in the group of graduate students ([7-9] %=72,73). The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: They should be guides, surely.

KI 2: Having knowledge of technology or technological pedagogical content knowledge is one of the content areas we try to improve for teacher candidates and teachers. Therefore, to this end we first try to determine their knowledge level and deficiencies. This may be seen in a class of people dominance at universities like material development courses. But in general it is an area of responsibility for biology teaching departments. Even though a teacher educator does not teach that course, in terms of competency we should expect him/her to have the knowledge of evaluating or determining the knowledge level.

KI 3: Would it be more sensible if we say try to improve the skills of using technology? Instead of trying to determine the dominance level, they can so something to improve their competency. There are some students who have not used a computer or prepared a presentation throughout their lives. But to show them to do these or improve their qualifications are much more important, instead of determining levels... The next item is intended for this aim. But this item is so detailed. Eventually, these guys should be able to use it.

KI 4: This item looks like a repetition of “Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.” They can be combined.

Although KI 1 and KI 2 stated that the indicator should remain, the opinions of KI 3 and KI 4 were intended not to keep the indicator in the framework. KI 3 stated that the next indicator covers this indicator. KI 4 stated this indicator could be combined with the indicator specified by KI 3. The proposed indicator mentioned teaching the use of technological tools during biology teaching. The aim of the discussed indicator was to determine the readiness levels of pre-service and in-service biology teachers before the instruction. Both key informants stated that it is imperative to determine the readiness levels of individuals before teaching. For this reason, the discussed item has been removed from the final version of biology teacher educator competency framework.

4.3.3. Results of the Delphi 4th Round in the Third Competency Area

Three competencies with 18 indicators were redefined in the third competency area named Biology Teacher Educator Education. In the statistical analysis, it was found that consensus was not reached in one competency and one indicator within one of the groups. These items, statistical results obtained from the Delphi 3rd Round of these items, views of the key informants and the final decision about each item are explained in detail below.

The first item was an indicator expressed as “Participates in the juries and commissions for the graduate studies in biology education” which was grouped under the competency named “Managing and supporting the researcher education processes with the aim of improving biology education.” This item satisfied all of the three criteria in the overall group analysis and within teacher educator and teacher groups. On the other hand, the requirement of at least 80% of respondents locating in [7-9] was not achieved in the group of teachers ([7-9] %=72,73). The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: This is an important indicator. It should be included.

KI 2: Who said this is not a need. This is not even worth discussing.

KI 3: Couldn't they understand? No, it is very clear. It should be.

KI 4: This can be combined with "Consults the prospective teacher educators for developing their skills of following and contributing to the literature." The new revision can be "Makes useful feedback and guidance in juries and commissions for graduate studies in biology education."

Three of the key informants who were interviewed stated that this indicator should be kept as it was given in the first draft of the competency framework. KI 4 stated that this indicator could be combined with another indicator. This other indicator with which the current indicator can be combined was intended for teacher education candidates to be able to follow up the literature and to conduct research that will contribute to the literature. Since this study is mostly directed to the graduate students of teacher educators, it requires a more in-depth study. However, taking part in juries and commissions was intended for students who are not directly consulted. Since the main objective of the study is to provide as much detailed information as possible through the use of indicators, it was decided to preserve both of the indicators.

There was only one competency on which no consensus could be reached in the competency area of Biology Teacher Educator Education stated as "Developing graduate education programs in biology education." For this competency, all of the criteria were satisfied in the analyses conducted with the overall group and within teacher educator and teacher groups. However, the criterion of having an IQR of 2 and below was not met in the group of graduate students (IQR=2,25). The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: Surely they should.

KI 2: This is something we do normally and it should be.

KI 3: Let's pass this. No need to think about it. This is an appropriate indicator. Who will develop it then?

KI 4: This should be kept.

Since all of the participants stated that this competency needs to be kept in the competency framework, it is decided that this competency be included in the final version of the Competency Framework for Biology Teacher Educators without any revisions.

4.3.4. Results of the Delphi 4th Round in the Fourth Competency Area

The fourth competency area of the biology teacher educator competency framework was named Research in Biology Education. Four competencies with 25 indicators were defined in this competency for the first version of the framework. After conducting the analysis using the data derived from the Delphi 3rd Round, there were only two indicators that did not lead to a consensus and these were included in the Delphi 4th Round.

The first indicator stated in the first draft of the competency framework was “Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.” The competency of the indicator defined above was “Following the efficient and effective scientific developments related to biology education.” This indicator was included in the Delphi 4th Round as this item did not satisfy two criteria among teacher educators (IQR=3,50; [7-9] %=75,00) in the Delphi 3rd Round. The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: I'm not sure about this item. I don't think that these enhance quality. They may raise awareness. But I don't think that this item is necessary.

KI 2: I may also doubt this. The quality or number of civil organizations is ambiguous here. The main problem about this item is its uncertainty. This is something that people say what I can do with it. Because there can be hundreds or thousands of them. They can be in different magnitudes from e-mail groups to forums. Therefore, this cannot be taken as an indicator. We do not know about their content... This can be something like joining professional groups; they also can be virtual. But I don't think that it is necessary.

KI 3: Actually this is something good even if I don't join. But following efficient and productive scientific developments is not something to do only with this. It may contribute. But this can be something about my perception. Let's look at the other indicators. They are really serious indicators... I think others are more serious, straight headed and needed to be included.

KI 4: This is not an indicator or competency. This is mainstream. This doesn't provide us how to conduct efficient and productive research or educate teachers.

In brief, all key informants mentioned that this indicator should not be kept in the framework of the biology teacher educator competency framework. Therefore, this indicator is not included in the final version of the framework.

The second item taken into the Delphi 4th Round in the Research in Biology Education competency area was an indicator stated as “Bases his/her research studies on the literature and social needs” which was under the competency named “Conducting innovative, effective and efficient research to improve biology education. “The statistical analysis into this item showed that all of the three criteria were satisfied using the data derived from the overall group, teacher educators and teachers. However, the requirement of at least 80% of respondents locating in the [7-9] point range was not met in the group of graduate students. The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: Of course. This should stay.

KI 2: Science is something we do for curiosity. We deal with education as science. Normally, scientists should conduct research not based on the needs. They are expected to base their studies on curiosity. The disturbing thing here is conducting research based on the needs of society. This is something that binds you. But the reality is this. Ideally, you don't want it to be like this, but in reality your aim in social studies is try to solve current problems. Where do they come from? They come from the needs of the society and related literature. If “bases” is a chosen word, this is a presentation skill of conducting each of your research that is matched with a problem and to solve it. This is also about literature. I think it should be.

KI 3: They may think that I conduct research in my area of interest, that it doesn't have to be a need of society. Actually they don't know that we

take our research questions from there and we look at the literature. We work by detecting the problems that need to be solved. Maybe they aren't aware of this.... But this is an indicator that should stay.

KI 4: This should be included in the competency framework.

As a summary, all key informants mentioned that this indicator should be kept in the framework. Therefore, this indicator was kept in the final version of the framework without any changes to the first draft.

4.3.5. Results of the Delphi 4th Round in the Fifth Competency Area

Positive Attitudes and Values for Biology Education was the fifth competency area of the Competency Framework for Biology Teacher Educators. In this competency area, there were five competencies and 38 indicators in the first version of the framework. According to the statistical analysis conducted on the data derived from the Delphi 3rd Round, there was only one indicator which did not bring about a consensus. Therefore, it was included in the Delphi 4th Round.

The indicator was expressed as “Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economic and physical environments.” This indicator was defined under the competency of “Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education.” For this indicator, all of the criteria were met in the analysis conducted with all participants, teacher educators and teachers. However, this item did not satisfy two of the criteria in the group of graduate students (IQR=3,00; [7-9] %=72,73). The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: This is so important. I think this should stay. They should form these kinds of environments. But I think this is a competency. Let's look at the indicator. In a word they simulate these environments. Surely, this should be.

KI 2: There are two phrases of settings. This is the reason I think. Most probably they had a difficulty in understanding. If you want to say they form effective learning environments for effective teaching, yes. But I think this item needs revision. When I read it for the second time, I

understood that this means that forming environments for coping with the problems in the east and west and teaching them to cope with these problems. I wouldn't say 100% yes. I don't think this is in the nature of the teaching. You need to educate them to be able to teach most effectively by modifying the physical conditions. They don't have any boundaries. There are infinite possibilities with different combinations; physical, economic, etc. Instead of it, I teach the basic parts and they can be implemented everywhere. After teaching the basic approach. I agree but I half agree. This seems like a perception of the 1960s. You cannot teach everything but you can educate people who have the mentality of teaching in every circumstance. If you set your aim to teach in a science laboratory, you should also teach hundreds of solutions to do this in the east. But you set your goal to educate people to improve biology literacy; there can be lots different ways to teach biology instead of doing experiments... In my opinion, the aim of teaching biology is not only teaching biology. It is to educate people who can argue about biology, engage in arguments, come to an agreement, collaborate on biological settings and say local things. This item respects the understanding of the 1960s-1970s. You should be able to generate alternatives to do them in tough conditions. In my opinion, the aim of biology teaching in the 2020s is to educate biology literates... There is no need for this indicator. Others cover what I have said.

KI 3: This is a very idealist item. Forming this kind of environment. Who can form this much? I do not believe we can construct this. Or if we constructed it, would it serve this indicator? Let's look at this with other indicators. How can we construct it? It looks like a bit utopian. We can inform them to evaluate the opportunities and difficulties. We can say if you confront this, you can do that. But when we say constructing environments... This item should not be included as for me.

KI 4: This is both utopian and it does not have any relationship with the competency. There is no need for this item. The previous item already covers this.

Although KI 1 stated the indicator should remain, the opinions of the other key informants were different. KI 2 mentioned that this indicator should not mention adapting the environment; it needs to refer to educating teachers with the mindset of teaching biology/science literates. The opinions of KI 3 were similar to those of KI 2. KI 3 emphasized that teachers need to have a mindset of teaching biology in different circumstances and teacher educators need to provide education according to his mindset. However, s/he mentioned that this cannot be achieved by modifying

the learning environment of pre-service and in-service teachers. KI 4 stated that this indicator should not remain in the framework. When all indicators in the competency were taken into consideration, it was seen that the indicator of “Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy” covers the opinions of the other key informants. Therefore, this indicator was removed from the final version biology teacher educator competency framework.

4.3.6. Results of the Delphi 4th Round in the Sixth Competency Area

Supporting Biology Education in Society was the last competency area of the Competency Framework for Biology Teacher Educators. In the first version of the framework, this competency included 4 competencies and 23 indicators.

The results of the analysis conducted on the data derived from the Delphi 3rd Round showed that no consensus could be reached on 2 competencies and 6 indicators and these items were included in the Delphi 4th Round. The first item was a competency stated as “Organizing effective in-service teacher education programs for biology teachers.” This item satisfied all of the three criteria in the overall group analysis and teacher group analysis. On the other hand, two of the criteria were not met among teacher educators (IQR=2,50; [7-9] %=75,00) and one criterion was not satisfied among graduate students. The opinions of the key informants in the Delphi 4th Round areas follows:

KI 1: “When needed” statement can be added to this.

KI 2: I think teacher educators do not think that in-service teacher education is their job. But this is one of our main competencies. Teacher education is not a thing only done at undergraduate degree. Teacher education is a lifelong process. Teachers should have efficient education in their whole career. Therefore, this is a necessity too.

KI 3: Do they think that everyone doesn't need to do this? I think in-service teacher education is so meaningful. This is because we work on the advantages and disadvantages of everything and transfer this knowledge to them. We are informed about the innovations before them. Therefore, this can be done to support biology education in society.

There can be a problem with the word of organizing. Attending those programs is OK. Participating in these kinds of programs is OK, even though some other institutions organize it. They may think that they should organize it. But I would like to make a contribution if there are organized programs. I have attended a few times and they are enjoyable. But they may think that they do not have to organize those programs. Attending, taking part can be better phrases. They may think like me, when it is written as organizing. Maybe the statement can be revised.

KI 4: How do we understand that it should be? Teachers gave high scores. So they should possess this competency. Teachers know the requirement.

KI 1 and KI 4 stated that this indicator should be kept as it was included in the first draft of the competency framework. However, KI 2 and KI 3 suggested that the statement of the item be revised. Therefore, this competency was revised as “Organizing effective in-service teacher education programs for biology teachers” and kept in the final version of the Competency Framework for Biology Teacher Educators.

The second item in the last competency area was an indicator which was in the same competency of the previous item and stated as “Takes into account the individual differences of teachers (knowledge, beliefs, experience, etc.) in the implementation of in-service teacher education programs.” This item did not satisfy two of the criteria in the overall group analysis (IQR=3,00, [7-9] %=72,2) and in the group of teachers (Mdn=6,0, [7-9] %=38,46) in the Delphi 3rd Round. The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: Did the teachers perceive it differently? Do they think that they do not have individual differences? For instance, there can be some teachers who have different experiences in laboratory practices. I think this an example of individual differences. This item needs to be included in the competency framework.

KI 2: This needs to be taken. Pedagogical content knowledge is the main thing. Acting in accordance with individual differences, revealing them and then changing the teaching practices in line with these differences. This is a necessity. It needs to be.

KI 3: Teachers' low score is interesting. They do not focus on the individual differences I guess. But it is really important. Their experiences, beliefs and environments are different. Implementing education considering those differences is important to me.

KI 4: This item should stay. 38% is an important rate. But again practice can be involved. Teachers do not use it, that's to say.

Since all key informants mentioned that this indicator should be kept in the framework, this indicator was kept in the final version of the framework without any changes to the first draft.

The third item included in the Delphi 4th Round for the last competency area was “Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education,” which was located under the competency of “Organizing effective in-service teacher education programs for biology teachers.” This item did not satisfy one of the criteria in the overall group analysis ([7-9] %=75,00) and two of the criteria in the graduate student group (Mdn=6,0; [7-9] %=27,27). The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: Of course this should be.

KI 2: This mentions the main aim of teacher educators. Every work we do should contribute to this directly or indirectly. They might not understand the expression of policy development but you need to expect that all of your work should contribute to the policy eventually. This must be included.

KI 3: What do they understand from policy development? Do they think they do not have to do something to develop policy? This may be the reason. But this is a very important indicator.

KI 4: There is a problem with the expression. There is not a thing local in Turkey. Quality means improvement and development. I may suggest a revision as I conduct research to improve biology education on national and international levels.

All of the key informants suggested that this indicator be kept in the final version of the Competency Framework for Biology Teacher Educators. However, KI 4 criticized that there are no local authorities in Turkey and the meaning of

development also covers improving quality. Since his criticism was meaningful, the indicator was changed to “Conducts research to improve national and international education policies in order to increase the quality of education by prioritizing biology education.”

The other item taken into the Delphi 4th Round was an indicator of the same competency with the previous indicator: “Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.” This indicator was included in the Delphi 4th Round because it did not satisfy one criterion in the overall group analysis ([7-9] %=66,67), among teacher educators ([7-9] %= 66,67) and two criteria among graduate students (Mdn=6,0; [7-9] %=36,36). The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: This needs to be kept.

KI 2: I do not think there is a problem with the item... This does not depend on teacher educators in Turkey. It may require some revision.

KI 3: This is interesting data too. This is also an important item. Teacher educators' low score is also interesting. Graduate students think that our job is to conduct research and write papers. The low score of teacher educators is interesting. This is a good item and needs to be done by teacher educators.

KI 4: There is no need. This is not possible for Turkey.

The opinions of KI 1 and KI 3 were about preserving this indicator as it was used in the first version of the competency framework. However, KI 2 mentioned that contributing to a document prepared by different foundations or institutions is not in educators' hands. Teacher educators can make a contribution if requested by institutions. Similarly, KI 4 criticized country-specific situations. Therefore, this indicator was revised as, “Is disposed to contribute to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and

recommendations about the topics in education with a priority in the specialized field” and taken into the final version of the competency framework.

Like the two previous indicators, the third indicator stated as “Organizes professional meetings / seminars / conferences for the stakeholders in biology education “was also an indicator under “Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)” competency. The result of the Delphi 3rd Round showed that the requirement of at least 80% of respondents in the 7-9-point range was not met in the overall group analysis ([7-9] %=77,78) and within the graduate student group ([7-9] %=54,55). Besides, two of the criteria were not satisfied in the teacher educator group (IQR=2,50; [7-9] %=75,00). The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: I think there is no need for organizing. I mean we should possess this. If we can do this, it indicates that we have this competency. We should be able to organize when it is needed. The word of organizing can be puzzling. The phrase “when needed” can be added.

KI 2: These are not same. You cannot equate conference and meeting. But organizing can differ from person to person.

KI 3: Is this because they do not believe in the content of the conferences? They may think that there is nothing about the quality. I do not know whether they saw this as unnecessary because of this reason. They might think that they should organize in any case. I have not organized any conferences up to now. This may need a little bit revision too. This is assertive. Participating to the organization is OK. You can revise it in this direction.

KI 4: Organizing can be confusing. But everyone can provide support. You cannot expect everyone to organize. This is not a one-person job. You can do this altogether.

All of the four key informants stated that organizing professional meetings / seminars / conferences cannot be done by a single teacher educator. However, they also mentioned that teacher educators should participate in such studies. Therefore, this item was preserved in the final version of the Competency Framework for Biology Teacher Educators by making some revisions. The final version of the indicator is

“Supports the organization of professional meetings / seminars / conferences for the stakeholders in biology education.”

One other indicator taken in the Delphi 4th Round from the same indicator was “Actively participates in the content and curriculum development of biology education.” For this indicator, all of the criteria were met in the analysis conducted with all participants. However, this item did not satisfy two of the criteria in the group of teacher educators (IQR = 2,50; [7-9]%=75,00) and one criterion in the graduate student group ([7-9]%=63,64). The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: Of course it should be.

KI 2: Participating actively seems a little bit problematic here too. This is something done upon request. I do not think all teacher educators are invited.

KI 3: Competent people should participate actively. But in Turkey this is not the case... This may be the reason. But somehow they should be in the development processes. They may not be involved actively but should contribute with their opinions and suggestions.

KI 4: They cannot participate actively. I can understand the logic behind this item but the phrase of actively participating is annoying.

All of the key informants mentioned that this indicator should be included in the final version of the competency framework. However, three of the key informants stated that active participation in content and program development processes is not an act that depends on teacher educators. Therefore, revisions were made in line with the opinions of the key informants. The final version of the indicator is “Participates in the content and curriculum development of biology education.”

One of the two competencies in Supporting Biology Education in Society taken into the Delphi 4th Round was “Supporting the professional development of colleagues.” For this indicator, all of the criteria were met in the analysis conducted with all participants, graduate students and teacher educators. However, this item did not

satisfy two of the criteria in the group of teachers (IQR=3,50; [7-9] %=69,23). The opinions of the key informants in the Delphi 4th Round are as follows:

KI 1: Of course. I think teachers did not understand.

KI 2: Giving feedback to the articles as a referee etc. is also included in this process. This is also a part of our job. Teachers may not be able to see it in this broad perspective.

KI 3: Of course this is a need. Otherwise, how can this field improve? This is a necessity.

KI 4: This should be.

As a summary, all key informants mentioned that this indicator should be kept in the framework. Therefore, this indicator was kept in the final version of the framework without any changes to the first draft.

The last indicator taken into the Delphi 4th Round was in the same competency with the previous item and stated as, “Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.” This item did not satisfy two of the criteria in the overall group analysis (IQR=2,75; [7-9] %= 75,00) and any of the criteria in the group of teacher educators (Mdn=6,0; IQR=2,75; [7-9] %=41,67) in the Delphi 3rd Round. The opinions of the key informants in Delphi 4th Round are as follows:

KI 1: Taking active role seems like in any case... I think the phrase of active participation can be revised.

KI 2: I understand as willing to actively take part in. I cannot object to this.

KI 3: I do not think this should be done in any case. This can be done differently. We even support people we meet at the conferences. We say that “there are some research studies in this field, you can also look into those areas.” We contribute to each other.

KI 4: Teacher educators know the reality. This is not a preference. How can they take active role?

All of the key informants participated in the study stated that this indicator needs to be included in the final version of the competency framework. However, they also

mentioned the statement of active participation includes meaning of necessity and this act does not only depend on teacher educators themselves. Therefore, revisions were made in line with the opinions of the key informants. The final version of the indicator is “Is disposed to take a role in the professional development activities of working groups and NGOs related to biology / science education.”

4.4. Summary of the Changes from the Delphi 1st to Delphi 4th Rounds and Final Version of the Competency Framework for Biology Teacher Educators

As mentioned previously at the end of the Delphi 1st Round, six competency areas and 29 competencies with 180 indicators were defined. Since the main aim of the method used in this study is to reach a consensus among the teacher educators, graduate students and teachers included in the study, three criteria were selected to ensure consensus. These criteria were having a median (Mdn) higher than 7, interquartile range (IQR) and three dot pitch which the median was located ([1-3], [4-6], [7-9]). After data was gathered from the Delphi 3rd Round, statistical analyses were conducted for the overall group and within teacher educators, graduate students and teachers. At the end of these analyses, it was found that no consensus was reached on 4 competencies and 16 indicators. For all of these items, interviews were conducted with the key informants who participated in the Delphi 1st Round to reach final decisions for these items. The revisions for each item are given above and summarized in Table 4.37.

Table 4.37. *Changes of the items from the Delphi 1st Round to the Delphi 4th Round*

In the Delphi 1st Round	After the Delphi 4th Round
Explains the historical development processes of biology.	Kept without any changes
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	Kept without any changes
Evaluating the biology curriculum	Kept without any change
Compares the biology curriculum with the biology curricula of different countries.	Compares the biology curriculum with the biology curricula of different countries when needed.
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	Kept without any changes
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	Has knowledge about the relationship between the biology curriculum and related curricula (science, physics, chemistry).
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	Removed from the final version
Participates in the juries and commissions for the graduate studies in biology education.	Kept without any changes
Developing graduate education programs in biology education	Kept without any changes
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields..	Kept without any change
Bases his/her research studies on the literature and social needs.	Kept without any change
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economical and physical environments.	Removed from the final version
Organizing effective in-service teacher education programs for biology teachers.	Kept without any change
Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.	Kept without any change

Table 4.37. (Continued)

In the Delphi 1st Round	After the Delphi 4th Round
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	Disposed to contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	Supports the organization of professional meetings / seminars / conferences for the stakeholders in biology education.
Actively participates in the content and curriculum development of biology education.	Participates in the content and curriculum development of biology education.
Supporting the professional development of colleagues	Kept without any change
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	Disposed to take role in the professional development activities of working groups and NGOs related to biology / science education.

* Competencies are presented as bold; competency indicators are presented normally

As a summary, the final version of the Competency Framework for Biology Teacher Educators is given in Table 4.38.

Table 4.38. *Final version of Competency Framework for Biology Teacher Educators*

Competency Framework for Biology Teacher Educators
COMPETENCY AREA A: BIOLOGY TEACHING
Analyzing the concepts and subjects in the biology curriculum (high school level)
Explains the theories, principles, generalizations and models that underlie the science of biology.
Constructs the experiment design process for solving problems in the science of biology.
Approaches the science of biology from a perspective that is required by the nature of science.
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.
Explains how biology benefits from closely related disciplines.
Explains the historical development processes of biology.
Developing the biology literacy level of high school students
Has experience in teaching biology.
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.
Constructs teaching processes within the framework of the properties of scientific knowledge.
Includes the relationship of biology with the society, humanity and environment in the teaching practices.
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.
Implementing biology learning and teaching approaches
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.
Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches.
Focuses on the development of scientific process skills in biology teaching.
Uses the laboratory activities in biology teaching effectively in teaching processes.
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.
Uses different measurement and evaluation approaches and methods in biology education.
Evaluating the biology curriculum
Questions the vision, philosophy, structure and scope of the biology curriculum.
Questions the distribution and arrangement of the subject contents in the biology curriculum.
Questions the contents and limitations of the acquisitions in the biology curriculum.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
Compares the biology curriculum with the biology curricula of different countries when needed.
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.
Has knowledge about the relationship between the biology curriculum and related curricula (science, physics, chemistry).
COMPETENCY AREA B: BIOLOGY TEACHER EDUCATION
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes
Explains the structure, scope, philosophy and approach of the teacher education program in the department.
Compares the implemented teacher education program with other teacher education programs at national and international level.
Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.
Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time.
Creates learning opportunities for the pre-service and in-service teachers to develop their knowledge and skills related to teaching methods and techniques.
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.
Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12th grade level).
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.
Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.
Guiding supervising teachers for effective mentoring of pre-service biology teachers
Identifies the areas of development in the supervising teachers with regard to mentoring.
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.
Being a role model for the pre-service and in-service teachers in teaching biology
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
Makes use of practices that promote a higher level of biology literacy in pre-service and in-service biology teachers.
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.
COMPETENCY AREA C: BIOLOGY TEACHER EDUCATOR EDUCATION
Supporting the prospective teacher educators in the education and training of biology teachers
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.
Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.
Managing and supporting the researcher education processes with the aim of improving biology education
Gives courses in biology education at graduate level.
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.
Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques.
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.
Consults the prospective teacher educators to support their development in the field of education that they want to specialize in.
Consults the prospective teacher educators to develop their skills for conducting research independently.
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.
Supports the prospective teacher educators to develop their understanding of scientific ethics.
Participates in the juries and commissions for the graduate studies in biology education.
Developing graduate education programs in biology education
Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education.
Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.
Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
COMPETENCY AREA D: RESEARCH IN BIOLOGY EDUCATION
Following the efficient and effective scientific developments related to biology education
Follows the national and international scientific research studies in the academic areas of interest.
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.
Reads about the topics in education and related fields to attain higher general knowledge.
Reads articles about biology to attain higher general knowledge.
Follows the qualified publications via the knowledge of indexes and properties of journals.
Conducting innovative, effective and efficient research to improve biology education
Has a research plan to maintain continuity and deepens on the research area of interest which is based on his/her own educational vision.
Conducts efficient and qualified research about biology education which will contribute to the area of specialization.
Bases his/her research studies on the literature and social needs.
Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.
Uses the latest technologies (web-based data collection tools, qualitative and quantitative data analysis software, etc.) in conducting scientific research.
Associates his/her own research with the current studies in the literature.
Has a foreign language proficiency to be able to follow and contribute to the international literature.
Reflects his/her acquired experiences as an educator to his/her research studies.
Sharing research results with different stakeholders effectively and efficiently
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.
Publishes the results of completed scientific research in books, book chapters or articles.
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.
Working effectively and efficiently in research groups by collaborating with colleagues
Demonstrates conflict resolution skills while working in collaboration with colleagues.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
Collaborates with other researchers from the field of biology education and/or different disciplines.
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.
Participates in international projects as executive/researcher/consultant.
COMPETENCY AREA E: POSITIVE ATTITUDES AND VALUES TOWARD BIOLOGY EDUCATION
Demonstrating a vision that is open to professional development
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.
Has an individual education philosophy and vision that are supported by professional experience and are open to development.
Associates the current developments in biology education with his/her educational practices and research.
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.
Enhances self-learning to develop his/her biology teaching methods.
Attaches importance to improving teacher training and education in the light of advanced practices and developments.
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his / her colleagues on biology education.
Plans professional development through identifying strengths and weaknesses through self-assessment.
Updates teaching processes by making use of his/her professional experience.
Regards improving field knowledge as an academic responsibility.
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.
Actively participates in the learning communities focusing on innovation and change in biology education.
Respects different opinions on biology education.
Is open to innovations in biology teacher education.
Supports research-based innovation in biology education.
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.
Acting in accordance with professional ethics
Prioritizes professional development to improve biology education.
Has a heightened awareness of ethical violation issues such as plagiarism, salami slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.
Follows codes of conduct in jury duty and refereeing.
Distinguishes the qualities of journals, indexes and activities in biology education and related fields.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education
Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops which may contribute to their professional development.
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.
Has a high motivation to guide the pre-service and in-service teachers on biology teaching.
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.
Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.
Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.
Gives feedback to the prospective teacher educators to improve their competencies.
Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.
Demonstrating collaboration skills for the aim of developing biology education
Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.
Constructs healthy, efficient and effective communication with group members to improve their skills that are open to improvement.
Shares work among group members within the scope of his/her competencies and proficiencies.
Fulfills the responsibilities undertaken within the division of work.
Contributes to the local, national and international educational research groups by prioritizing biology education.
COMPETENCY AREA F: SUPPORTING BIOLOGY EDUCATION IN SOCIETY
Organizing effective in-service teacher education programs for biology teachers
Actively participates in the in-service teacher education programs for biology teachers.
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.
Takes into account the individual differences of teachers (knowledge, beliefs, experience, etc.) in the implementation of in-service teacher education programs.
Plans the in-service teacher educational practices based on the needs of biology teachers.

Table 4.38. (Continued)

Competency Framework for Biology Teacher Educators
Takes into account the characteristics of adult education in the in-service teacher education practices.
Takes into account both theoretical and practical implementations in the in-service teacher education practices.
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)
Follows the local, national and international education policies by prioritizing biology education.
Conducts research to improve national and international education policies in order to increase the quality of education by prioritizing biology education.
Is disposed to contribute to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.
Supports the organization of professional meetings / seminars / conferences for the stakeholders in biology education.
Participates in the content and curriculum development of biology education.
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.
Leading the development of biology education in the society
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.
Determines the requirements of biology education and engages in action (meeting, workshop, etc.) to fulfill them.
Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders.
Brings the developed implementations and materials to the use of relevant stakeholders.
Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education.
Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).
Supporting the professional development of colleagues
Is disposed to take role in the professional development activities of working groups and NGOs related to biology / science education.
Develops course materials to support professional development and shares them with colleagues.
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops, etc.).
Takes an active role in providing professional development in different environments (social sharing, panels, workshops, etc.).

* Competency areas, competencies are presented as bold; competency indicators are presented normally.

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The Delphi method works on successive rounds and the result of each round constitutes the inputs of the prospective rounds. Therefore, the results of the study are presented in line with the methodological process of the study in the previous chapter. In the current chapter, the findings of each Delphi Round are discussed in the light of the literature in the same order as presented in the previous chapter. Additionally, the methodological perspective of the research is also discussed in the chapter. Thereafter, an overall discussion is drawn based on the discussions of the results. Some opinions are shared as to how to apply the results of this study into future studies, policies and practical life of biology teacher educators. The recommendations for further research are then addressed in the final section.

5.1. Discussion of the Results from Delphi 1st Rounds

5.1.1. Extent of the Competency Framework

In the literature, there are four main documents focusing on the standards of teacher educators. Even though there are similarities between the standards proposed by institutions, some differences are also detected among these proposed standard documents. For constructing the competency areas of the biology teacher educators of the present dissertation, these four documents are analyzed in depth. At the beginning of the Delphi 1st Round, 14 themes for competency areas were listed after this analysis to be used during the interviews with the key informants. At the end of the Delphi 1st Round, 6 competency areas were formed after the analysis of the interviews with 4 key informants.

As one of the main findings of this study, the differences between the proposed standards documents and the findings of the study are seen as a need for thorough

scrutiny and discussion in the present section of this dissertation. The discussion of this process of the research is provided in detail in line with these constructed competency areas in the present dissertation.

Firstly, content knowledge was taken as a separate standard in three of these proposed standards (VELOV, 2012; ASTE, 1997; AMTE, 2002.). On the other hand, the theme of teaching was taken as a separate standard in all of these three standard documents. It was taken as “a supervisor of learning and development processes” in VELOV (2012) while, ASTE ((1997) defined it as Science Pedagogy. Teaching was taken with the theme of teaching for teachers and named Teaching and Teacher Education in the document proposed by AMTE (2002). On the other hand, content knowledge was taken with the theme of teaching in the document proposed by ATE (2006).

For the present dissertation, content knowledge and pedagogical content knowledge themes were foreseen as two different potential competency areas. After analyzing the interviews conducted with the key informants in the Delphi 1st Round, it was seen that the key informants took competencies toward knowledge for content (biology) and competencies toward pedagogical content knowledge (biology teaching) engaged tightly. Additionally, the result of the analysis indicates that being a biology teacher is the first and one of the main steps for being a biology teacher educator from the key informants’ point of view. Therefore, the first competency area was named Biology Teaching for the present dissertation.

Teacher education was taken as a separate standard in all of the standard documents proposed by different institutions (ATE, 2006; AMTE, 2002; ASTE, 1997; VELOV, 2012). Therefore, it was foreseen that teacher education would be a separate competency area for biology teacher educators. As predicted, at the end of Delphi 1st Round one main competency area for teacher education was acquired as a second competency area for biology teacher educators. This competency area was named Educating and Developing Biology Teachers.

It should be mentioned that there were some other standards related to teaching and teacher education. The results of the data gathered in Delphi 1st Round revealed that these competencies are related to biology teaching and / or biology teacher education. For example, one of the standards taken in the ATE's (2006) document was Program Development. Similarly, in ASTE (1997) there were two separate standards Curriculum, Instruction and Assessment, and Knowledge of Learning and Cognition. In the standard document of AMTE (2002) Technology, Curriculum, and Assessment were taken as three different standards. After the analysis of these documents, which corresponds to the beginning of the Delphi 1st Round, two potential competency areas were formed: program development, assessment and evaluation and other educational activities, and pedagogical content knowledge. After the analysis of the data gathered in Delphi 1st Round, it was seen that all of the competencies related to curriculum, instruction and assessment were taken in harmony with biology teaching and biology teacher education. Therefore, the competencies which were foreseen as potential competency areas were taken either under the competency area of Biology Teaching or Educating and Developing Biology Teachers by relevance.

One of the main critiques toward standards was the idea that roles and profiles of teacher educators are complex and nested in nature (Berrt, 2007; ETUCE, 2008; Goodwin et al., 2014), and proposing standards for teacher educators do not reveal the complexity and unpredictability of the teaching and learning environment (Korthagen, 2004). On the other hand, it can be concluded that, compared with standard documents, the proposed Competency Framework for Biology Teacher Educators is more inclusive and reflects the complexity of needed qualifications of biology teacher educators. Since this proposed competency framework was structured from the perspective of biology teacher educators' roles and responsibilities, it is more apt to present the nested structure of the competencies of biology teacher educators on competency area level.

The third competency area of the Competency Framework for Biology Teacher Educators is named Biology Teacher Educator Education. None of the four standards documents have established a standard toward the education of prospective biology teacher educators. On the other hand, Abell et al. (2008) criticized this absence during the analysis of Professional Knowledge Standards for Science Teacher Educators proposed by ASTE (1997), and suggested to add one more standard for science teacher educators. In line with this criticism, it was seen as a potential competency area for this dissertation and was incorporated into the interview protocol as a separate theme. During the interviews, all of the four key informants mentioned that the education of prospective biology teacher educators was one of their main duties and responsibilities. Moreover, it was defined as a different competency area by all of the key informants.

The fourth competency area of the present dissertation ,is Being a Researcher and Innovativeness, featuring two different themes which are conducting research and following innovations in the field in the interview protocol. Additionally, this was the only standard proposed as a separate standard in all of the four standards documents. It was named Scholarship in the document of ATE (2006), Research and Scholarly Active in the document proposed by ASTE (1997), Research in the document of AMTE (2002), and expressed as teacher educator as an innovator and researcher in the document of VELOV (2012). This finding reveals that conducting research is totally a different and uniquely needed quality of all teacher educators.

The fifth competency area of the current study is Positive Attitudes and Values for Biology Education. In the interview protocol, four potential competency areas were foreseen which were taken under this competency area after the analysis of the interviews in the Delphi 1st Round. These potential competency areas were: carrying out the professional development of oneself and other teacher educators, self-organization, collaborating with other teacher educators, and vision and mission. These listed potential competency areas were formed by using the standard documents proposed by four institutions. As mentioned before, there were some

differentiations between these standard documents. The standard document proposed by AMTE (2002) does not contain any standards related to these four potential competency areas. Therefore, the standard documents provided by ATE (2006), VELOV (2012) and ASTE (1997) have been used to construct mentioned potential competency areas. As the interviews conducted with the key informants demonstrated, all of these potential competency areas are the competencies that are needed in a biology teacher educator and they are interconnected to one another. Therefore, they are taken under a single competency area. This finding reveals that this dissertation provides contextually similar competencies together, unlike other documents. It has also cured the shortcomings in some of the other documents. This finding reveals that the Competency Framework for Biology Teacher Educators constructed through this study takes the competencies that are similar contextually together without any of the deficiencies in other standard documents.

The interview analyses of the Delphi 1st Round revealed that three of the listed potential competency areas were gathered together under the sixth competency area named Supporting Biology Education in Society. These potential competency areas were: serving the society, participating in the policies on biology education, and social outputs related to education. The standard document proposed by ASTE (1997) does not contain any standards related to these three potential competency areas. Therefore, the standard documents provided by ATE (2006), VELOV (2012) and AMTE (2002) have been used to construct the mentioned potential competency areas. Two of these potential competency areas were taken under the competency area named Supporting Biology Education in Society, which are: serving the society and participating in the policies on biology education. As a summary, the opinions of the key informants were both in two potential competency areas under supporting the biology education in the society. Moreover, the social outputs related to education were seen as a need for every adult not only for biology teacher educators or teacher educators.

One of the other strengths of the proposed competency framework in comparison with the standards proposed by other institutions is that it gives the nested nature of competencies needed by biology teacher educators. The only model that presents the professional development of teacher educators is proposed by Abell et al. (2008), which mentions that the professional development of teacher educators starts from the beginning of the doctoral program. On the other hand, the first competency area, named Biology Teaching, of the constructed framework in the present dissertation focuses on the qualifications of biology teachers. Even though Abell et al. (2008) start the professional development of teacher educators with PCK of instructional strategies for teaching teachers (V1), this study presents that one more step can be added before this V1 phase as undergraduate degree of biology education.

In summary, although the complex nature of the competences of biology teacher educators is a reality, these findings suggest that the Competency Framework for Biology Teacher Educators proposed by this study presents the connections between teacher educators' competences. The present dissertation reveals the efficiency of the method to determine the competencies of biology teacher educators through the work they carry out based on their duties and responsibilities.

5.1.2. Preference of Competency

Even though using standards for teacher educators is more common worldwide instead of defining standards, the aim of this dissertation is to identify the competencies of biology teacher educators. As mentioned in the Literature Review chapter of this dissertation, there are some critiques and discussions toward both using standards and using competencies to define the needed characteristics of qualified teachers and/or teacher educators.

One of the main critiques toward the identification of standards was not taking account of the complexity and unpredictability of the teaching and learning environment (Korthagen, 2004). One other critique toward using standards was the practical use of the standards (Zeichner, 2005), since standards define the

qualifications of teacher educators in a general manner. Additionally, Korthagen (2004) criticized this issue and emphasized that preset standards cannot meet the needed definition for qualified teacher educators and cannot represent the depth of needed qualifications.

There is also a discussion on generalizing or specifying descriptions of the competencies in the literature (Stoof, Martens & Van Merriënboer, 2000, retrieved from Koster, Dengerink, Korthagen & Lunenberg, 2008). Some think that if competencies are overspecialized, this may lead to very long lists to manage so as to decide whether teacher educators possess these competencies. Besides, some other critics also claim that general statements of competencies do not have clarity, which leads to poor communication and diminished credibility (Eraut, 1994).

These critiques are taken into consideration. In order to avoid the criticism about defining the qualifications of teacher educators in a general manner, not revealing the complexity and unpredictability of the process of teaching environment and not representing the depth of needed qualifications by way of using standards; it was decided not to prefer standards to define the characteristics of biology teacher educators. On the other hand, the critiques regarding competencies need to be addressed for the present dissertation. To avoid overspecialization and creating a long list of competencies, it was decided to present both competencies and competency indicators. In this way, the complexity of the needed qualifications of biology teacher educators that would be able to define the competencies could be revealed without leading to overspecialization, but also the processes could be concretized by using competency indicators.

It can be said that the current research results support these criticisms made against the standards. In the Delphi 1st Round, biology teacher educators (key informants) were asked what competencies they needed to fulfill their duties and responsibilities. In response to this question, it was seen that they usually gave detailed and concrete examples. This led to the fact that teacher educators need to reveal both the

complexity and give the depth of needed qualifications to define the needed characteristics to fulfill their duties and responsibilities. Moreover, their statements were more elaborated and to the point than a competency therefore, the statements of key informants are defined as competency indicators of competence rather than qualifications.

In addition, when the statements of the key informants are examined in detail, they can be evaluated under more than one competency or even competency area. This, in turn, demonstrates the complexity of their work while defining the competencies that the key informants think they should have. For example, KI 3 said, *“In the end, we participate in juries too. We don’t only contribute to the students there, we also contribute to one another.”* This statement was evaluated under two main competency areas, which were Biology Teacher Educator Education and Supporting Biology Education in Society. In other words, biology teacher educators use more than one competency and even more than one competency area when performing a task.

The statements of key informants interviewed in the Delphi 1st Round reveal that biology teacher educators need to have intertwined competencies to fulfill their complex tasks and responsibilities. This leads to the assumption that standards cannot present this complexity, and defining the qualifications of biology teacher educators with competencies and competency indicators simplifies the complexity of the work carried out by biology teacher educators.

Additionally, the comparison of the results of this dissertation and the standards of teacher educators proposed by ATE also reveals the need for using competencies instead of standards to define the qualifications of teacher educators. In the standards document of ATE, the main standard was taken as Teaching and 10 indicators were defined under this standard which were not concrete and did not provide any details related to the multidimensionality of biology teacher educator qualifications. Two of these indicators were “Mentor novice teachers and/or teacher educators” and

“Ground practice in current policy and research related to education and teacher education.” Only these two indicators proposed by ATE were taken under three competency areas at the level of competency. That is, even though indicators are used when defining standards, they are still quite broad, unclear, and therefore impossible to use in practice.

5.1.2. Discussion of the Results from Delphi 2nd and Delphi 3rd Rounds

5.1.2.1. Opinions of Different Groups

One of the main purposes of preferring the Delphi method in this dissertation is to evaluate the opinions of different groups of people who may have opposite and/or different opinions about the competencies of biology teacher educators (Dalkey, 1972; Landeta, 2006). In this regard, in Delphi 2nd and 3rd Rounds data were collected from three different groups: biology teacher educators, graduate students who study on biology education and biology teachers. The data gathered in the Delphi 3rd Round was analyzed with the data gathered from both the overall group and within different groups: biology teacher educators, graduate students who study on biology education and biology teachers.

When the result of the overall group, in other words, the data gathered from all of the participants are analyzed in accordance with these three defined criteria, the highest scores were obtained for two competencies of biology teacher educators. These competencies are “Implementing biology learning and teaching approaches” and “Following the efficient and effective scientific developments related to biology education.”

“Implementing biology learning and teaching approaches” competency was located under the competency area of Being a Biology Teacher. Having the highest score for the competency of “Implementing biology learning and teaching approaches” reveals that biology teacher educators need to possess the qualification of biology teaching on the highest level. This can indicate that biology teacher educators are seen as people who need to be as competent as biology teachers. This can be seen as

another important clue that the professional development of biology teacher educators starts at the point of being a competent biology teacher. Therefore, it can be suggested that the model proposed by Abell et al. (2008) can be revised and one more phase can be added, which is being a competency biology teacher (V_0) can be added.

The second competency which had the highest consensus among biology teacher educators was under the competency area of “Being a Researcher and Innovativeness.” Having the highest score for this competency indicates that participants are in the opinion that biology teacher educators should follow the innovations in biology education. On the other hand, it is noteworthy that none of the competencies got the highest scores in the competency area of Educating and Developing Biology Teachers.

Even though all of the competencies led to a consensus in the overall group analysis, there were four items that did not bring about a consensus in different group analyses. “Evaluating the biology curriculum” and “Developing graduate education programs in biology education” were competencies that did not reach a consensus only among graduate students. Both of these competencies were about competencies related to curriculum. As mentioned by one of the key informants in Delphi 4th Round, this result can indicate that graduate students may not have interiorized the importance of knowledge about curriculum. This gives an important clue for the content of the graduate programs on biology education programs. Even though it requires further research, it can be concluded that the importance of curriculum for teaching biology cannot be emphasized during graduate programs. It was found by Goodwin, et al. (2014) that most teacher educators mentioned that there was no specific professional development during their doctoral studies. Thanks to Goodwin et al.’s (2014) finding, it can be suggested that teacher education programs need to be analyzed deeply so as to whether they provide the sufficient baseline competencies for prospective teacher educators.

The competency of “Supporting the professional development of colleagues” did not bring about a consensus among the group of biology teachers. Even though none of the key informants interviewed in Delphi 4th Round mentioned the reason of this no consensus among the biology teachers, key informants mentioned that this competency should be taken in the Competency Framework for Biology Teacher Educators with no doubt.

For the competency of “Organizing effective in-service teacher education programs for biology teachers,” a consensus was reached in the group of biology teachers but not in the groups of biology teacher educators and graduate students, which is one of the most significant results obtained. This finding demonstrates that this competency is seen as a need for teachers and graduate students. In other words, biology teachers expect biology teacher educators to organize effective in-service teacher education programs. However, this expectation is not prevalent among biology teacher educators and graduate students. This finding can show that the biology teacher educators do not have a consensus on their roles and profile as biology teacher educators. Roles, therefore, the responsibilities of teacher educators vary from country to country (European Trade Union Committee for Education, 2008; Snoek, Shagrirer, & Zogla, 2009). However, for Turkey there is no definition for the roles and responsibilities of teacher educators. Similarly, the main differentiation in the definitions of teacher educators is the inclusion of responsibility for in-service teacher education (Koster, Brekelmans, Korthagen & Wubbels, 2005; Murray and Male, 2005; Swennen & van der Klink, 2009). Even though biology teacher educators do not have a consensus on having competencies regarding in-service teacher education, biology teachers think that biology teacher educators should have competencies on in-service teacher educators, which leads to the needs of teachers in practice.

5.1.2.2. Differentiation from the Delphi 2nd Round to the Delphi 3rd Round

The purpose of the Delphi 2nd Round was to obtain the opinions of biology teacher educators, biology students on biology education and biology teachers about the needed competencies and competency indicators of biology teacher educators. The Delphi Method was developed by Rand Corporation to synthesize the most reliable opinions on which consensus is reached among individuals by using a series of questionnaires with controlled feedback (Dalkey & Helmer, 1962). Therefore, the Delphi 3rd Round was added to the method to enable participants to reach a consensus on the needed competencies and competency indicators of biology teacher educators. Three main criteria were selected to identify whether consensus was reached for an item which were: having a median (Mdn) higher than 7, interquartile range (IQR) lower or equal to 2 and having more than 80% items loaded in [7-9]) in three dot pitch of [1-3], [4-6], [7-9]. These criteria will hereafter be referred to as median criterion, IQR criterion and 80% criterion for simplification purposes.

The differentiation of the items (competencies and competency indicators) on which a consensus was reached from the Delphi 2nd Round to Delphi 3rd Round needs to be analyzed and discussed. In the Delphi 2nd Round, there were 32 items (3 competencies and 29 competency indicators) that did not bring about a consensus. The role for determining not reaching a consensus was, not satisfying at least one of these mentioned criteria. After the analysis it was seen that all of the items that did not bring about a consensus did not satisfy the 80% criterion, whereas some of the items did not satisfy the criterion of IQR and all of them satisfied the criterion of Median. Therefore, the items related to the criterion of 80% are examined in the discussion chapter.

There were 7 of the 32 items in which the respondents loaded in [7-9] dot lower than 60% in the Delphi 2nd Round. Six of these items led to a consensus at the end of the Delphi 3rd Round. However, only one of these items, which is the only competency among these items and named “Organizing effective in-service teacher education

programs for biology teachers,” brought about a consensus in the Delphi 3rd Round in the overall group analysis. On the other hand, this item did not bring about a consensus among biology teacher educators and graduate students. There are two main reasons for this result of reaching a consensus at the end of the Delphi 3rd Round in the overall group analysis. First of all, the score given by the biology teacher group was very high. Additionally, the score of the teacher educators and graduate students increased slightly from the Delphi 2nd Round to the Delphi 3rd Round. However, it was important to evaluate the result of the analysis gathered for this competency. This differentiation among teacher educators can indicate that even though teacher educators do not think that they should possess the competency on in-service teacher education, their thoughts can be affected by the opinions of other people. This led us to the idea that teacher educators may not see in-service teacher education as one of their main responsibilities. This dilemma can also be seen in the interviews with the key informants in the Delphi 1st Round. KI 1 said, *“We do not have a lot of duties for in-service teacher education,”* and added: *“Reaching teachers at schools should also be among our duties. There should be collaboration and every teacher educator welcomes the offers positively. This is also a duty. There can be some project duties in private schools. This does not have any contribution to your academic development but we should not refuse such offers.”* Additionally, KI 3 said, *“I think in-service teacher education is also important, not as much as pre-service teacher training. Indeed, teachers in service have too many needs. They also need to be supported. Although they are not directly in our area of responsibility now, we need to work with them also. I think we can see this as a service to society.”* When the opinions of the key informants in the Delphi 4th Round were analyzed, it was seen that all of the key informants mentioned that biology teacher educators should possess this competency. The statement of KI 2 after analyzing the results of the Delphi 3rd Round gives the meaning of this dilemma: *“I think teacher educators do not think that in-service teacher education is their job. But this is one of our main competencies.”* Moreover, KI 4 expressed, *“How do we understand that it should be? Teachers gave high scores. So they should possess this competency. Teachers*

know the requirement.” As a summary, even though teacher educators are in a dilemma when deciding whether in-service teacher training is their responsibility and if they should possess this competency, they are also aware of the need of teachers in practice. Therefore, this competency was kept at the end of the Delphi 4th Round and included in the Competency Framework for Biology Teacher Educators. However, this dilemma is not specific to the biology teacher educators in Turkey. It is a universal dilemma that can be observed in the definition of teacher educators defined by different teacher educators. The definition made by Swennen and van der Klink (2009) for teacher educators covers both educating pre-service and in-service teacher educators, while the definition presented by Koster, Brekelmans, Korthagen and Wubbels (2005) refers only to the education of pre-service teachers.

There were 25 of the 32 items in which respondents loaded in [7-9] dot lower than 70% in Delphi 2nd Round. 23 of these items reached a consensus at the end of the Delphi 3rd Round. There were only two competency indicators which did not reach a consensus at the end of the Delphi 3rd Round, which are “Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry)” and “Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.” None of these competency indicators reached a consensus in the data analysis of the overall group and graduate student group. The reason for not satisfying the criteria of 80% is because the group of graduate students has very low scores in Delphi 3rd Round. Therefore, both of those indicators were analyzed from the point of view of graduate students. The opinion of KI 3 seems to be the most explanatory explanation of the opinions of graduate students for the item of “Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).” In Delphi 4th Round KI 3 stated, *“Graduate students gave low scores because they are not engaged in. Or they may not know the curricula. They may think, after they learn biology, why they should be related. This might be unnecessary for them. This is an understandable and required item.”* For

the indicator of “Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education,” KI 3 mentioned that the reason of having low scores in graduate students is that they may not be able to understand the phrase of policy development.

Since both of those indicators did not reach a consensus among graduate students, this finding is also similar to Goodwin et al. (2014)’s study, which shows that graduate studies may not be sufficient for the professional development of teacher educators. On the other hand, as mentioned by Abell et al. (2008) graduate programs need to give importance to the preparation of prospective teacher educators. However, it can be concluded that prospective biology teacher educators have gaps in their knowledge of the roles and needed competencies.

5.1.3. Discussion of the Results from the Delphi 4th Round

At the end of the Delphi 3rd Round, there were 20 items which did not lead to a consensus in the overall group analysis or one of the groups of biology teacher educators, graduate students studying biology education and biology teachers. Four of these items were competencies and the rest were competency indicators. Seven of these items showed consensus among the overall group analysis, 8 of them did not reach a consensus among biology teacher educators, 14 of them did not reach a consensus among graduate students and 4 of them did not reach a consensus among biology teachers. For reaching a consensus on the Competency Framework for Biology Teacher Educator competencies, Delphi 4th Round is the last step of the research. Key informants who participated in the study in the Delphi 1st Round were asked to determine whether these items should be kept in Competency Framework for Biology Teacher Educators or should kept with some revisions.

At the end of the Delphi 4th Round it was decided that 11 of these 20 items should be kept, 2 of them be removed from the final version of the framework and 7 of them be kept with some revisions in the statement. The reason behind removing the indicator of “Estimates the proficiency level of pre-service and in-service teachers

regarding the technological tools used in biology education” was that two key informants mentioned that this indicator was also involved in another indicator. The other indicator which was “Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economical and physical environments” was also removed from the final version of the competency framework. Key informants mentioned that this item seems very unrealistic and also it was hard to understand the importance of constructing environments for that purpose.

For the revised and preserved items in the final version of the framework, two different explanations were made by the key informants in general. Two of the items were revised because the level of skill needed for the indicator was higher or required knowledge was deeper. On the other hand, the main reason for revising 5 items was explained in terms of country-specific situations. Since the reasons behind these 5 items were similar, it was explained with one item. The competency of “Takes an active role in the professional development activities of working groups and NGOs related to biology / science education” was revised as “Is disposed to take role in the professional development activities of working groups and NGOs related to biology / science education.” All of the key informants mentioned that taking active participation for such an activity was not a preference for a teacher educator. For example, KI 4 stated, *“Teacher educators know the reality. This is not a preference. How can they take active role?”*

In summary, all of the revised items were explained with Turkey-specific reasons. As Snoek et al. (2009) mentioned, these revisions refer to the need of constituting country-specific frameworks due to the fact that different nations or countries have different contexts. From this point of view, it should be mentioned that all of these five items were in the competency area of Supporting Biology Education in Society. The importance of these indicators in explaining the needed competency was also mentioned by the key informants. Additionally, they also stated their demands for taking an active role in activities organized by different institutions or MoNE. This

shows that although biology teacher educators are willing to participate in those activities, the criteria for taking part in such activities do not only depend on the opinions of biology teacher educators. In other words, biology teacher educators state that this is not possible in some cases even if they wanted to take part in community service activities.

5.1.4. Discussion of the Methodology

As mentioned in the method chapter of the dissertation, the methodology of the current study differentiates from the classical Delphi Method and it was recommended to mention the method of the current study as Modified Delphi Method. Because of the modifications conducted in the method of the study, it is thought that this process should be discussed in detail in the current chapter of the thesis.

In the literature there are some main critiques toward the Delphi Method. The first critic is that using the opinions of experts as the only source of information can limit the sources that are used (Linstone, 1975). For the current study, this criticism was addressed by extending the experts and participants in Delphi 1st, 2nd and 3rd Rounds. Delphi 1st Round is conducted in two phases in which experts' profiles are different from one another. In the 1st phase of the Delphi 1st Round, experts are named key informants and they are experts on biology education. All of these key informants were working in biology education, had an experience of at least five years lecturing both undergraduate and graduate students, were postgraduate PhD students and had studies on biology education. In addition to the key informants in Delphi 1st Round, the opinions of the expert panel about the competencies and competency indicators of biology teacher educators are gathered. All of the experts in this panel are the teacher educators who have an expertise in the competencies of teacher educators.

The participants of Delphi 2nd and 3rd Rounds were the same due to the nature of the Delphi Method. The aim of both of these rounds was to get the opinions of the participants about the necessity of the listed competencies and competency

indicators that biology teacher educators need to possess. Three different groups were included in the study to expand the participant profile. The first group consisted of biology teacher educators as expected. Besides, two different groups, graduate students in biology education and biology teachers, are included in the study as the participants of Delphi 2nd and 3rd Rounds, since they are the beneficiary of the competencies of biology teacher educators.

The results of the study revealed that including the expert panel, graduate students in biology education and biology teachers to the study enhanced the validity of the study. Two of the important competencies, which are “Evaluating the biology curriculum” and “Developing graduate education programs in biology education” were recommended by the expert panel. Besides, the differences between the opinions of biology teacher educators and graduate students in biology education on these two competencies indicate the differentiation between the groups of participants.

The second criticism of the Delphi method was the non-interactivity among participants. Even though non-interactivity among participants is seen as a positive feature of the method, this may prevent the formation of new ideas that can emerge through interaction between the participants (Van de Ven & Delbecq, 1974). By including two different participant groups from different areas of expertise in teacher education in the Delphi 1st Round, the aim was to increase the comprehensiveness of the competencies and competency indicators of biology teacher educators.

The fact that the researcher is responsible for the coordination of the research leaves this process prone to manipulation was the third critique toward the Delphi Method. In order to increase the validity of the current study, the interview protocol used in Delphi 1st Round was piloted twice. The protocol was redesigned in line with the findings gathered in the first pilot study and newly created interview protocol was piloted as well. Additionally, all of the interviews were coded by the researcher and a PhD student in science education.

The possibility of not selecting proper experts, probability of losing experts during the research process, and not selecting appropriate data analysis techniques are criticized with regard to internal validity (Rieger, 1986). As mentioned before, extending the experts who participated in both Delphi 1st Round and Delphi 2nd and 3rd Rounds was also taken as a factor to increase validity to prevent not selecting proper experts. However, the probability of losing experts during the research was a risk needless to say. To minimize this risk, all of the participants were informed about the methodology of the study before they participated in the study. Since there was no loss of participant during the dissertation, this potential risk did not affect the study. In order to address the critiques of not selecting the appropriate data analysis technique, data analysis procedure was determined by the expert panel working on a similar project to the current dissertation. Therefore, it can be said that the determination of the data analysis techniques was planned in accordance with expert opinions.

5.2. Conclusions

This study focuses on the professional competencies desired in biology education teacher educators in Turkey and aims to contribute to four objectives. One of these objectives is to contribute to the professional development of biology teacher educators. As explained in the literature chapter of this dissertation there is a growing interest of research on the professional development of teacher educators (Ping et al., 2018). More importantly there are some institutions which aim to facilitate the professional development of teacher educators in the world such as the MOFET Institute in Israel.

Likewise, in the Netherlands teacher educators should register to a program operated by VELON (2012) and linked with professional standards designed for teacher educators (Koster & Dengerink 2001, Koster et al., 2008). Dengerink, Lunenberg and Kools's (2015) study revealed an important finding on what kind of learning activities teacher educators want to participate in to improve their professional

development and with whom they prefer to learn. More than half of the teacher educators indicated that they wanted to improve their learning individually, and 43% preferred to learn with colleagues of their own institution or school.

The Competency Framework for Biology Teacher Educators constituted at the end of this dissertation can help biology teacher educators evaluate their strengths and weaknesses to determine a path for their own professional development activities. One of the strengths of this framework in comparison with standards is that it gives the sophisticated nature of qualifications desired in biology teacher educators to fulfill their complex duties and responsibilities. Thus, this framework can guide biology teacher educators to identify the desired self-development path in accordance with the competency areas and competencies under each competency area. Another important strength of this framework is simplifying the complexity of the needed qualifications by giving concrete, succinct and behavioral competencies and indicators.

The second aim of this dissertation was to contribute to the re-evaluation of biology teacher educator education. The model constituted by Abell et al. (2008) mentions that the professional development of teacher educators starts from the beginning of the doctoral program. On the other hand, the first competency area, named Biology Teaching, of the constructed framework in the present dissertation focuses on the qualifications of biology teachers. Even though Abell et al. (2008) start the professional development of teacher educators with PCK of instructional strategies for teaching teachers (V_1), this study presents that one more step can be added before this V_1 phase as the undergraduate degree of biology education.

Additionally, the results of the Delphi 2nd and 3rd Rounds reveal that the opinions of graduate students differ from biology teacher educators and biology teachers in some areas. Especially, the opinions of graduate biology students on the importance of curriculum can be evaluated as an important clue for the extent of graduate programs of biology education. Key informant opinions in the Delphi 4th Round indicates that

graduate students are far removed from the reality of the profession. The aim of doctoral education is to educate biology teacher educators. This research points out the need to question whether doctoral students are educated for the purpose of acquiring teacher educator qualifications in the context of competencies, especially in the areas of competence put forward. As mentioned by Goodwin, et al. (2014), teacher education programs need to involve knowledge about the field of teacher education. As a result, it can be concluded that biology teacher education programs can be evaluated from the perspective of the competencies needed for biology teacher educators.

The contribution to the criteria for academic assignment and promotion of biology teacher educators was the third aim of this dissertation. In Turkey, the main criterion for the assignment of biology teacher educators is having a PhD in biology education. Even though universities are entitled to identify additional criteria, most of the universities focus on the research studies conducted by the teacher educator candidates. Additionally, for the promotion of teacher educators, main focus is limited by the research conducted by teacher educators. On the other hand, current study reveals that needed competencies for biology teacher educators are more complicated. Therefore, it can be concluded that the criteria for the appointment and promotion of biology teacher educators can be revised in the light of the competencies revealed by the current study. However, it should be noted that the Competency Framework for Biology Teacher Educators is not the constructed viewpoint of an evaluation tool. The competencies and competency indicators do not have an aim to be used as a scoring document. Although this document can be seen as an efficient framework that reflects the complex nature of needed competencies for biology teacher educators, it should not be used as a scoring tool for academic assignment and promotion of biology teacher educators.

This study also makes an important contribution in terms of its methodology. Since there are some critiques of the classical Delphi Method, additional methodological stages and phases in addition to different groups of participants like key informants,

expert panel, biology teacher educators, graduate students on biology education and biology teachers are included in the study. All of them are taken into consideration in accordance with the research question of this dissertation. As a result, they all differed from the classical Delphi Method. Therefore, it is suggested that the method of the study be changed to Modified Delphi Method. The findings of the study revealed that these precautions to enhance the reliability and validity of the study make a significant contribution to the Competency Framework for Biology Teacher Educators.

The last aim of this dissertation was to contribute to the future studies in the field of teacher educators, especially in biology teacher educators. The suggestions for future research for this aim are summarized in next section of this chapter.

Lastly, it should be noted that the constructed Competency Framework for Biology Teacher Educators is limited by the specific time that the research was conducted and by the opinions of the experts. Therefore, this framework should not be seen as an unchangeable document. Most importantly, the competency indicators, competencies and even competency areas are open to improvement in accordance with potential changes in the needed competencies of biology teacher educators. The Competency Framework for Biology Teacher Educators needs to be a dynamic document in parallel to the research conducted on the competencies of teacher educators, especially biology teacher educators.

5.3. Recommendation

The determined Competency Framework of Biology Teacher Educators gives a baseline for the needed competencies for biology teacher educators in accordance with their roles and responsibilities. This competency framework can be suggested for use as a baseline for different purposes.

Since there is a growing research interest on the professional development of teacher educators, Competency Framework of Biology Teachers can be used as a tool to identify the self-efficacy of biology teacher educators who work at universities in

Turkey. With the help of this finding, the needed professional development fields of biology teacher educators can be identified. Moreover, thanks to this finding, institutes like MOFET in Israel can be established and give guidance to biology teacher educators. Additionally, different models can be established for the professional development of biology teacher educators.

Additionally, the Competency Framework for Biology Teachers reveals that the needed competencies for biology teacher educators are not limited by their competencies for research. Therefore, using research outputs of biology teacher educators, as well as other teacher educators, academic assignment and promotion seems to be limited. It can be suggested to YOK to enhance the criteria for academic assignment and promotion for biology teacher educators.

Graduate education, especially PhD education, is one of the most important educational stages for becoming biology teacher educators. Therefore, with the help of the Competency Framework for Biology Teacher Educators the extent, scope and content of PhD programs can be revised.

The Competency Framework for Teacher Educators who are specialized in other fields of education like chemistry, physics, and mathematics can be determined with a similar methodology as a further research. Moreover, with the help of these research studies the needed competencies of teacher educators in different fields can be compared.

Even though there are some critiques of the Delphi Method, it is the most reliable consensus of opinion in a group of experts by using a series of questionnaires with controlled feedback (Dalkey & Helmer, 1962). Besides, the reliability and validity of the method can be enhanced with additional precautions for the selection of participants and implementation. However, it should be noted that these methodological modifications need to be designed in harmony with the research questions of each study.



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APPENDICES

A. Interview Questions Used in the Delphi 1st Round

1. Biyoloji öğretmen eğitimcilerinin görev ve sorumlulukları nelerdir?
 - Öğretmen eğitimi
 - Lisansüstü eğitim verme
 - Alan bilgisine sahip olma
 - Alan eğitimi bilgi sahibi olma
 - Program geliştirme, ölçme değerlendirme vb. eğitsel faaliyetlere hakim olma
 - Araştırma yapma
 - Bireysel ve alanındaki diğer öğretmen eğitimcilerin profesyonel gelişimlerini yürütme
 - Alandaki yenilikleri sürekli takip etme
 - Topluma hizmet kapsamında çalışmalar yürütme
 - Kendi kendini organize etme
 - Diğer araştırmacılar ile ortak çalışmalar yürütme
 - Biyoloji eğitime yön verecek politikalara katılma
 - Eğitim alanındaki sosyal çıktılar adına çalışma
 - Vizyon ve misyona sahip olma
2. Sizce iyi bir biyoloji öğretmen eğitimcisinin sahip olması gereken bilgi ve beceriler nelerdir?



B. Sample of Questionnaire Implemented to Biology Teacher Educators in the Delphi 2nd Round

Değerli Katılımcı,

Biyoloji öğretmenlerinin eğitimi ve araştırmacıların yetiştirilmesi gibi pek çok alanda eğitim ve öğretim çalışmalarını aktif olarak yürüten biyoloji öğretmen eğitimcilerinin hangi niteliklere sahip olmaları gerektiğinin belirlenmesi kritik öneme sahiptir. Bu amaçtan hareketle mevcut araştırma kapsamında, biyoloji öğretmen eğitimcilerinin yeterliklerinin belirlenmesi hedeflenmektedir.

Biyoloji öğretmen eğitimcisi yeterlikleri tanımlanırken konunun alandaki uygulayıcısı ve en önemli paydaşı olarak sizlerin bireysel bakış açılarının yansıtılması ve ihtiyaçlarının anlaşılması önemlidir. Bu kapsamda, üniversitelerin biyoloji eğitimi bölümlerinde görev yapan dört uzmanın görüşleri alınarak ve ilgili alan yazın taranarak belirlenen biyoloji öğretmen eğitimcilerinin sahip olmaları gereken taslak yeterlikleri sizlerin görüşlerine sunuyoruz.

Sizin deneyiminizden yola çıkarak bir biyoloji öğretmen eğitimcisinin, ekteki ankette belirtilen yeterlik ve göstergelerden hangilerine ne düzeyde sahip olmaları gerektiğini belirlemek istiyoruz. Anketteki her bir ifade için üzerinde düşünmeniz istenen temel soruştur: ***“Bir biyoloji öğretmen eğitimcisinin belirtilen niteliğe sahip olmasının gerekliliği sizce nedir?”*** Ayrıca ankette yer alan yeterlikler/nitelikler dışında bir biyoloji öğretmen eğitimcisinin sahip olması gerektiğini düşündüğünüz başka nitelikleri varsa bunları da belirtmenizi istiyoruz.

Bir sonraki aşamada bu anket çerçevesinde katılımcılarından gelen veriler derlenerek kendi cevaplarınızla birlikte size sunulacak ve yanıtınızı değiştirmek isteyip istemediğiniz veya aynen korumak isteyip istemediğiniz sorulacaktır. Bu aşamada elde edilecek verilerin analizi ile biyoloji öğretmen eğitimcisi yeterlikleri ve bu yeterliklerin göstergeleri konusunda ortak ve nihaî bir metne ulaşılması hedeflenmektedir.

Çalışmayla ilgili daha detaylı bilgi isterseniz veya anketle ilgili sorularınız varsa Fulya Koyuncu ile irtibata geçebilirsiniz: Tel: 0537 357 9914; e-posta: koyuncufulya@gmail.com.

Çalışmaya katılımınız ve desteğiniz için şimdiden teşekkür ederim.

Saygılarımla

Aşağıda kişisel bilgileriniz ile ilgili kısa sorular bulacaksınız, buradaki bilgiler sadece cevapları kategorize etmek için kullanılacaktır. Bu bilgiler başka hiçbir amaçla kullanılmayacak ve anket sonuçlarında size ait bilgiler asla belirtilmeyecektir.

Kişisel Bilgiler

1. Adınız Soyadınız:

2. Yaşınız: ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 ve üstü

3. Öğrenim Durumunuz:

Mezun olduğunuz lisans programı (üniversite / bölüm):.....

Mezun olduğunuz yüksek lisans programı (üniversite / bölüm):...

.....

Mezun olduğunuz doktora programı (üniversite / bölüm):.....

4. Görev yaptığınız kurum(Fakülte / Bölüm / Süre):.....

Öğretmenlik tecrübeniz var mı?☐Hayır ☐Evet, Süre:...

BİYOLOJİ ÖĞRETMEN EĞİTİMCİSİ YETERLİKLERİ

Aşağıda bir biyoloji öğretmen eğitimcisinin sahip olması beklenebilecek yeterlikler ve göstergeler sunulmuştur. Lütfen her bir yeterliği/göstergeyi dikkatlice okuyarak bir **biyoloji öğretmen eğitimcisinin** belirtilen niteliğe sahip olma gerekliliğini maddenin yanında **1’den 9’a** kadarki rakamlardan size uygun olanı işaretleyerek derecelendiriniz. Eğer bulunduğunuz ortam, yaptığınız işler ve (mevcut ya da meslekte ilerledikçe karşınıza çıkacak) görev tanımlarınız düşünüldüğünde ilgili yeterlik/performans göstergesinin sizin için karşılığı olmadığını düşünüyorsanız “Fikrim yok” seçeneğini işaretleyebilirsiniz.

YETERLİK ALANI - A: Biyoloji Öğretimi

	Fikrim Yok	Kesinlikle Gereksiz		Çok az Gerekli		Biraz Gerekli		Oldukça Gerekli		Kesinlikle Gerekli
A.1.Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan konu ve kavramları analiz edebilme	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.1.Biyoloji biliminin temelinde yer alan kuram, ilke, genelleme ve modelleri açıklar.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.2.Biyoloji bilimindeki problemlerin çözümüne yönelik deney tasarlama süreçlerini kurgular.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.3.Biyoloji bilimine, bilimin doğasının gerektirdiği bir bakış açısı ile yaklaşır.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐

C. Sample of Questionnaire Implemented to Biology Graduate Students in the Delphi 2nd Round

Değerli Katılımcı,

Biyoloji öğretmenlerinin eğitimi ve araştırmacıların yetiştirilmesi gibi pek çok alanda eğitim ve öğretim çalışmalarını aktif olarak yürüten biyoloji öğretmen eğitimcilerinin hangi niteliklere sahip olmaları gerektiğinin belirlenmesi kritik öneme sahiptir. Bu amaçtan hareketle mevcut araştırma kapsamında, biyoloji öğretmen eğitimcilerinin yeterliklerinin belirlenmesi hedeflenmektedir.

Biyoloji öğretmen eğitimcisi yeterlikleri tanımlanırken konunun alandaki uygulayıcısı ve en önemli paydaşı olarak sizlerin bireysel bakış açılarının yansıtılması ve ihtiyaçlarının anlaşılması önemlidir. Bu kapsamda, üniversitelerin biyoloji eğitimi bölümlerinde görev yapan dört uzmanın görüşleri alınarak ve ilgili alan yazın taranarak belirlenen biyoloji öğretmen eğitimcilerinin sahip olmaları gereken taslak yeterlikleri sizlerin görüşlerine sunuyoruz.

Sizin deneyiminizden yola çıkarak bir biyoloji öğretmen eğitimcisinin, ekteki ankette belirtilen yeterlik ve göstergelerden hangilerine ne düzeyde sahip olmaları gerektiğini belirlemek istiyoruz. Anketteki her bir ifade için üzerinde düşünmeniz istenen temel soruştur: **“Bir biyoloji öğretmen eğitimcisinin belirtilen niteliğe sahip olmasının gerekliliği sizce nedir?”** Ayrıca ankette yer alan yeterlikler/nitelikler dışında bir biyoloji öğretmen eğitimcisinin sahip olması gerektiğini düşündüğünüz başka nitelikleri varsa bunları da belirtmenizi istiyoruz.

Bir sonraki aşamada bu anket çerçevesinde katılımcılarından gelen veriler derlenerek kendi cevaplarınızla birlikte size sunulacak ve yanıtınızı değiştirmek isteyip istemediğiniz veya aynen korumak isteyip istemediğiniz sorulacaktır. Bu aşamada elde edilecek verilerin analizi ile biyoloji öğretmen eğitimcisi yeterlikleri ve bu yeterliklerin göstergeleri konusunda ortak ve nihai bir metne ulaşılması hedeflenmektedir.

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Çalışmaya katılımınız ve desteğiniz için şimdiden teşekkür ederim.

Saygılarımla

Aşağıda kişisel bilgileriniz ile ilgili kısa sorular bulacaksınız, buradaki bilgiler sadece cevapları kategorize etmek için kullanılacaktır. Bu bilgiler başka hiçbir amaçla kullanılmayacak ve anket sonuçlarında size ait bilgiler asla belirtilmeyecektir.

Kişisel Bilgiler

1. **Adınız Soyadınız:**

2. **Yaşınız:** ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 ve üstü

3. **Öğretmenlik tecrübeniz:** ☐ 0-5 yıl ☐ 6-10 yıl ☐ 11-15 yıl ☐ 16-20 yıl
☐ 21-25 yıl ☐ 26 yıl ve üstü

4. **Çalıştığınız kurum:**

☐ Üniversite (.... yıl) ☐ Ortaokul (.... yıl) ☐ Lise (.... yıl) ☐ Diğer:

☐ Çalışmıyorum

5. **Mezun olduğunuz fakülte (lisans)**

☐ Eğitim Fakültesi ☐ Fen-Edebiyat Fakültesi ☐ Diğer:

6. **Eğitim Düzeyiniz (Lisansüstü)**

☐ Yüksek Lisans Öğrencisi ☐ Yüksek Lisans Mezunu ☐ Doktora Öğrencisi

☐ Diğer:

7. **Yüksek Lisans/Doktora yaptığınız üniversite/bölüm:**

BİYOLOJİ ÖĞRETMEN EĞİTİMCİSİ YETERLİKLERİ

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YETERLİK ALANI - A: Biyoloji Öğretimi

	Fikrim Yok	Kesinlikle Gereksiz		Çok az Gerekli		Biraz Gerekli		Oldukça Gerekli		Kesinlikle Gerekli
A.1.Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan konu ve kavramları analiz edebilme	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.1.Biyoloji biliminin temelinde yer alan kuram, ilke, genelleme ve modelleri açıklar.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.2.Biyoloji bilimindeki problemlerin çözümüne yönelik deney tasarlama süreçlerini kurgular.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.3.Biyoloji bilimine, bilimin doğasının gerektirdiği bir bakış açısı ile yaklaşır.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐

D. Sample of Questionnaire Implemented to the Biology Teachers in Delphi 2nd Round

Değerli Katılımcı,

Biyoloji öğretmenlerinin eğitimi ve araştırmacıların yetiştirilmesi gibi pek çok alanda eğitim ve öğretim çalışmalarını aktif olarak yürüten biyoloji öğretmen eğitimcilerinin hangi niteliklere sahip olmaları gerektiğinin belirlenmesi kritik öneme sahiptir. Bu amaçtan hareketle mevcut araştırma kapsamında, biyoloji öğretmen eğitimcilerinin yeterliklerinin belirlenmesi hedeflenmektedir.

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Saygılarımla

Aşağıda kişisel bilgileriniz ile ilgili kısa sorular bulacaksınız, buradaki bilgiler sadece cevapları kategorize etmek için kullanılacaktır. Bu bilgiler başka hiçbir amaçla kullanılmayacak ve anket sonuçlarında size ait bilgiler asla belirtilmeyecektir.

Kişisel Bilgiler

1. Adınız Soyadınız:
2. Yaşınız: ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 ve üstü
3. Öğretmenlik tecrübeniz:
☐ 0-5 yıl ☐ 6-10 yıl ☐ 11-15 yıl ☐ 16-20 yıl ☐ 21-25 yıl ☐ 26 yıl ve üstü
4. Çalışmakta Olduğunuz Kurum ve Türü
☐ Özel ☐ Devlet
☐ Ortaokul ☐ Anadolu Lisesi ☐ Meslek Lisesi ☐ Fen Lisesi ☐ Diğer:
5. Eğitim Düzeyiniz
Lisans
☐ Eğitim Fakültesi Mezunu
☐ Fen-Edebiyat Fakültesi Mezunu
☐ Diğer:
Lisans Üstü
☐ Yüksek Lisans Öğrencisi
☐ Yüksek Lisans Mezunu
☐ Doktora Öğrencisi
☐ Doktora Mezunu

BİYOLOJİ ÖĞRETMEN EĞİTİMCİSİ YETERLİKLERİ

Aşağıda bir biyoloji öğretmen eğitimcisinin sahip olması beklenebilecek yeterlikler ve göstergeler sunulmuştur. Lütfen her bir yeterliği/göstergeyi dikkatlice okuyarak bir **biyoloji öğretmen eğitimcisinin belirtilen niteliğe sahip olma gerekliliğini** maddenin yanında **1’den 9’a** kadarki rakamlardan size uygun olanı işaretleyerek derecelendiriniz. Eğer bulunduğunuz ortam, yaptığınız işler ve (mevcut ya da meslekte ilerledikçe karşınıza çıkacak) görev tanımlarınız düşünüldüğünde ilgili yeterlik/performans göstergesinin sizin için karşılığı olmadığını düşünüyorsanız “Fikrim yok” seçeneğini işaretleyebilirsiniz.

YETERLİK ALANI - A: Biyoloji Öğretimi

	Fikrim Yok	Kesinlikle Gereksiz		Çok az Gerekli		Biraz Gerekli		Oldukça Gerekli		Kesinlikle Gerekli
A.1.Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan konu ve kavramları analiz edebilme	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.1.Biyoloji biliminin temelinde yer alan kuram, ilke, genelleme ve modelleri açıklar.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.2.Biyoloji bilimindeki problemlerin çözümüne yönelik deney tasarlama süreçlerini kurgular.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.3.Biyoloji bilimine, bilimin doğasının gerektirdiği bir bakış açısı ile yaklaşır.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐

E. Statistical Results of the Delphi 2nd Round

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
COMPETENCY AREA A: BIOLOGY TEACHING									
Analyzing the concepts and subjects in the biology curriculum (high school level)	8.24	1.23	9.0	1.50	8.00	9.00	0.00	15.15	84.85
Explains the theories, principles, generalizations and models that underlie the science of biology.	8.13	1.21	9.0	2.00	7.00	9.00	0.00	10.53	89.47
Constructs the experiment design process for solving problems in the science of biology.	8.16	1.12	9.0	2.00	7.00	9.00	0.00	5.41	94.59
Approaches the science of biology from a perspective that is required by the nature of science.	8.65	0.68	9.0	0.50	9.00	9.00	0.0	0.0	100.0
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.	8.32	1.11	9.0	1.50	8.00	9.00	0.00	8.11	91.89
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.	8.42	0.87	9.0	1.75	7.50	9.00	0.00	0.00	100.00
Explains how biology benefits from closely related disciplines.	7.89	1.05	8.0	2.00	7.00	9.00	0.00	8.11	91.89
Explains the historical development processes of biology.	7.16	1.60	7.0	3.00	6.00	9.00	5.26	28.95	65.79
Developing the biology literacy level of high school students	7.67	1.53	8.0	2.50	7.00	9.00	0.00	24.24	75.76
Has experience in teaching biology.	7.57	1.75	9.0	3.00	6.00	9.00	2.86	25.71	71.43
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	7.87	1.23	8.0	2.00	7.00	9.00	0.00	10.53	89.47
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.	7.97	1.26	9.0	2.00	7.00	9.00	0.00	13.16	86.84
Constructs teaching processes within the framework of the properties of scientific knowledge.	8.03	1.15	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Includes the relationship of biology with the society, humanity and environment in the teaching practices.	8.18	1.11	9.0	1.25	8.00	9.00	0.0	10.5	89.5
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	7.35	1.48	7.0	3.00	6.00	9.00	2.70	24.32	72.97
Implementing biology learning and teaching approaches	8.07	1.57	9.0	2.00	7.00	9.00	3.70	11.11	85.19
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.	7.51	1.63	8.0	3.00	6.00	9.00	2.70	24.32	72.97
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.	7.55	1.41	7.5	2.00	7.00	9.00	0.00	18.42	81.58
Makes use of the models, theories and conceptual frameworks specific to	7.83	1.18	8.0	2.00	7.00	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1–3)	(4–6)	(7–9)
biology/science education in establishing learning and teaching approaches.									
Focuses on the development of scientific process skills in biology teaching.	7.82	1.39	8.0	2.00	7.00	9.00	0.00	15.79	84.21
Uses the laboratory activities in biology teaching effectively in teaching processes.	7.84	1.24	8.0	2.00	7.00	9.00	0.00	16.22	83.78
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.	8.13	1.09	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.	8.26	1.13	9.0	2.00	7.00	9.00	0.0	13.2	86.8
Uses different measurement and evaluation approaches and methods in biology education.	7.92	1.28	8.5	2.00	7.00	9.00	0.00	15.79	84.21
Evaluating the biology curriculum	7.58	1.32	7.5	2.00	7.00	9.00	0.00	16.67	83.33
Questions the vision, philosophy, structure and scope of the biology curriculum.	7.97	1.22	8.0	2.00	7.00	9.00	0.00	15.79	84.21
Questions the distribution and arrangement of the subject contents in the biology curriculum.	7.89	1.18	8.0	2.00	7.00	9.00	0.00	13.16	86.84
Questions the contents and limitations of the acquisitions in the biology curriculum.	8.00	1.19	8.0	2.00	7.00	9.00	0.00	10.53	89.47
Compares the biology curriculum with the biology curricula of different countries.	6.92	1.60	7.0	2.00	6.00	8.00	2.63	28.95	68.42
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	7.74	1.41	8.0	2.00	7.00	9.00	0.00	21.05	78.95
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.29	1.35	7.0	3.00	6.00	9.00	0.00	28.95	71.05
COMPETENCY AREA B: BIOLOGY TEACHER EDUCATION									
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes	7.77	1.31	7.5	2.00	7.00	9.00	0.00	11.54	88.46
Explains the structure, scope, philosophy and approach of the teacher education program in the department.	7.71	1.31	8.0	2.00	7.00	9.00	0.00	15.79	84.21
Compares the implemented teacher education program with other teacher education programs at national and international level.	7.32	1.36	7.0	1.50	7.00	8.00	0.00	18.92	81.08
Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)	7.97	1.33	8.0	2.00	7.00	9.00	0.00	13.16	86.84
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.	7.92	1.34	8.5	2.00	7.00	9.00	0.00	13.89	86.11
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	7.64	1.36	8.0	2.00	7.00	9.00	0.00	22.22	77.78
Guiding pre-service and in-service biology teachers for using appropriate learning	7.84	1.46	8.0	2.00	7.00	9.00	0.00	16.00	84.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
and teaching approaches in the right place and at the right time.									
Creates learning opportunities for the pre-service and in-service teachers to develop their knowledge and skills related to teaching methods and techniques.	8.21	1.17	9.0	1.00	8.00	9.00	0.00	10.53	89.47
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.	8.21	1.19	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.	8.16	1.24	9.0	2.00	7.00	9.00	0.00	13.51	86.49
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	8.11	1.23	9.0	2.00	7.00	9.00	0.00	10.53	89.47
Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12th grade level).	8.21	1.17	9.0	1.25	8.00	9.00	0.00	7.89	92.11
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.	7.97	1.26	9.0	2.00	7.00	9.00	0.00	10.81	89.19
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials	7.85	1.03	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.	8.05	1.29	8.5	2.00	7.00	9.00	2.63	7.89	89.47
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.	8.00	1.34	9.0	2.00	7.00	9.00	2.63	7.89	89.47
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.	8.03	1.40	9.0	2.00	7.00	9.00	2.63	10.53	86.84
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.	7.87	1.46	9.0	2.00	7.00	9.00	2.63	13.16	84.21
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.	7.79	1.42	8.0	2.00	7.00	9.00	2.63	13.16	84.21

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.	8.08	1.25	9.0	1.75	7.50	9.00	0.00	16.67	83.33
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.	7.55	1.48	8.0	2.00	7.00	9.00	0.00	18.42	81.58
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.	8.00	1.27	9.0	2.00	7.00	9.00	0.00	13.16	86.84
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.	7.89	1.48	9.0	2.00	7.00	9.00	2.63	13.16	84.21
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	7.87	1.55	9.0	2.00	7.00	9.00	2.63	15.79	81.58
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.	7.89	1.50	9.0	2.00	7.00	9.00	2.63	10.53	86.84
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education	7.84	1.07	8.0	2.00	7.00	9.00	0.00	8.00	92.00
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.	7.42	1.35	7.0	2.00	7.00	9.00	2.63	13.16	84.21
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	7.35	1.67	8.0	2.00	7.00	9.00	5.41	16.22	78.38
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.	7.61	1.65	8.0	2.00	7.00	9.00	5.26	13.16	81.58
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.	7.62	1.44	8.0	2.00	7.00	9.00	2.70	16.22	81.08
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.	7.62	1.62	8.0	2.00	7.00	9.00	5.41	8.11	86.49
Creates learning environments to give feedback to pre-service and in-service	7.68	1.63	8.0	2.00	7.00	9.00	5.41	10.81	83.78

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.									
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students	7.75	1.11	8.0	2.00	7.00	9.00	0.00	14.29	85.71
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.	8.11	1.14	9.0	2.00	7.00	9.00	0.00	11.11	88.89
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.	8.05	1.15	8.0	1.50	8.00	9.00	0.00	10.81	89.19
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.	8.24	1.22	9.0	1.00	8.00	9.00	2.63	5.26	92.11
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education	7.63	1.13	7.5	2.00	7.00	9.00	0.00	12.50	87.50
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.	7.71	1.47	8.0	2.00	7.00	9.00	2.94	17.65	79.41
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.	7.71	1.47	8.0	2.00	7.00	9.00	2.94	14.71	82.35
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.	7.62	1.46	8.0	2.00	7.00	9.00	2.94	14.71	82.35
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.	7.50	1.48	8.0	2.00	7.00	9.00	2.94	17.65	79.41
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.	8.03	1.14	9.0	2.00	7.00	9.00	0.00	8.11	91.89
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.	7.81	1.26	8.0	2.00	7.00	9.00	0.00	16.67	83.33
Guiding supervising teachers for effective mentoring of pre-service biology teachers	7.15	1.38	7.0	1.25	7.00	8.00	0.00	15.38	84.62

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Identifies the areas of development in the supervising teachers with regard to mentoring.	7.63	1.33	8.0	2.00	7.00	9.00	0.00	17.14	82.86
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.	7.53	1.40	8.0	2.00	7.00	9.00	0.00	19.44	80.56
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.	7.69	1.58	8.0	2.00	7.00	9.00	2.78	13.89	83.33
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.	7.89	1.30	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.	7.72	1.43	8.0	2.00	7.00	9.00	0.00	16.67	83.33
Being a role model for the pre-service and in-service teachers in teaching biology	8.12	1.18	8.5	2.00	7.00	9.00	0.00	3.85	96.15
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.	8.13	1.17	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.	7.71	1.21	8.0	2.00	7.00	9.00	0.00	13.16	86.84
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.	8.11	1.13	9.0	2.00	7.00	9.00	0.00	10.53	89.47
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.	7.97	1.17	8.0	2.00	7.00	9.00	0.00	7.89	92.11
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.	7.95	1.31	8.0	2.00	7.00	9.00	2.63	7.89	89.47
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.	8.27	1.24	9.0	1.00	8.00	9.00	2.70	2.70	94.59
Makes use of practices that promote a higher level of biology literacy in pre-service and in-service biology teachers.	8.18	1.27	9.0	1.25	8.00	9.00	2.63	5.26	92.11
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	8.03	1.35	8.5	2.00	7.00	9.00	2.63	7.89	89.47
COMPETENCY AREA C: BIOLOGY TEACHER EDUCATOR EDUCATION									
Supporting the prospective teacher educators in the education and training of biology teachers	7.79	1.38	8.0	2.00	7.00	9.00	0.00	12.50	87.50

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	7.86	1.16	8.0	2.00	7.00	9.00	0.00	13.51	86.49
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	8.08	1.19	9.0	2.00	7.00	9.00	0.00	8.11	91.89
Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.	8.20	1.21	9.0	2.00	7.50	9.00	0.00	8.57	91.43
Managing and supporting the researcher education processes with the aim of improving biology education	8.30	0.99	9.0	1.00	8.00	9.00	0.00	7.41	92.59
Gives courses in biology education at graduate level.	7.83	1.25	8.0	2.00	7.00	9.00	0.00	11.43	88.57
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	7.97	1.21	8.0	2.00	7.00	9.00	0.00	10.81	89.19
Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques.	8.19	1.17	9.0	1.50	8.00	9.00	0.00	8.11	91.89
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.	8.33	0.93	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Consults the prospective teacher educators to support their development in the field of education that they want to specialize in.	8.24	1.12	9.0	1.00	8.00	9.00	0.00	10.81	89.19
Consults the prospective teacher educators to develop their skills for conducting research independently.	8.32	1.03	9.0	1.00	8.00	9.00	0.00	5.41	94.59
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	8.13	1.26	9.0	2.00	7.00	9.00	0.00	10.53	89.47
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	7.92	1.32	8.5	2.00	7.00	9.00	0.00	15.79	84.21
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	7.97	1.28	8.5	2.00	7.00	9.00	0.00	13.16	86.84
Supports the prospective teacher educators to develop their understanding of scientific ethics.	8.24	1.10	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Participates in the juries and commissions for the graduate studies in biology education.	7.26	1.46	7.0	3.00	6.00	9.00	0.00	28.57	71.43
Developing graduate education programs in biology education	7.67	1.15	7.0	2.00	7.00	9.00	0.00	14.29	85.71
Questions the contents and limitations of the applied program by comparing the national	7.89	1.05	8.0	2.00	7.00	9.00	0.00	5.41	94.59

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
and international graduate programs in biology education.									
Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.	7.83	1.08	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.	7.91	1.09	8.0	2.00	7.00	9.00	0.00	8.57	91.43
COMPETENCY AREA D: RESEARCH IN BIOLOGY EDUCATION									
Following the efficient and effective scientific developments related to biology education	8.29	1.12	9.0	1.75	7.50	9.00	0.00	7.14	92.86
Follows the national and international scientific research studies in the academic areas of interest.	8.34	1.12	9.0	1.00	8.00	9.00	0.00	7.89	92.11
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.	8.21	1.21	9.0	2.00	7.00	9.00	0.00	10.53	89.47
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.	8.55	1.06	9.0	0.00	9.00	9.00	0.0	5.3	94.7
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.	8.18	1.23	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Reads about the topics in education and related fields to attain higher general knowledge.	7.74	1.33	8.0	2.00	7.00	9.00	0.00	18.42	81.58
Reads articles about biology to attain higher general knowledge.	7.86	1.08	8.0	2.00	7.00	9.00	0.00	5.41	94.59
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	7.14	1.67	7.0	3.00	6.00	9.00	2.70	27.03	70.27
Follows the qualified publications via the knowledge of indexes and properties of journals.	7.97	1.65	9.0	2.00	7.00	9.00	2.6	10.5	86.8
Conducting innovative, effective and efficient research to improve biology education	7.96	1.34	8.5	2.00	7.00	9.00	0.00	7.69	92.31
Has a research plan to maintain continuity and deepens on the research area of interest which is based on his/her own educational vision.	8.00	1.19	8.0	2.00	7.00	9.00	0.00	7.89	92.11
Conducts efficient and qualified research about biology education which will contribute to the area of specialization.	8.16	1.20	9.0	1.00	8.00	9.00	0.00	7.89	92.11
Bases his/her research studies on the literature and social needs.	7.39	1.31	7.0	2.00	7.00	9.00	0.00	18.42	81.58
Uses quantitative, qualitative or mixed research methods appropriately based on the	7.87	1.46	8.5	2.00	7.00	9.00	0.00	13.16	86.84

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
nature of the research problem and research questions.									
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.	8.08	1.30	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Uses the latest technologies (web-based data collection tools, qualitative and quantitative data analysis software, etc.) in conducting scientific research.	8.08	1.34	9.0	1.25	8.00	9.00	0.00	13.16	86.84
Associates his/her own research with the current studies in the literature.	8.17	1.30	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Has a foreign language proficiency to be able to follow and contribute to the international literature.	7.97	1.48	9.0	2.00	7.00	9.00	0.00	18.42	81.58
Reflects his/her acquired experiences as an educator to his/her research studies.	7.74	1.41	8.0	2.00	7.00	9.00	0.00	18.42	81.58
Sharing research results with different stakeholders effectively and efficiently	7.88	1.13	8.0	2.00	7.00	9.00	0.00	12.00	88.00
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	7.97	1.26	8.0	2.00	7.00	9.00	0.00	13.16	86.84
Publishes the results of completed scientific research in books, book chapters or articles.	8.11	1.23	9.0	2.00	7.00	9.00	0.00	7.89	92.11
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.	7.74	1.64	8.0	2.00	7.00	9.00	2.63	13.16	84.21
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.	7.16	1.59	7.0	3.50	6.00	9.00	0.00	29.73	70.27
Working effectively and efficiently in research groups by collaborating with colleagues	7.65	0.94	7.5	1.25	7.00	8.00	0.00	7.69	92.31
Demonstrates conflict resolution skills while working in collaboration with colleagues.	7.58	1.08	7.0	2.00	7.00	9.00	0.00	5.26	94.74
Collaborates with other researchers from the field of biology education and/or different disciplines.	7.81	1.10	8.0	2.00	7.00	9.00	0.00	10.81	89.19
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.	7.46	1.17	7.0	1.00	7.00	8.00	0.00	13.51	86.49
Participates in international projects as executive/researcher/consultant.	7.30	1.20	7.0	1.00	7.00	8.00	0.00	18.92	81.08
COMPETENCY AREA E: POSITIVE ATTITUDES AND VALUES TOWARD BIOLOGY EDUCATION									
Demonstrating a vision that is open to professional development	7.93	1.09	8.0	2.00	7.00	9.00	0.00	10.71	89.29
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.	7.89	1.15	8.0	2.00	7.00	9.00	0.00	13.51	86.49

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Has an individual education philosophy and vision that are supported by professional experience and are open to development.	7.89	1.16	8.0	2.00	7.00	9.00	0.00	10.53	89.47
Associates the current developments in biology education with his/her educational practices and research.	8.11	0.98	8.0	1.25	8.00	9.00	0.00	5.26	94.74
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.	7.42	1.32	7.0	2.00	7.00	9.00	0.00	19.44	80.56
Enhances self-learning to develop his/her biology teaching methods.	8.05	1.11	8.5	2.00	7.00	9.00	0.00	7.89	92.11
Attaches importance to improving teacher training and education in the light of advanced practices and developments.	8.13	1.07	8.5	2.00	7.00	9.00	0.00	7.89	92.11
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his / her colleagues on biology education.	7.87	1.14	8.0	2.00	7.00	9.00	0.00	7.89	92.11
Plans professional development through identifying strengths and weaknesses through self-assessment.	8.00	1.11	8.0	2.00	7.00	9.00	0.00	8.11	91.89
Updates teaching processes by making use of his/her professional experience.	8.05	1.06	8.0	2.00	7.00	9.00	0.00	7.89	92.11
Regards improving field knowledge as an academic responsibility.	8.21	1.04	9.0	2.00	7.00	9.00	0.00	5.26	94.74
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.	8.26	1.06	9.0	1.00	8.00	9.00	0.00	7.89	92.11
Actively participates in the learning communities focusing on innovation and change in biology education.	7.68	1.16	8.0	2.00	7.00	9.00	0.00	15.79	84.21
Respects different opinions on biology education.	8.34	1.10	9.0	1.00	8.00	9.00	0.00	10.53	89.47
Is open to innovations in biology teacher education.	8.42	1.00	9.0	1.00	8.00	9.00	0.00	7.89	92.11
Supports research-based innovation in biology education.	8.37	1.00	9.0	1.00	8.00	9.00	0.00	7.89	92.11
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.	8.13	1.02	8.0	2.00	7.00	9.00	0.00	5.26	94.74
Acting in accordance with professional ethics	8.59	0.97	9.0	0.00	9.00	9.00	0.0	7.4	92.6
Prioritizes professional development to improve biology education.	8.16	1.10	9.0	1.25	8.00	9.00	0.00	10.53	89.47
Has a heightened awareness of ethical violation issues such as plagiarism, salamislicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.	8.49	0.99	9.0	1.00	8.00	9.00	0.0	5.4	94.6
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.	8.38	1.16	9.0	1.00	8.00	9.00	0.0	10.8	89.2

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.	8.26	1.18	9.0	1.00	8.00	9.00	0.00	10.53	89.47
Follows codes of conduct in jury duty and refereeing.	8.41	1.07	9.0	1.00	8.00	9.00	0.0	8.1	91.9
Distinguishes the qualities of journals, indexes and activities in biology education and related fields.	8.03	1.26	9.0	2.00	7.00	9.00	0.0	13.2	86.8
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.	8.03	1.15	8.0	2.00	7.00	9.00	0.00	7.89	92.11
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education	7.96	1.23	8.0	2.00	7.00	9.00	0.00	7.14	92.86
Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops which may contribute to their professional development.	7.94	1.04	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.	7.82	1.27	8.0	2.00	7.00	9.00	0.00	13.16	86.84
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economic and physical environments.	7.58	1.43	8.0	2.00	7.00	9.00	0.00	21.05	78.95
Has a high motivation to guide the pre-service and in-service teachers on biology teaching.	7.89	1.20	8.0	2.00	7.00	9.00	0.00	5.26	94.74
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	7.27	1.77	7.0	2.50	7.00	9.00	2.70	21.62	75.68
Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.	8.03	1.24	8.5	2.00	7.00	9.00	0.00	7.89	92.11
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education	7.44	1.34	8.0	1.00	7.00	8.00	0.00	18.52	81.48
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.	7.27	1.45	7.0	1.00	7.00	8.00	2.70	18.92	78.38
Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.	7.76	1.51	8.0	2.00	7.00	9.00	2.63	13.16	84.21
Gives feedback to the prospective teacher educators to improve their competencies.	8.19	1.49	9.0	1.00	8.00	9.00	2.78	5.56	91.67
Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.	7.89	1.43	8.0	2.00	7.00	9.00	2.70	8.11	89.19

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Demonstrating collaboration skills for the aim of developing biology education	8.04	1.06	8.0	2.00	7.00	9.00	0.00	8.00	92.00
Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.	8.03	1.19	8.0	2.00	7.00	9.00	0.0	8.1	91.9
Constructs healthy, efficient and effective communication with group members to improve their skills that are open for improvement.	8.16	1.17	9.0	2.00	7.00	9.00	0.0	7.9	92.1
Shares work among group members within the scope of his/her competencies and proficiencies.	8.00	1.21	8.0	2.00	7.00	9.00	0.00	10.53	89.47
Fulfills the responsibilities under taken within during the division of work.	8.21	1.23	9.0	1.00	8.00	9.00	0.0	13.2	86.8
Contributes to the local, national and international educational research groups by prioritizing biology education.	7.68	1.16	8.0	2.00	7.00	9.00	0.00	13.16	86.84
COMPETENCY AREA F: SUPPORTING BIOLOGY EDUCATION IN SOCIETY									
Organizing effective in-service teacher education programs for biology teachers.A188:A213	6.91	1.23	7.0	1.25	6.00	7.00	0.00	31.82	68.18
Actively participates in the in-service teacher education programs for biology teachers.	7.40	1.31	7.0	2.00	7.00	8.50	0.00	20.00	80.00
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.	7.58	1.27	7.0	2.00	7.00	9.00	0.00	16.67	83.33
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.	7.56	1.40	8.0	2.00	7.00	9.00	0.00	22.22	77.78
Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.	7.09	1.40	7.0	3.00	6.00	8.50	0.00	40.00	60.00
Plans the in-service teacher educational practices based on the needs of biology teacher.	7.46	1.54	8.0	2.00	7.00	9.00	2.86	20.00	77.14
Takes into account the characteristics of adult education in the in-service teacher education practices.	7.49	1.56	8.0	2.00	7.00	9.00	2.86	17.14	80.00
Takes into account both theoretical and practical implementations in the in-service teacher education practices.	7.50	1.18	7.5	1.00	7.00	8.00	0.00	13.89	86.11
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	7.00	1.41	7.0	2.00	6.00	8.00	4.00	24.00	72.00
Follows the local, national and international education policies by prioritizing biology education.	7.39	1.44	7.5	2.00	7.00	9.00	0.00	22.22	77.78
Conducts research to improve local, national and international education policies in order	7.11	1.41	7.0	2.00	6.00	8.00	0.00	27.03	72.97

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
to increase the quality of education by prioritizing biology education.									
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	6.78	1.38	7.0	2.00	6.00	8.00	0.00	38.89	61.11
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	6.97	1.40	7.0	2.00	6.00	8.00	0.00	32.43	67.57
Actively participates in the content and curriculum development of biology education.	7.16	1.24	7.0	1.50	7.00	8.00	0.00	24.32	75.68
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.	7.43	1.34	7.0	2.00	7.00	9.00	0.00	21.62	78.38
Leading the development of biology education in the society	7.72	0.94	7.0	2.00	7.00	9.00	0.00	4.00	96.00
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	8.18	1.16	9.0	1.50	8.00	9.00	0.00	6.06	93.94
Determines the requirements of biology education and engage in action (meeting, workshop, etc.) to fulfill them.	7.86	1.23	8.0	2.00	7.00	9.00	0.00	8.11	91.89
Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders.	7.67	1.17	8.0	1.75	7.00	8.50	0.00	11.11	88.89
Brings the developed implementations and materials to the use of relevant stakeholders.	7.95	1.27	8.0	2.00	7.00	9.00	0.00	10.81	89.19
Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education.	8.08	1.26	9.0	2.00	7.00	9.00	0.00	8.11	91.89
Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).	7.49	1.44	7.0	2.00	7.00	9.00	0.00	20.00	80.00
Supporting the professional development of colleagues	6.90	1.45	7.0	2.00	6.00	8.00	0.00	30.00	70.00
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	7.05	1.56	7.0	3.00	6.00	8.00	0.00	35.14	64.86
Develops course materials to support professional development and shares them with colleagues.	7.37	1.40	7.5	2.25	7.00	9.00	0.00	23.68	76.32
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.).	7.55	1.20	7.5	2.00	7.00	9.00	0.00	13.16	86.84
Takes an active role in providing professional development in different	7.39	1.15	7.0	1.00	7.00	8.00	0.00	13.16	86.84

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
environments (social sharing, panel, workshop etc.).									



F. Sample of Questionnaire Implemented in Delphi 3rd Round

BİYOLOJİ ÖĞRETMEN EĞİTİMCİSİ YETERLİKLERİ

Aşağıda, bir biyoloji öğretmen eğitimcisinin sahip olması beklenebilecek yeterlikler ve göstergelerin ne derece gerekli olduğu ile ilgili yaptığımız ankete verdiğiniz yanıt ve diğer katılımcıların verdikleri yanıtların yüzde dağılımları sunulmuştur. Buradaki yüzde değerleri, ilgili madde için 1'den 9'a kadar bir değerlendirmede bulunan katılımcı sayıları üzerinden hesaplanmıştır; "Fikrim yok" diyenler veya boş bırakanlar bu değerlerin hesaplanmasına dahil edilmemiştir. Sizden ricamız, her bir madde ile ilgili sunulan sayısal değerleri inceledikten sonra bu maddenin gerekliliği ile ilgili son değerlendirmenizi ilgili maddenin yanında son sütunda yer alan boşluğa 1'den 9'a kadarki rakamlardan size uygun olanı yazarak yapmanızdır. Eğer ilgili yeterlik/performans göstergesinin sizin için bir karşılığı olmadığını düşünüyorsanız ilgili boşluğa "Fikrim yok (FY)" yazabilirsiniz.



YETERLİK ALANI - A: Biyoloji Öğretimi

	1 Diyenlerin yüzdesi	2 Diyenlerin yüzdesi	3 Diyenlerin yüzdesi	4 Diyenlerin yüzdesi	5 Diyenlerin yüzdesi	6 Diyenlerin yüzdesi	7 Diyenlerin yüzdesi	8 Diyenlerin yüzdesi	9 Diyenlerin yüzdesi	Önceki Yantınız	Değiştirmek İstiyorsanız Yeni Yantınız
A.1.Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan konu ve kavramları analiz edebilme	-	-	-	-	-	8,3	8,3	8,3	75,0	9	
A.1.1.Biyoloji biliminin temelinde yer alan kuram, ilke, genelleme ve modelleri açıklar.	-	-	-	-	7,7	7,7	23,1	7,7	53,8	8	
A.1.2.Biyoloji bilimindeki problemlerin çözümüne yönelik deney tasarlama süreçlerini kurgular.	-	-	-	-	7,7	-	23,1	7,7	61,5	9	
A.1.3.Biyoloji bilimine, bilimin doğasının gerektirdiği bir bakış açısı ile yaklaşır.	-	-	-	-	-	-	16,7	16,7	66,7	9	



G. Statistical Results of the Delphi 3rd Round

RESULTS OF THE OVERALL GROUP ANALYSIS

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
COMPETENCY AREA A: BIOLOGY TEACHING									
Analyzing the concepts and subjects in the biology curriculum (high school level)	8.57	0.85	9.0	1.00	8.00	9.00	0.00	5.71	94.29
Explains the theories, principles, generalizations and models that underlie the science of biology.	8.28	1.16	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Constructs the experiment design process for solving problems in the science of biology.	8.28	0.97	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Approaches the science of biology from a perspective that is required by the nature of science.	8.69	0.63	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.	8.46	0.95	9.0	1.00	8.00	9.00	0.00	5.71	94.29
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.	8.51	0.82	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Explains how biology benefits from closely related disciplines.	7.97	1.07	8.0	2.00	7.00	9.00	0.00	5.71	94.29
Explains the historical development processes of biology.	7.19	1.45	7.0	2.75	6.00	8.75	2.78	30.56	66.67
Developing the biology literacy level of high school students	8.31	0.95	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Has experience in teaching biology.	8.11	1.19	9.0	2.00	7.00	9.00	0.00	11.11	88.89
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	8.06	1.12	9.0	2.00	7.00	9.00	0.00	5.56	94.44
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.	8.17	1.03	9.0	2.00	7.00	9.00	0.00	5.56	94.44
Constructs teaching processes within the framework of the properties of scientific knowledge.	8.19	0.98	9.0	2.00	7.00	9.00	0.00	2.78	97.22
Includes the relationship of biology with the society, human and environment in the teaching practices.	8.42	0.84	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	7.56	1.23	7.0	2.00	7.00	9.00	0.00	16.67	83.33
Implementing biology learning and teaching approaches	8.40	1.63	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.	8.09	1.09	8.0	1.00	8.00	9.00	0.00	11.43	88.57
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.	7.78	1.29	8.0	2.00	7.00	9.00	0.00	11.11	88.89

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches .	7.94	1.15	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Focuses on the development of scientific process skills in biology teaching.	8.14	1.13	9.0	2.00	7.00	9.00	0.00	2.78	97.22
Uses the laboratory activities in biology teaching effectively in teaching processes.	8.11	1.12	9.0	2.00	7.00	9.00	0.00	5.56	94.44
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.	8.28	1.03	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.	8.39	0.99	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Uses different measurement and evaluation approaches and methods in biology education .	8.22	1.07	9.0	2.00	7.00	9.00	0.00	5.56	94.44
Evaluating the biology curriculum	7.83	1.27	8.0	2.00	7.00	9.00	0.00	14.29	85.71
Questions the vision, philosophy, structure and scope of the biology curriculum.	8.22	0.99	8.5	1.00	8.00	9.00	0.00	5.56	94.44
Questions the distribution and arrangement of the subject contents in the biology curriculum.	8.03	1.16	8.0	1.75	7.25	9.00	0.00	11.11	88.89
Questions the contents and limitations of the acquisitions in the biology curriculum.	8.08	1.16	8.5	2.00	7.00	9.00	0.00	8.33	91.67
Compares the biology curriculum with the biology curricula of different countries.	7.11	1.53	7.0	1.00	7.00	8.00	2.78	19.44	77.78
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	8.00	1.26	8.5	2.00	7.00	9.00	0.00	13.89	86.11
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.47	1.30	7.5	2.00	7.00	9.00	0.00	22.22	77.78
COMPETENCY AREA B: BIOLOGY TEACHER EDUCATION									
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes+A34:A56	7.97	1.14	8.5	2.00	7.00	9.00	0.00	5.88	94.12
Explains the structure, scope, philosophy and approach of the teacher education program in the department.	7.81	1.21	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Compares the implemented teacher education program with other teacher education programs at national and international level.	7.44	1.25	7.0	1.75	7.00	8.75	0.00	13.89	86.11
Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)	8.19	1.17	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.	8.11	1.26	9.0	2.00	7.00	9.00	0.00	8.33	91.67
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	7.89	1.21	8.0	2.00	7.00	9.00	0.00	11.43	88.57
Guiding pre-service and in-service biology teachers for using appropriate learning	8.31	1.08	9.0	1.00	8.00	9.00	0.00	5.71	94.29

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
and teaching approaches in the right place and at the right time.									
Creates learning opportunities for the pre-service and in-service teachers to develop their knowledge and skills related to teaching methods and techniques.	8.39	1.05	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.	8.36	1.07	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.	8.44	1.11	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	8.28	1.14	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12th grade level).	8.33	1.04	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.	8.11	1.19	9.0	2.00	7.00	9.00	0.00	5.56	94.44
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials	8.21	0.88	8.0	1.25	7.75	9.00	0.00	2.94	97.06
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.	8.28	1.21	9.0	1.00	8.00	9.00	2.78	2.78	94.44
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.	8.22	1.24	9.0	2.00	7.00	9.00	2.78	0.00	97.22
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.	8.25	1.25	9.0	1.00	8.00	9.00	2.78	2.78	94.44
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.	8.17	1.32	9.0	2.00	7.00	9.00	2.78	5.56	91.67
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.	8.11	1.26	9.0	2.00	7.00	9.00	2.78	2.78	94.44

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.	8.56	0.70	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.	7.89	1.19	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.	8.25	1.13	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.	8.08	1.42	9.0	2.00	7.00	9.00	2.78	5.56	91.67
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	8.17	1.34	9.0	1.00	8.00	9.00	2.78	5.56	91.67
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.	8.08	1.44	9.0	2.00	7.00	9.00	2.78	5.56	91.67
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education	8.06	1.01	8.0	2.00	7.00	9.00	0.00	5.88	94.12
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.	7.44	1.32	7.0	1.75	7.00	8.75	2.78	8.33	88.89
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	7.47	1.59	7.5	2.00	7.00	9.00	5.56	5.56	88.89
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.	7.86	1.51	8.0	2.00	7.00	9.00	5.56	2.78	91.67
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.	7.86	1.38	8.0	2.00	7.00	9.00	2.78	5.56	91.67
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.	7.75	1.50	8.0	2.00	7.00	9.00	5.56	2.78	91.67
Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which	7.81	1.60	8.0	2.00	7.00	9.00	5.56	2.78	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.									
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students	8.14	0.94	8.0	2.00	7.00	9.00	0.00	2.86	97.14
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.	8.28	1.03	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.	8.14	1.10	8.0	1.00	8.00	9.00	0.00	8.33	91.67
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.	8.39	1.10	9.0	1.00	8.00	9.00	2.78	0.00	97.22
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education	7.85	0.80	8.0	1.50	7.00	8.50	0.00	0.00	100.00
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.	7.97	1.42	8.0	2.00	7.00	9.00	2.86	5.71	91.43
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.	8.14	1.29	9.0	1.00	8.00	9.00	2.86	2.86	94.29
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.	7.89	1.45	8.0	2.00	7.00	9.00	5.71	0.00	94.29
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.	7.60	1.48	8.0	2.00	7.00	9.00	5.71	2.86	91.43
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.	8.08	0.97	8.0	2.00	7.00	9.00	0.00	2.78	97.22
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.	7.97	1.11	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Guiding supervising teachers for effective mentoring of pre-service biology teachers	7.54	1.07	7.0	2.00	7.00	9.00	0.00	2.86	97.14

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Identifies the areas of development in the supervising teachers with regard to mentoring.	7.75	1.34	8.0	2.00	7.00	9.00	0.00	13.89	86.11
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.	7.75	1.13	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.	7.92	1.36	8.0	2.00	7.00	9.00	2.78	2.78	94.44
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.	8.06	1.12	8.0	2.00	7.00	9.00	0.00	2.78	97.22
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.	7.81	1.28	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Being a role model for the pre-service and in-service teachers in teaching biology	8.38	1.07	9.0	1.00	8.00	9.00	0.00	2.94	97.06
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.	8.19	1.12	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.	7.92	1.08	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.	8.39	0.96	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.	8.25	1.02	9.0	2.00	7.00	9.00	0.00	2.78	97.22
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.	8.22	1.22	9.0	1.75	7.25	9.00	2.78	0.00	97.22
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.	8.39	1.18	9.0	1.00	8.00	9.00	2.78	0.00	97.22
Makes use of practices that promote a higher biology literacy in pre-service and in-service biology teachers.	8.39	1.15	9.0	1.00	8.00	9.00	2.78	0.00	97.22
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	8.19	1.28	9.0	1.00	8.00	9.00	2.78	2.78	94.44
COMPETENCY AREA C: BIOLOGY TEACHER EDUCATOR EDUCATION									
Supporting the prospective teacher educators in the education and training of biology teachers	8.29	0.86	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships	8.06	1.07	8.0	2.00	7.00	9.00	0.00	5.56	94.44

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.									
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	8.25	1.13	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.	8.25	1.16	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Managing and supporting the researcher education processes with the aim of improving the biology education	8.57	0.65	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Gives courses in biology education at graduate level.	7.91	1.22	8.0	2.00	7.00	9.00	0.00	8.57	91.43
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	8.08	1.18	8.5	2.00	7.00	9.00	0.00	8.33	91.67
Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques.	8.28	1.14	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.	8.43	0.85	9.0	1.00	8.00	9.00	0.00	2.86	97.14
Consults the prospective teacher educators to support their development in the field of education that they want to specialize in.	8.42	1.00	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Consults the prospective teacher educators to develop their skills for conducting research independently.	8.44	1.00	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	8.28	1.11	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	8.17	1.16	9.0	1.75	7.25	9.00	0.00	8.33	91.67
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	8.11	1.14	9.0	2.00	7.00	9.00	0.00	5.56	94.44
Supports the prospective teacher educators to develop their understanding of scientific ethics.	8.36	0.99	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Participates in the juries and commissions for the graduate studies in biology education.	7.56	1.38	8.0	2.00	7.00	9.00	0.00	16.67	83.33
Developing graduate education programs in biology education	8.03	1.03	8.0	2.00	7.00	9.00	0.00	5.88	94.12
Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education.	7.89	1.04	8.0	2.00	7.00	9.00	0.00	5.56	94.44

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.	7.94	1.04	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.	8.06	0.98	8.0	2.00	7.00	9.00	0.00	2.78	97.22
COMPETENCY AREA D: RESEARCH IN BIOLOGY EDUCATION									
Following the efficient and effective scientific developments related to biology education	8.63	0.73	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Follows the national and international scientific research studies in the academic areas of interest.	8.39	1.08	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.	8.42	1.13	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.	8.64	1.02	9.0	0.00	9.00	9.00	0.00	5.56	94.44
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.	8.36	1.10	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Reads about the topics in education and related fields to attain higher general knowledge.	8.00	1.17	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Reads articles about biology to attain higher general knowledge.	8.08	0.97	8.0	2.00	7.00	9.00	0.00	2.78	97.22
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	7.36	1.55	7.0	2.00	7.00	9.00	2.78	11.11	86.11
Follows the qualified publications via the knowledge of indexes and properties of journals.	8.17	1.54	9.0	1.00	8.00	9.00	2.78	2.78	94.44
Conducting innovative, effective and efficient research to improve biology education	8.29	1.23	9.0	1.00	8.00	9.00	0.00	5.71	94.29
Has a research plan to maintain continuity and deepens on the research area of interest which is based on his/her own educational vision.	8.08	1.20	8.0	1.00	8.00	9.00	0.00	8.33	91.67
Conducts efficient and qualified research about biology education which will contribute to the area of specialization.	8.39	1.05	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Bases his/her research studies on the literature and social needs.	7.61	1.25	7.0	2.00	7.00	9.00	0.00	11.11	88.89
Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.	8.19	1.26	9.0	1.75	7.25	9.00	0.00	8.33	91.67
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.	8.28	1.14	9.0	1.00	8.00	9.00	0.00	5.56	94.44

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Uses the latest technologies (web-based data collection tools, qualitative and quantitative data analysis software, etc.) in conducting scientific research.	8.28	1.11	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Associates his/her own research with the current studies in the literature.	8.39	1.08	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Has a foreign language proficiency to be able to follow and contribute to the international literature.	8.17	1.21	9.0	2.00	7.00	9.00	0.00	8.33	91.67
Reflects his/her acquired experiences as an educator to his/her research studies.	8.06	1.17	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Sharing research results with different stakeholders effectively and efficiently	8.18	0.83	8.0	1.00	8.00	9.00	0.00	2.94	97.06
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	8.14	1.13	8.0	1.00	8.00	9.00	0.00	8.33	91.67
Publishes the results of completed scientific research in books, book chapters or articles.	8.19	1.14	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.	7.92	1.59	8.5	2.00	7.00	9.00	2.78	8.33	88.89
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.	7.53	1.30	7.0	2.00	7.00	9.00	0.00	13.89	86.11
Working effectively and efficiently in research groups by collaborating with colleagues	7.91	0.89	8.0	2.00	7.00	9.00	0.00	2.86	97.14
Demonstrates conflict resolution skills while working in collaboration with colleagues.	7.61	1.10	7.0	2.00	7.00	9.00	0.00	5.56	94.44
Collaborates with other researchers from the field of biology education and/or different disciplines.	7.89	1.06	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.	7.56	1.13	7.5	1.00	7.00	8.00	0.00	8.33	91.67
Participates in international projects as executive/researcher/consultant.	7.44	1.11	7.0	1.00	7.00	8.00	0.00	11.11	88.89
COMPETENCY AREA E: POSITIVE ATTITUDES AND VALUES TOWARD BIOLOGY EDUCATION									
Demonstrating a vision that is open to professional development	8.17	0.98	8.0	1.00	8.00	9.00	0.00	5.71	94.29
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.	7.97	1.06	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Has an individual education philosophy and vision that are supported by professional experience and open to development.	8.03	1.03	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Associates the current developments in biology education with his/her educational practices and research.	8.14	0.99	8.0	1.00	8.00	9.00	0.00	5.56	94.44

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.	7.56	1.25	7.5	2.00	7.00	9.00	0.00	11.11	88.89
Enhances self-learning to develop his/her biology teaching methods.	8.22	1.07	9.0	2.00	7.00	9.00	0.00	5.56	94.44
Attaches importance to improving teacher training and education in the light of advanced practices and developments.	8.22	1.02	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his / her colleagues on biology education.	7.89	1.14	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Plans professional development through identifying strengths and weaknesses through self-assessment.	8.06	1.07	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Updates teaching processes by making use of his/her professional experience.	8.19	1.01	8.5	1.00	8.00	9.00	0.00	5.56	94.44
Regards improving field knowledge as an academic responsibility.	8.33	1.01	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.	8.42	1.00	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Actively participates in the learning communities focusing on innovation and change in biology education.	7.78	1.07	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Respects different opinions on biology education.	8.47	1.03	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Is open to innovations in biology teacher education.	8.53	0.94	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Supports research-based innovation in biology education.	8.44	0.94	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.	8.28	0.97	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Acting in accordance with professional ethics	8.74	0.75	9.0	0.00	9.00	9.00	0.00	2.94	97.06
Prioritizes professional development to improve biology education.	8.33	0.99	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Has a heightened awareness of ethical violation issues such as plagiarism, salami-slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.-	8.64	0.90	9.0	0.00	9.00	9.00	0.00	5.56	94.44
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.	8.58	0.81	9.0	0.75	8.25	9.00	0.00	2.78	97.22
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.	8.47	0.84	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Follows codes of conduct in jury duty and refereeing.	8.56	0.84	9.0	0.75	8.25	9.00	0.00	2.78	97.22
Distinguishes the qualities of journals, indexes and activities in biology education and related fields.	8.33	0.99	9.0	1.75	7.25	9.00	0.00	5.56	94.44

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.	8.31	0.98	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education	8.19	1.14	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops which may contribute to their professional development.	8.00	0.94	8.0	2.00	7.00	9.00	0.00	2.86	97.14
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.	8.03	1.13	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economic and physical environments.	7.86	1.31	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Has a high motivation to guide the pre-service and in-service teachers on biology teaching.	7.94	1.22	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	7.61	1.76	8.0	2.00	7.00	9.00	2.78	11.11	86.11
Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.	8.28	1.09	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education	7.92	1.05	8.0	2.00	7.00	9.00	0.00	2.78	97.22
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.	7.61	1.13	8.0	1.75	7.00	8.75	0.00	11.11	88.89
Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.	8.03	1.16	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Gives feedback to the prospective teacher educators to improve their competencies.	8.47	1.08	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.	8.19	1.09	9.0	1.75	7.25	9.00	0.00	2.78	97.22
Demonstrating collaboration skills for the aim of developing biology education	8.38	0.85	9.0	1.25	7.75	9.00	0.00	0.00	100.00
Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.	8.22	1.15	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Constructs healthy, efficient and effective communication with group members to	8.31	1.09	9.0	1.00	8.00	9.00	0.00	2.78	97.22

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
improve their skills that are open to improvement.									
Shares work among group members within the scope of his/her competencies and proficiencies.	8.22	1.15	9.0	1.75	7.25	9.00	0.00	5.56	94.44
Fulfills the responsibilities undertaken within the division of work.	8.31	1.17	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Contributes to the local, national and international educational research groups by prioritizing biology education.	7.92	1.16	8.0	2.00	7.00	9.00	0.00	8.33	91.67
COMPETENCY AREA F: SUPPORTING BIOLOGY EDUCATION IN SOCIETY									
Organizing effective in-service teacher education programs for biology teachers.	7.29	1.15	7.0	1.00	7.00	8.00	0.00	20.00	80.00
Actively participates in the in-service teacher education programs for biology teachers.	7.58	1.11	7.0	1.75	7.00	8.75	0.00	8.33	91.67
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.	7.89	1.17	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.	7.81	1.24	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Takes into account the individual differences of teachers (knowledge, beliefs, experience, etc.) in the implementation of in-service teacher education programs.	7.36	1.40	7.0	3.00	6.00	9.00	0.00	27.78	72.22
Plans the in-service teacher educational practices based on the needs of biology teachers.	7.64	1.55	8.0	2.00	7.00	9.00	2.78	8.33	88.89
Takes into account the characteristics of adult education in the in-service teacher education practices.	7.86	1.24	8.0	2.00	7.00	9.00	0.00	8.57	91.43
Takes into account both theoretical and practical implementations in the in-service teacher education practices.	7.58	1.13	8.0	1.00	7.00	8.00	0.00	8.33	91.67
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	7.56	0.96	7.0	1.00	7.00	8.00	0.00	5.88	94.12
Follows the local, national and international education policies by prioritizing biology education.	7.67	1.15	8.0	2.00	7.00	9.00	0.00	5.56	94.44
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	7.17	1.42	7.0	1.75	6.25	8.00	0.00	25.00	75.00
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority in the specialized field.	6.86	1.31	7.0	2.00	6.00	8.00	0.00	33.33	66.67
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	7.19	1.31	7.0	1.00	7.00	8.00	0.00	22.22	77.78

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Actively participates in the content and curriculum development of biology education.	7.25	1.23	7.0	1.00	7.00	8.00	0.00	19.44	80.56
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.	7.69	1.28	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Leading the development of biology education in the society	7.94	0.92	8.0	2.00	7.00	9.00	0.00	2.94	97.06
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	8.28	1.11	9.0	1.00	8.00	9.00	0.00	5.56	94.44
Determines the requirements of biology education and engages in action (meeting, workshop, etc.) to fulfill them.	8.08	1.11	8.0	2.00	7.00	9.00	0.00	2.78	97.22
Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders.	7.86	0.99	8.0	1.75	7.00	8.75	0.00	2.78	97.22
Brings the developed implementations and materials to the use of relevant stakeholders.	8.11	1.14	8.5	2.00	7.00	9.00	0.00	5.56	94.44
Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education.	8.25	1.08	9.0	1.00	8.00	9.00	0.00	2.78	97.22
Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).	7.75	1.20	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Supporting the professional development of colleagues	7.26	1.31	7.0	1.00	7.00	8.00	0.00	20.00	80.00
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	7.33	1.47	7.5	2.75	6.25	9.00	0.00	25.00	75.00
Develops course materials to support professional development and shares them with colleagues.	7.67	1.26	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops, etc.).	7.64	1.22	8.0	2.00	7.00	9.00	0.00	11.11	88.89
Takes an active role in providing professional development in different environments (social sharing, panels, workshops, etc.).	7.44	1.16	7.5	1.00	7.00	8.00	0.00	11.11	88.89

RESULTS OF BIOLOGY TEACHER EDUCATOR GROUP ANALYSIS

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
COMPETENCY AREA A: BIOLOGY TEACHING									
Analyzing the concepts and subjects in the biology curriculum (high school level)	8.58	0.90	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Explains the theories, principles, generalizations and models that underlie the science of biology.	8.00	1.41	9.0	2.00	7.00	9.00	0.00	16.67	83.33
Constructs the experiment design process for solving problems in the science of biology.	8.50	0.90	9.0	1.50	8.00	9.00	0.00	0.00	100.00
Approaches the science of biology from a perspective that is required by the nature of science.	8.64	0.67	9.0	1.00	8.50	9.00	0.00	0.00	100.00
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.	8.73	0.65	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.	8.82	0.60	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Explains how biology benefits from closely related disciplines.	8.73	0.47	9.0	1.00	8.50	9.00	0.00	0.00	100.00
Explains the historical development processes of biology.	7.42	1.16	7.0	2.50	6.50	8.50	0.00	25.00	75.00
Developing the biology literacy level of high school students	8.42	1.00	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Has experience in teaching biology.	8.00	1.41	9.0	2.00	7.00	9.00	0.00	16.67	83.33
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	8.00	1.13	8.5	2.00	7.00	9.00	0.00	8.33	91.67
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.	8.33	1.07	9.0	1.75	7.50	9.00	0.00	8.33	91.67
Constructs teaching processes within the framework of the properties of scientific knowledge.	8.50	0.80	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Includes the relationship of biology with the society, human and environment in the teaching practices.	8.67	0.89	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	7.83	1.27	8.0	2.00	7.00	9.00	0.00	16.67	83.33
Implementing biology learning and teaching approaches	9.00	0.00	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.	8.55	0.52	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches .	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Focuses on the development of scientific process skills in biology teaching.	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Uses the laboratory activities in biology teaching effectively in teaching processes.	8.25	1.29	9.0	1.75	7.50	9.00	0.00	8.33	91.67
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.	8.42	1.24	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.	8.50	1.00	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Uses different measurement and evaluation approaches and methods in biology education .	8.08	1.31	9.0	2.00	7.00	9.00	0.00	8.33	91.67
Evaluating the biology curriculum	8.25	1.54	9.0	1.50	8.00	9.00	0.00	8.33	91.67
Questions the vision, philosophy, structure and scope of the biology curriculum.	8.08	1.31	9.0	2.00	7.00	9.00	0.00	8.33	91.67
Questions the distribution and arrangement of the subject contents in the biology curriculum.	8.00	1.35	8.5	1.75	7.50	9.00	0.00	16.67	83.33
Questions the contents and limitations of the acquisitions in the biology curriculum.	8.17	1.27	9.0	1.75	7.50	9.00	0.00	8.33	91.67
Compares the biology curriculum with the biology curricula of different countries.	7.08	1.93	7.0	2.50	6.50	8.50	8.33	16.67	75.00
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	8.00	1.48	8.5	1.75	7.50	9.00	0.00	8.33	91.67
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.83	1.53	8.0	1.75	7.50	9.00	0.00	16.67	83.33
COMPETENCY AREA B: BIOLOGY TEACHER EDUCATION									
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes	8.27	1.01	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Explains the structure, scope, philosophy and approach of the teacher education program in the department.	7.92	1.44	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Compares the implemented teacher education program with other teacher education programs at national and international level.	7.50	1.38	7.5	1.75	7.00	8.50	0.00	8.33	91.67
Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.	8.33	1.44	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	8.00	1.48	8.0	1.00	8.00	9.00	0.00	9.09	90.91
Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time.	8.42	1.51	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Creates learning opportunities for the pre-service and in-service teachers to develop	8.50	1.17	9.0	0.75	8.50	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
their knowledge and skills related to teaching methods and techniques.									
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.	8.58	1.16	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.	8.67	1.15	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	8.33	1.44	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12th grade level).	8.33	1.44	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.	8.17	1.53	9.0	1.75	7.50	9.00	0.00	8.33	91.67
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials	8.91	0.30	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.	8.00	1.71	8.5	1.00	8.00	9.00	8.33	0.00	91.67
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.	8.17	1.75	9.0	1.00	8.00	9.00	8.33	0.00	91.67
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.	8.08	1.73	9.0	1.00	8.00	9.00	8.33	0.00	91.67
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.	8.17	1.75	9.0	1.00	8.00	9.00	8.33	0.00	91.67
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.	8.00	1.76	9.0	1.75	7.50	9.00	8.33	0.00	91.67
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.	8.73	0.47	9.0	1.00	8.50	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.	7.92	1.62	9.0	2.00	7.00	9.00	0.00	16.67	83.33
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.	8.33	1.72	9.0	0.75	8.50	9.00	8.33	0.00	91.67
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	8.25	1.71	9.0	1.00	8.00	9.00	8.33	0.00	91.67
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.	8.33	1.78	9.0	0.00	9.00	9.00	8.33	0.00	91.67
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education	8.27	0.90	9.0	2.00	7.50	9.00	0.00	0.00	100.00
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.	7.75	1.71	8.0	2.00	7.00	9.00	8.33	0.00	91.67
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	7.67	1.72	8.0	2.00	7.00	9.00	8.33	0.00	91.67
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.	7.92	1.73	8.5	1.75	7.50	9.00	8.33	0.00	91.67
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.	7.83	1.75	8.5	2.00	7.00	9.00	8.33	0.00	91.67
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.	7.75	1.71	8.0	2.00	7.00	9.00	8.33	0.00	91.67
Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.	7.75	1.76	8.5	2.00	7.00	9.00	8.33	0.00	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students	8.33	0.89	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.	8.50	1.17	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.	8.08	1.51	9.0	1.00	8.00	9.00	0.00	16.67	83.33
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.	8.17	1.70	9.0	1.00	8.00	9.00	8.33	0.00	91.67
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education	8.27	0.65	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.	8.00	1.76	9.0	1.75	7.50	9.00	8.33	0.00	91.67
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.	8.08	1.73	9.0	1.00	8.00	9.00	8.33	0.00	91.67
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.	7.75	1.71	8.0	2.00	7.00	9.00	8.33	0.00	91.67
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.	7.67	1.67	8.0	2.00	7.00	9.00	8.33	0.00	91.67
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.	8.25	1.06	9.0	1.75	7.50	9.00	0.00	8.33	91.67
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.	8.08	1.24	8.5	1.75	7.50	9.00	0.00	8.33	91.67
Guiding supervising teachers for effective mentoring of pre-service biology teachers	7.67	1.44	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Identifies the areas of development in the supervising teachers with regard to mentoring.	7.58	1.62	8.0	2.00	7.00	9.00	0.00	16.67	83.33

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.	7.50	1.45	8.0	1.75	7.00	8.50	0.00	16.67	83.33
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.	7.92	1.44	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.	7.75	1.48	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.	8.00	1.48	8.5	1.75	7.50	9.00	0.00	8.33	91.67
Being a role model for the pre-service and in-service teachers in teaching biology	8.18	1.54	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.	8.08	1.24	8.5	1.75	7.50	9.00	0.00	8.33	91.67
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.	8.00	1.41	9.0	2.00	7.00	9.00	0.00	16.67	83.33
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.	8.42	1.24	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.	8.33	1.30	9.0	1.50	8.00	9.00	0.00	8.33	91.67
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.	8.33	1.78	9.0	0.00	9.00	9.00	8.33	0.00	91.67
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.	8.33	1.72	9.0	0.75	8.50	9.00	8.33	0.00	91.67
Makes use of practices that promote a higher biology literacy in pre-service and in-service biology teachers.	8.25	1.76	9.0	0.75	8.50	9.00	8.33	0.00	91.67
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	8.08	1.73	9.0	1.00	8.00	9.00	8.33	0.00	91.67
COMPETENCY AREA C: BIOLOGY TEACHER EDUCATOR EDUCATION									
Supporting the prospective teacher educators in the education and training of biology teachers	8.91	0.30	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches,	8.25	1.29	9.0	1.75	7.50	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
learning theories, learning strategies and teaching methods in the field education.									
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.	8.33	1.50	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Managing and supporting the researcher education processes with the aim of improving the biology education	8.73	0.47	9.0	1.00	8.50	9.00	0.00	0.00	100.00
Gives courses in biology education at graduate level.	8.00	1.60	9.0	2.00	7.00	9.00	0.00	16.67	83.33
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques.	8.50	1.45	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.	8.91	0.30	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Consults the prospective teacher educators to support their development in the field of education that they want to specialize in.	8.58	1.16	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Consults the prospective teacher educators to develop their skills for conducting research independently.	8.58	1.16	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	8.50	1.17	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	8.42	1.16	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	8.25	1.22	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Supports the prospective teacher educators to develop their understanding of scientific ethics.	8.58	1.16	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Participates in the juries and commissions for the graduate studies in biology education.	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Developing graduate education programs in biology education	8.64	0.67	9.0	1.00	8.50	9.00	0.00	0.00	100.00
Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education.	8.25	1.22	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.	8.33	1.23	9.0	1.00	8.00	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.	8.58	1.16	9.0	0.00	9.00	9.00	0.00	8.33	91.67
COMPETENCY AREA D: RESEARCH IN BIOLOGY EDUCATION									
Following the efficient and effective scientific developments related to biology education	8.91	0.30	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Follows the national and international scientific research studies in the academic areas of interest.	8.58	1.16	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.	8.67	1.15	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.	8.67	1.15	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.	8.08	1.31	9.0	2.00	7.00	9.00	0.00	8.33	91.67
Reads about the topics in education and related fields to attain higher general knowledge.	8.00	1.35	9.0	2.00	7.00	9.00	0.00	8.33	91.67
Reads articles about biology to attain higher general knowledge.	8.25	1.22	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	7.08	2.19	7.0	3.50	6.00	9.00	8.33	16.67	75.00
Follows the qualified publications via the knowledge of indexes and properties of journals.	7.75	2.45	9.0	1.75	7.50	9.00	8.33	8.33	83.33
Conducting innovative, effective and efficient research to improve biology education	8.58	1.44	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Has a research plan to maintain continuity and deepens on the research area of interest which is based on his/her own educational vision.	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Conducts efficient and qualified research about biology education which will contribute to the area of specialization.	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Bases his/her research studies on the literature and social needs.	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.	8.42	1.51	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.	8.42	1.51	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Uses the latest technologies (web-based data collection tools, qualitative and quantitative	8.08	1.44	8.5	1.00	8.00	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
data analysis software, etc.) in conducting scientific research.									
Associates his/her own research with the current studies in the literature.	8.50	1.45	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Has a foreign language proficiency to be able to follow and contribute to the international literature.	7.92	1.62	9.0	2.00	7.00	9.00	0.00	16.67	83.33
Reflects his/her acquired experiences as an educator to his/her research studies.	8.08	1.44	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Sharing research results with different stakeholders effectively and efficiently	8.09	0.70	8.0	1.00	8.00	8.50	0.00	0.00	100.00
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Publishes the results of completed scientific research in books, book chapters or articles.	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.	7.67	2.31	9.0	1.75	7.50	9.00	8.33	8.33	83.33
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.	7.25	1.54	7.0	1.75	7.00	8.50	0.00	16.67	83.33
Working effectively and efficiently in research groups by collaborating with colleagues	8.36	0.67	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Demonstrates conflict resolution skills while working in collaboration with colleagues.	7.58	1.44	7.5	2.00	7.00	9.00	0.00	8.33	91.67
Collaborates with other researchers from the field of biology education and/or different disciplines.	7.83	1.27	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.	7.92	1.44	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Participates in international projects as executive/researcher/consultant.	7.83	1.27	8.0	2.00	7.00	9.00	0.00	8.33	91.67
COMPETENCY AREA E: POSITIVE ATTITUDES AND VALUES TOWARD BIOLOGY EDUCATION									
Demonstrating a vision that is open to professional development	8.00	1.21	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.	8.08	1.16	8.0	1.00	8.00	9.00	0.00	8.33	91.67
Has an individual education philosophy and vision that are supported by professional experience and open to development.	8.17	1.19	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Associates the current developments in biology education with his/her educational practices and research.	8.25	1.14	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.	7.75	1.22	8.0	2.00	7.00	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Enhances self-learning to develop his/her biology teaching methods.	8.25	1.22	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Attaches importance to improving teacher training and education in the light of advanced practices and developments.	8.17	1.19	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his / her colleagues on biology education.	8.17	1.19	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Plans professional development through identifying strengths and weaknesses through self-assessment.	8.25	1.22	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Updates teaching processes by making use of his/her professional experience.	8.25	1.14	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Regards improving field knowledge as an academic responsibility.	8.33	1.23	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.	8.42	1.16	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Actively participates in the learning communities focusing on innovation and change in biology education.	8.00	1.21	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Respects different opinions on biology education.	8.42	1.16	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Is open to innovations in biology teacher education.	8.42	1.16	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Supports research-based innovation in biology education.	8.33	1.15	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.	8.25	1.14	8.5	1.00	8.00	9.00	0.00	8.33	91.67
Acting in accordance with professional ethics	8.91	0.30	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Prioritizes professional development to improve biology education.	8.33	0.98	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Has a heightened awareness of ethical violation issues such as plagiarism, salami-slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.-	8.75	0.87	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.	8.58	0.90	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.	8.33	0.98	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Follows codes of conduct in jury duty and refereeing.	8.75	0.87	9.0	0.00	9.00	9.00	0.00	8.33	91.67
Distinguishes the qualities of journals, indexes and activities in biology education and related fields.	8.58	0.90	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.	8.50	1.17	9.0	0.75	8.50	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops which may contribute to their professional development.	8.55	0.69	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.	8.00	1.48	8.5	1.75	7.50	9.00	0.00	8.33	91.67
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economical and physical environments.	7.92	1.44	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Has a high motivation to guide the pre-service and in-service teachers on biology teaching.	7.92	1.51	8.5	2.00	7.00	9.00	0.00	8.33	91.67
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	8.00	1.60	9.0	1.75	7.50	9.00	0.00	16.67	83.33
Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.	7.83	1.53	8.0	1.75	7.50	9.00	0.00	16.67	83.33
Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Gives feedback to the prospective teacher educators to improve their competencies.	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Demonstrating collaboration skills for the aim of developing biology education	8.45	0.82	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Constructs healthy, efficient and effective communication with group members to improve their skills that are open for improvement.	8.33	1.50	9.0	0.75	8.50	9.00	0.00	8.33	91.67

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Shares work among group members within the scope of his/her competencies and proficiencies.	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Fulfills the responsibilities under taken within during the division of work.	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Contributes to the local, national and international educational research groups by prioritizing biology education.	8.17	1.47	9.0	1.00	8.00	9.00	0.00	8.33	91.67
COMPETENCY AREA F: SUPPORTING BIOLOGY EDUCATION IN SOCIETY									
Organizing effective in-service teacher education programs for biology teachers.	7.25	1.48	7.0	2.50	6.50	8.50	0.00	25.00	75.00
Actively participates in the in-service teacher education programs for biology teachers.	7.58	1.38	8.0	1.75	7.00	8.50	0.00	8.33	91.67
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.	7.50	1.38	7.5	1.75	7.00	8.50	0.00	8.33	91.67
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.	7.67	1.44	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.	7.83	1.47	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Plans the in-service teacher educational practices based on the needs of biology teacher.	7.25	2.14	8.0	1.75	7.00	8.50	8.33	8.33	83.33
Takes into account the characteristics of adult education in the in-service teacher education practices.	7.92	1.44	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Takes into account both theoretical and practical implementations in the in-service teacher education practices.	7.75	1.36	8.0	1.50	7.50	8.50	0.00	8.33	91.67
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	7.82	0.87	8.0	2.00	7.00	8.50	0.00	0.00	100.00
Follows the local, national and international education policies by prioritizing biology education.	7.58	1.38	8.0	1.75	7.00	8.50	0.00	8.33	91.67
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	7.58	1.44	7.5	2.00	7.00	9.00	0.00	8.33	91.67
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	7.08	1.44	7.0	2.00	6.00	8.00	0.00	33.33	66.67
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	7.42	1.62	8.0	2.50	6.50	8.50	0.00	25.00	75.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Actively participates in the content and curriculum development of biology education.	7.42	1.51	8.0	2.50	6.50	8.50	0.00	25.00	75.00
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.	7.33	1.50	8.0	1.00	7.00	8.00	0.00	16.67	83.33
Leading the development of biology education in the society	7.91	0.83	8.0	2.00	7.00	8.50	0.00	0.00	100.00
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	8.42	1.44	9.0	0.75	8.50	9.00	0.00	8.33	91.67
Determines the requirements of biology education and engage in action (meeting, workshop, etc.) to fulfill them.	7.92	1.44	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders.	7.75	1.36	8.0	1.50	7.50	8.50	0.00	8.33	91.67
Brings the developed implementations and materials to the use of relevant stakeholders.	7.92	1.44	8.0	1.75	7.50	9.00	0.00	8.33	91.67
Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education.	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).	8.25	1.48	9.0	1.00	8.00	9.00	0.00	8.33	91.67
Supporting the professional development of colleagues	7.42	1.38	7.0	1.75	7.00	8.50	0.00	8.33	91.67
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	6.42	1.62	6.0	2.75	5.00	7.50	0.00	58.33	41.67
Develops course materials to support professional development and shares them with colleagues.	7.75	1.42	8.0	2.00	7.00	9.00	0.00	8.33	91.67
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.).	7.83	1.59	8.5	2.00	7.00	9.00	0.00	16.67	83.33
Takes an active role in providing professional development in different environments (social sharing, panel, workshop etc.).	7.42	1.44	7.5	1.75	7.00	8.50	0.00	16.67	83.33

RESULTS OF BIOLOGY GRADUATE STUDENT GROUP ANALYSIS

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
COMPETENCY AREA A: BIOLOGY TEACHING									
Analyzing the concepts and subjects in the biology curriculum (high school level)	8.20	1.14	9.0	2.00	7.00	9.00	0.00	10.00	90.00
Explains the theories, principles, generalizations and models that underlie the science of biology.	8.36	0.81	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Constructs the experiment design process for solving problems in the science of biology.	7.73	1.10	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Approaches the science of biology from a perspective that is required by the nature of science.	8.91	0.30	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.	8.00	1.26	9.0	2.00	7.00	9.00	0.00	18.18	81.82
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.	8.09	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Explains how biology benefits from closely related disciplines.	7.64	1.36	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Explains the historical development processes of biology.	8.00	1.18	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Developing the biology literacy level of high school students	8.00	1.10	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Has experience in teaching biology.	8.00	1.10	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	7.45	1.21	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.	7.64	1.03	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Constructs teaching processes within the framework of the properties of scientific knowledge.	7.82	1.17	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Includes the relationship of biology with the society, human and environment in the teaching practices.	8.18	0.87	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	8.36	0.81	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Implementing biology learning and teaching approaches	7.36	2.62	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.	7.55	1.04	8.0	1.00	7.00	8.00	0.00	18.18	81.82
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.	7.73	1.19	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches .	7.55	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Focuses on the development of scientific process skills in biology teaching.	7.91	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Uses the laboratory activities in biology teaching effectively in teaching processes.	7.45	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.	7.73	0.90	8.0	1.00	7.00	8.00	0.00	9.09	90.91
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.	7.82	1.17	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Uses different measurement and evaluation approaches and methods in biology education .	8.18	1.08	9.0	2.00	7.00	9.00	0.00	9.09	90.91
Evaluating the biology curriculum	7.30	1.16	7.0	2.25	6.00	8.25	0.00	30.00	70.00
Questions the vision, philosophy, structure and scope of the biology curriculum.	8.18	1.08	9.0	2.00	7.00	9.00	0.00	9.09	90.91
Questions the distribution and arrangement of the subject contents in the biology curriculum.	7.73	1.42	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Questions the contents and limitations of the acquisitions in the biology curriculum.	7.82	1.40	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Compares the biology curriculum with the biology curricula of different countries.	6.91	1.51	7.0	2.00	6.00	8.00	0.00	27.27	72.73
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	7.55	1.29	7.0	3.00	6.00	9.00	0.00	27.27	72.73
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.09	1.30	7.0	2.00	6.00	8.00	0.00	36.36	63.64
COMPETENCY AREA B: BIOLOGY TEACHER EDUCATION									
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes	8.20	1.14	9.0	2.00	7.00	9.00	0.00	10.00	90.00
Explains the structure, scope, philosophy and approach of the teacher education program in the department.	8.00	1.10	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Compares the implemented teacher education program with other teacher education programs at national and international level.	7.36	1.43	7.0	2.00	7.00	9.00	0.00	18.18	81.82
Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)	7.64	1.12	8.0	1.00	7.00	8.00	0.00	9.09	90.91
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.	7.36	1.29	7.0	2.00	7.00	9.00	0.00	18.18	81.82
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	7.27	0.90	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time.	8.20	0.92	8.0	1.00	8.00	9.00	0.00	10.00	90.00
Creates learning opportunities for the pre-service and in-service teachers to develop	7.82	1.17	8.0	2.00	7.00	9.00	0.00	18.18	81.82

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
their knowledge and skills related to teaching methods and techniques.									
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.	7.91	1.14	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.	7.73	1.27	7.0	2.00	7.00	9.00	0.00	18.18	81.82
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	7.82	1.08	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12th grade level).	8.27	0.79	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.	7.73	1.10	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials	7.60	0.84	8.0	1.00	7.00	8.00	0.00	10.00	90.00
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.	8.18	1.08	9.0	2.00	7.00	9.00	0.00	9.09	90.91
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.	7.73	0.90	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.	7.91	1.14	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.	7.27	1.01	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.	7.45	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.	8.10	0.99	8.5	2.00	7.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.	7.82	0.98	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.	8.09	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.	7.18	1.33	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	7.55	1.29	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.	7.18	1.33	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education	7.00	0.67	7.0	0.50	6.75	7.25	0.00	20.00	80.00
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.	6.91	1.14	7.0	0.00	7.00	7.00	0.00	18.18	81.82
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	6.45	1.69	7.0	1.00	6.00	7.00	9.09	18.18	72.73
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.	6.91	1.51	7.0	1.00	7.00	8.00	9.09	9.09	81.82
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.	7.00	1.00	7.0	0.00	7.00	7.00	0.00	18.18	81.82
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.	6.82	1.47	7.0	0.00	7.00	7.00	9.09	9.09	81.82
Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.	6.91	1.87	7.0	1.00	7.00	8.00	9.09	9.09	81.82

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students	8.10	0.99	8.5	2.00	7.00	9.00	0.00	0.00	100.00
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.	7.82	1.08	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.	7.91	0.94	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.	8.27	0.79	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education	7.44	0.53	7.0	1.00	7.00	8.00	0.00	0.00	100.00
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.	7.40	1.51	8.0	1.50	6.75	8.25	0.00	20.00	80.00
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.	7.50	1.08	8.0	1.00	7.00	8.00	0.00	10.00	90.00
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.	7.20	1.62	7.5	1.00	7.00	8.00	10.00	0.00	90.00
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.	7.10	1.79	8.0	1.50	6.50	8.00	10.00	10.00	80.00
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.	7.64	0.81	7.0	1.00	7.00	8.00	0.00	0.00	100.00
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.	7.64	1.21	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Guiding supervising teachers for effective mentoring of pre-service biology teachers	7.50	0.85	7.0	1.25	7.00	8.25	0.00	0.00	100.00
Identifies the areas of development in the supervising teachers with regard to mentoring.	7.45	1.13	7.0	1.00	7.00	8.00	0.00	9.09	90.91

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.	7.64	0.81	7.0	1.00	7.00	8.00	0.00	0.00	100.00
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.	7.27	1.62	7.0	1.00	7.00	8.00	9.09	0.00	90.91
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.	8.00	0.89	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.	7.18	1.25	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Being a role model for the pre-service and in-service teachers in teaching biology	8.10	0.88	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.	7.91	1.30	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.	8.09	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.	8.09	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.	7.73	0.90	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.	7.82	0.87	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.	8.00	1.00	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Makes use of practices that promote a higher biology literacy in pre-service and in-service biology teachers.	8.36	0.67	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	7.91	1.22	8.0	2.00	7.00	9.00	0.00	9.09	90.91
COMPETENCY AREA C: BIOLOGY TEACHER EDUCATOR EDUCATION									
Supporting the prospective teacher educators in the education and training of biology teachers	8.00	0.89	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches,	7.55	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
learning theories, learning strategies and teaching methods in the field education.									
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	7.91	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.	7.82	1.08	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Managing and supporting the researcher education processes with the aim of improving the biology education	8.09	0.83	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Gives courses in biology education at graduate level.	8.20	1.03	8.5	1.25	7.75	9.00	0.00	10.00	90.00
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	7.82	1.17	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques.	7.91	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.	8.00	1.00	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Consults the prospective teacher educators to support their development in the field of education that they want to specialize in.	8.27	1.01	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Consults the prospective teacher educators to develop their skills for conducting research independently.	8.36	1.03	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	7.82	1.25	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	7.64	1.36	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	7.82	1.33	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Supports the prospective teacher educators to develop their understanding of scientific ethics.	8.27	0.90	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Participates in the juries and commissions for the graduate studies in biology education.	7.09	1.38	7.0	2.00	6.00	8.00	0.00	27.27	72.73
Developing graduate education programs in biology education	7.70	1.25	7.5	2.25	6.75	9.00	0.00	20.00	80.00
Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education.	7.82	0.98	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.	7.64	0.92	8.0	1.00	7.00	8.00	0.00	9.09	90.91

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.	7.82	0.75	8.0	1.00	7.00	8.00	0.00	0.00	100.00
COMPETENCY AREA D: RESEARCH IN BIOLOGY EDUCATION									
Following the efficient and effective scientific developments related to biology education	8.18	0.98	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Follows the national and international scientific research studies in the academic areas of interest.	8.00	1.26	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.	7.55	1.29	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.	8.27	1.35	9.0	2.00	7.00	9.00	0.00	9.09	90.91
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.	8.27	1.27	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Reads about the topics in education and related fields to attain higher general knowledge.	7.91	1.22	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Reads articles about biology to attain higher general knowledge.	7.91	0.83	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	7.45	1.44	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Follows the qualified publications via the knowledge of indexes and properties of journals.	8.36	0.67	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Conducting innovative, effective and efficient research to improve biology education	8.20	1.32	9.0	1.25	7.75	9.00	0.00	10.00	90.00
Has a research plan to maintain continuity and deepens on the research area of interest which is based on his/her own educational vision.	7.73	1.19	8.0	0.00	8.00	8.00	0.00	18.18	81.82
Conducts efficient and qualified research about biology education which will contribute to the area of specialization.	8.09	0.94	8.0	1.00	8.00	9.00	0.00	9.09	90.91
Bases his/her research studies on the literature and social needs.	6.82	0.98	7.0	1.00	6.00	7.00	0.00	27.27	72.73
Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.	7.64	1.36	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.	7.91	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Uses the latest technologies (web-based data collection tools, qualitative and quantitative	8.00	1.10	8.0	2.00	7.00	9.00	0.00	9.09	90.91

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
data analysis software, etc.) in conducting scientific research.									
Associates his/her own research with the current studies in the literature.	8.18	0.98	8.0	1.00	8.00	9.00	0.00	9.09	90.91
Has a foreign language proficiency to be able to follow and contribute to the international literature.	8.00	1.10	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Reflects his/her acquired experiences as an educator to his/her research studies.	7.27	0.90	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Sharing research results with different stakeholders effectively and efficiently	7.60	0.97	7.5	1.25	7.00	8.25	0.00	10.00	90.00
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	7.82	1.08	8.0	2.00	7.00	9.00	0.00	18.18	81.82
Publishes the results of completed scientific research in books, book chapters or articles.	7.73	1.01	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.	7.91	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.	7.91	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Working effectively and efficiently in research groups by collaborating with colleagues	7.45	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Demonstrates conflict resolution skills while working in collaboration with colleagues.	7.45	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Collaborates with other researchers from the field of biology education and/or different disciplines.	7.55	1.04	8.0	1.00	7.00	8.00	0.00	18.18	81.82
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.	7.36	1.21	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Participates in international projects as executive/researcher/consultant.	7.18	1.08	7.0	1.00	7.00	8.00	0.00	18.18	81.82
COMPETENCY AREA E: POSITIVE ATTITUDES AND VALUES TOWARD BIOLOGY EDUCATION									
Demonstrating a vision that is open to professional development	8.30	1.06	9.0	1.25	7.75	9.00	0.00	10.00	90.00
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.	8.27	1.01	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Has an individual education philosophy and vision that are supported by professional experience and open to development.	8.18	0.98	8.0	1.00	8.00	9.00	0.00	9.09	90.91
Associates the current developments in biology education with his/her educational practices and research.	7.91	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.	7.27	1.62	7.0	2.00	7.00	9.00	0.00	18.18	81.82

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Enhances self-learning to develop his/her biology teaching methods.	7.73	1.10	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Attaches importance to improving teacher training and education in the light of advanced practices and developments.	7.82	0.98	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his / her colleagues on biology education.	7.82	1.08	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Plans professional development through identifying strengths and weaknesses through self-assessment.	7.36	0.92	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Updates teaching processes by making use of his/her professional experience.	7.73	1.01	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Regards improving field knowledge as an academic responsibility.	7.91	0.94	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.	8.09	1.04	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Actively participates in the learning communities focusing on innovation and change in biology education.	7.64	1.21	7.0	2.00	7.00	9.00	0.00	18.18	81.82
Respects different opinions on biology education.	8.27	1.27	9.0	2.00	7.00	9.00	0.00	18.18	81.82
Is open to innovations in biology teacher education.	8.36	1.03	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Supports research-based innovation in biology education.	8.45	0.93	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.	7.82	0.98	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Acting in accordance with professional ethics	8.20	1.23	8.5	1.00	8.00	9.00	0.00	10.00	90.00
Prioritizes professional development to improve biology education.	7.73	1.19	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Has a heightened awareness of ethical violation issues such as plagiarism, salami-slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.-	8.18	1.25	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.	8.09	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.	8.09	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Follows codes of conduct in jury duty and refereeing.	8.00	1.00	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Distinguishes the qualities of journals, indexes and activities in biology education and related fields.	7.82	0.98	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.	7.82	0.87	8.0	2.00	7.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education	8.36	1.03	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops which may contribute to their professional development.	7.73	1.01	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.	7.73	1.01	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social, economical and physical environments.	7.18	1.47	7.0	3.00	6.00	9.00	0.00	27.27	72.73
Has a high motivation to guide the pre-service and in-service teachers on biology teaching.	7.64	1.21	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	7.64	1.29	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.	8.09	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education	7.82	0.75	8.0	1.00	7.00	8.00	0.00	0.00	100.00
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.	7.45	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.	7.55	1.04	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Gives feedback to the prospective teacher educators to improve their competencies.	8.36	1.03	9.0	1.00	8.00	9.00	0.00	9.09	90.91
Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.	7.91	0.94	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Demonstrating collaboration skills for the aim of developing biology education	7.70	0.95	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.	7.64	1.03	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Constructs healthy, efficient and effective communication with group members to improve their skills that are open for improvement.	7.82	0.87	8.0	2.00	7.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Shares work among group members within the scope of his/her competencies and proficiencies.	7.64	1.03	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Fulfills the responsibilities under taken within during the division of work.	7.45	1.04	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Contributes to the local, national and international educational research groups by prioritizing biology education.	7.09	0.83	7.0	0.00	7.00	7.00	0.00	18.18	81.82
COMPETENCY AREA F: SUPPORTING BIOLOGY EDUCATION IN SOCIETY									
Organizing effective in-service teacher education programs for biology teachers.	7.00	0.94	7.0	1.25	6.00	7.25	0.00	30.00	70.00
Actively participates in the in-service teacher education programs for biology teachers.	7.36	1.03	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.	7.55	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.	7.55	0.93	7.0	1.00	7.00	8.00	0.00	9.09	90.91
Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.	7.73	1.10	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Plans the in-service teacher educational practices based on the needs of biology teacher.	7.27	1.19	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Takes into account the characteristics of adult education in the in-service teacher education practices.	7.60	0.97	7.5	1.25	7.00	8.25	0.00	10.00	90.00
Takes into account both theoretical and practical implementations in the in-service teacher education practices.	7.09	1.04	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	7.27	1.19	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Follows the local, national and international education policies by prioritizing biology education.	7.64	1.21	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	6.09	1.45	6.0	2.00	5.00	7.00	0.00	72.73	27.27
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	6.09	1.30	6.0	2.00	5.00	7.00	0.00	63.64	36.36
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	6.45	1.13	7.0	2.00	5.00	7.00	0.00	45.45	54.55

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Actively participates in the content and curriculum development of biology education.	6.73	1.19	7.0	1.00	6.00	7.00	0.00	36.36	63.64
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.	7.36	1.21	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Leading the development of biology education in the society	7.90	0.99	8.0	2.00	7.00	9.00	0.00	10.00	90.00
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	8.00	1.00	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Determines the requirements of biology education and engage in action (meeting, workshop, etc.) to fulfill them.	7.73	0.90	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders.	7.73	0.79	8.0	1.00	7.00	8.00	0.00	0.00	100.00
Brings the developed implementations and materials to the use of relevant stakeholders.	7.64	1.03	7.0	2.00	7.00	9.00	0.00	9.09	90.91
Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education.	8.18	0.87	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).	7.82	1.08	8.0	2.00	7.00	9.00	0.00	9.09	90.91
Supporting the professional development of colleagues	7.00	0.67	7.0	0.50	6.75	7.25	0.00	20.00	80.00
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	7.45	1.04	8.0	1.00	7.00	8.00	0.00	9.09	90.91
Develops course materials to support professional development and shares them with colleagues.	7.18	1.08	7.0	1.00	7.00	8.00	0.00	18.18	81.82
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.).	7.45	1.21	8.0	1.00	7.00	8.00	0.00	18.18	81.82
Takes an active role in providing professional development in different environments (social sharing, panel, workshop etc.).	7.27	1.27	8.0	1.00	7.00	8.00	0.00	18.18	81.82

RESULTS OF BIOLOGY TEACHER GROUP ANALYSIS

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
COMPETENCY AREA A: BIOLOGY TEACHING									
Analyzing the concepts and subjects in the biology curriculum (high school level)	8.85	0.38	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Explains the theories, principles, generalizations and models that underlie the science of biology.	8.46	1.20	9.0	0.50	8.50	9.00	0.00	7.69	92.31
Constructs the experiment design process for solving problems in the science of biology.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Approaches the science of biology from a perspective that is required by the nature of science.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Explains the relationship between the subjects in the high school biology curriculum and the subjects and concepts at the secondary school and university level.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Has the biological literacy level to establish connections between the concepts in the sub-disciplines of biology.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Explains how biology benefits from closely related disciplines.	7.62	0.87	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Explains the historical development processes of biology.	6.31	1.49	6.0	1.50	5.50	7.00	7.69	46.15	46.15
Developing the biology literacy level of high school students	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Has experience in teaching biology.	8.31	1.11	9.0	2.00	7.00	9.00	0.00	7.69	92.31
Constructs projects, experiments and activities aimed at developing the scientific research and process skills of students.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Uses appropriate laboratory methods and techniques for the biology subjects in order to improve students' biology knowledge.	8.46	0.88	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Constructs teaching processes within the framework of the properties of scientific knowledge.	8.23	0.93	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Includes the relationship of biology with the society, human and environment in the teaching practices.	8.38	0.77	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Reflects the accumulation of knowledge about the historical development processes of biology on teaching practices.	6.62	0.87	7.0	1.00	6.00	7.00	0.00	30.77	69.23
Implementing biology learning and teaching approaches	8.77	0.60	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Identifies the individual and group needs of high school students and integrates these needs into the teaching process.	8.15	1.34	9.0	1.50	7.50	9.00	0.00	15.38	84.62
Explains the basic approaches, learning theories, learning strategies and teaching methods in field education, and the existing relationships within and among them.	7.38	1.12	7.0	1.50	7.00	8.50	0.00	7.69	92.31
Makes use of the models, theories and conceptual frameworks specific to biology/science education in establishing learning and teaching approaches .	7.85	0.90	8.0	2.00	7.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1–3)	(4–6)	(7–9)
Focuses on the development of scientific process skills in biology teaching.	8.31	0.95	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Uses the laboratory activities in biology teaching effectively in teaching processes.	8.54	0.88	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Uses the current sources and tools, as well as information and communication technologies in biology teaching processes.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Takes account of the challenges and misconceptions experienced by students in the biology teaching process.	8.77	0.60	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Uses different measurement and evaluation approaches and methods in biology education .	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Evaluating the biology curriculum	7.85	0.99	8.0	2.00	7.00	9.00	0.00	7.69	92.31
Questions the vision, philosophy, structure and scope of the biology curriculum.	8.38	0.51	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Questions the distribution and arrangement of the subject contents in the biology curriculum.	8.31	0.63	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Questions the contents and limitations of the acquisitions in the biology curriculum.	8.23	0.83	8.0	1.50	7.50	9.00	0.00	0.00	100.00
Compares the biology curriculum with the biology curricula of different countries.	7.31	1.18	7.0	1.50	7.00	8.50	0.00	15.38	84.62
Identifies and solves the problems that are related to the content, structure and implementations of the biology curriculum.	8.38	0.96	9.0	1.00	8.00	9.00	0.00	7.69	92.31
Explains the relationship between the biology curriculum and related curricula (science, physics, chemistry).	7.46	1.05	7.0	1.50	7.00	8.50	0.00	15.38	84.62
COMPETENCY AREA B: BIOLOGY TEACHER EDUCATION									
Evaluating the biology teacher education program(s) and integrating it/them into the teacher education processes	7.54	1.20	7.0	2.00	7.00	9.00	0.00	7.69	92.31
Explains the structure, scope, philosophy and approach of the teacher education program in the department.	7.54	1.13	7.0	2.00	7.00	9.00	0.00	15.38	84.62
Compares the implemented teacher education program with other teacher education programs at national and international level.	7.46	1.05	7.0	1.50	7.00	8.50	0.00	15.38	84.62
Supports the development of teacher education programs in the department. (recommending courses, updating the contents of existing courses, etc.)	8.62	0.65	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Identifies the issues in the implemented teacher education program and recommends revisions for improvement.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Explains the scope and contents of the courses taken by teacher candidates to ensure alignment with their colleagues.	8.31	1.03	9.0	1.50	7.50	9.00	0.00	7.69	92.31
Guiding pre-service and in-service biology teachers for using appropriate learning and teaching approaches in the right place and at the right time.	8.31	0.75	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Creates learning opportunities for the pre-service and in-service teachers to develop	8.77	0.60	9.0	0.00	9.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
their knowledge and skills related to teaching methods and techniques.									
Provides examples to pre-service and in-service teachers to illustrate the effective use of different learning and teaching approaches in biology education.	8.54	0.88	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Creates opportunities for the pre-service and in-service teachers to enable them to benefit from the field-specific models, theories and conceptual frameworks while teaching biology.	8.85	0.55	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Creates learning environments for the pre-service and in-service teachers where they can internalize the existing relationships within and among the basic approaches, learning theories, learning strategies and teaching methods in the field education.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Creates learning environments for the pre-service and in-service teachers in order to develop the skills required for raising individuals with a high level of biology literacy (9-12th grade level).	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Gives feedback about the lesson plans prepared by pre-service and in-service teachers before and after the implementation of the lessons in terms of learning/teaching approaches.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Guiding the pre-service and in-service biology teachers to select, design, use and develop teaching materials	8.08	0.86	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Recommends appropriate resources to the pre-service and in-service teachers for enhancing their teaching material repertoire in biology education.	8.62	0.65	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Provides examples of the appropriate teaching materials to be used in biology education to the pre-service and in-service teachers.	8.69	0.75	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Emphasizes the importance of teaching material diversity to the pre-service and in-service teachers for developing the diverse scientific thinking and learning styles of students.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Provides examples to the pre-service and in-service teachers for selecting up-to-date and appropriate materials about various subjects and concepts in biology education.	8.92	0.28	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Creates learning opportunities for the pre-service and in-service teachers to provide them with feedback on designing the materials that can be used in biology education.	8.77	0.44	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Guiding the pre-service and in-service biology teachers to use appropriate assessment and evaluation methods in biology education.	8.77	0.44	9.0	0.50	8.50	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Estimates the proficiency level of pre-service and in-service teachers in the assessment and evaluation methods for assessing conceptual knowledge and scientific process skills in biology.	7.92	0.95	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Recommends resources to the pre-service and in-service teachers to enhance their assessment and evaluation methods-technique repertoire for assessing conceptual knowledge and scientific process skills in biology education.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Provides examples of the assessment and evaluation methods used in biology education in the courses given to the pre-service and in-service teachers.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Provides appropriate assessment and evaluation examples to the pre-service and in-service teachers for assessing the conceptual knowledge and scientific process skills to be used in teaching biology.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Creates appropriate learning opportunities for the pre-service and in-service teachers through which they can design different questions, tasks and tools for assessing conceptual knowledge and scientific process skills in the science of biology.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Guiding the pre-service and in-service biology teachers for the appropriate use of technology in biology education	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Evaluates the opportunities and limitations of the technologies used in biology education in general and specific to the subject / concept / acquisition in particular with the pre-service and in-service teachers.	7.62	0.96	7.0	1.50	7.00	8.50	0.00	7.69	92.31
Estimates the proficiency level of pre-service and in-service teachers regarding the technological tools used in biology education.	8.15	0.90	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Recommends appropriate resources to the pre-service and in-service teachers to develop their repertoire of technological tools used in biology education.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Gives examples regarding the use of technological tools in biology education during the pre-service and in-service teacher education.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Provides various examples to pre-service and in-service teachers about the technological tools specific to the subjects / concepts / acquisitions in biology education.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Creates learning environments to give feedback to pre-service and in-service teachers about designing applications which make use of the technological tools specific to the subjects / concepts / acquisitions in biology education.	8.62	0.51	9.0	1.00	8.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Guiding the pre-service and in-service biology teachers for teaching biology in line with the scientific thinking skills and learning styles of students	8.00	1.00	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Creates learning opportunities for the pre-service and in-service teachers to use different methods and tools for identifying the scientific thinking skills and learning styles (misconception, difficulties, solutions, etc.) of students on diverse subjects and concepts.	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Creates learning research- and implementation-based opportunities for the pre-service and in-service teachers on different subjects and concepts in biology education.	8.38	0.77	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Creates learning opportunities for the pre-service and in-service teachers to give feedback on the design and implementation of courses that take into account the thinking and learning styles of students regarding various subjects and concepts in biology.	8.69	0.48	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Monitoring and evaluating the professional development of pre-service and in-service biology teachers in biology education	7.77	0.93	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Develops tools (observation forms, self-assessment forms, interview protocols, etc.) to evaluate / observe activities, practices and course practices for the professional development of pre-service and in-service teachers.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Uses the methods and tools aimed at determining and monitoring the competencies of pre-service and in-service teachers in biology education.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Creates situations for observing the biology education practices of pre-service and in-service teachers on a regular basis.	8.54	0.66	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Prepares monitoring and evaluation reports for the professional development of pre-service and in-service teachers in biology education.	7.92	0.95	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Provides timely and constructive feedback to the pre-service and in-service teachers on biology teaching practices.	8.31	0.95	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Uses feedback acquired from the supervising/mentor teachers in monitoring and evaluating the professional development of pre-service and in-service teachers.	8.15	0.90	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Guiding supervising teachers for effective mentoring of pre-service biology teachers	7.46	0.88	7.0	1.00	7.00	8.00	0.00	0.00	100.00
Identifies the areas of development in the supervising teachers with regard to mentoring.	8.15	1.21	9.0	2.00	7.00	9.00	0.00	15.38	84.62

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Organizes seminars / education programs for the supervising teachers on the topics of need in mentoring.	8.08	1.04	8.0	2.00	7.00	9.00	0.00	7.69	92.31
Creates learning environments that encourage the supervising teachers to keep abreast of the developments in biology education.	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Shares / recommends resources and tools that can contribute to the professional development of supervising teachers.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Encourages the supervising teachers to participate in national and international symposiums, conferences, workshops and congresses that can contribute to their professional development.	8.15	0.99	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Being a role model for the pre-service and in-service teachers in teaching biology	8.77	0.60	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Presents learning environments for the pre-service and in-service biology teachers to support them in scrutinizing the philosophy, scope, subject and acquisition distribution, activity examples, etc. of the biology program.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Pays attention to the thinking and learning styles of students (K-12), pre-service and in-service teachers during biology teaching practices.	7.69	0.85	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Uses different teaching strategies, methods and techniques in the courses to guide the pre-service and in-service teachers for timely and on-site implementations.	8.62	0.65	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Uses materials that are fit for the purpose during the biology teaching practices in order to guide pre-service and in-service teachers.	8.62	0.65	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Uses appropriate and effective instructional technologies during the biology teaching practices for the observation of pre-service and in-service teachers.	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Uses reliable and valid assessment tools to evaluate the learning of pre-service and in-service biology teachers.	8.77	0.44	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Makes use of practices that promote a higher biology literacy in pre-service and in-service biology teachers.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Uses the experiences acquired during his/her research studies in the pre-service and in-service teacher education processes.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
COMPETENCY AREA C: BIOLOGY TEACHER EDUCATOR EDUCATION									
Supporting the prospective teacher educators in the education and training of biology teachers	8.00	0.91	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Designs teaching environments for the prospective biology teacher educators where they can learn the existing relationships within and among the basic approaches,	8.31	0.85	9.0	1.50	7.50	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
learning theories, learning strategies and teaching methods in the field education.									
Provides guidance to the prospective biology teacher educators about the problems and solutions encountered during the education of pre-service and in-service teachers.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Involves the prospective biology teacher educators in the educational processes of pre-service and in-service teachers.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Managing and supporting the researcher education processes with the aim of improving the biology education	8.85	0.38	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Gives courses in biology education at graduate level.	7.62	0.96	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Provides guidance to the prospective teacher educators to enable them to focus on the basic and current research areas in biology education.	8.00	0.91	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Creates opportunities for the prospective teacher educators to develop their knowledge and skills related to the research methods and techniques.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Consults the prospective teacher educators for developing their skills of following and contributing to the literature.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Consults the prospective teacher educators to support their development in the field of education that they want to specialize in.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Consults the prospective teacher educators to develop their skills for conducting research independently.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Consults the prospective teacher educators in the process of conducting innovative, effective and efficient research studies.	8.46	0.88	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Consults the prospective teacher educators in the process of reporting and presenting finalized research studies.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Encourages the prospective teacher educators to participate in the national and international (conferences, symposiums, workshops, etc.) events organized in education and related fields.	8.23	0.93	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Supports the prospective teacher educators to develop their understanding of scientific ethics.	8.23	0.93	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Participates in the juries and commissions for the graduate studies in biology education.	7.38	1.19	7.0	1.50	7.00	8.50	0.00	15.38	84.62
Developing graduate education programs in biology education	7.77	0.93	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Questions the contents and limitations of the applied program by comparing the national and international graduate programs in biology education.	7.62	0.87	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Recommends revisions to the philosophy and structure of the applied biology education graduate program by identifying its issues.	7.85	0.90	8.0	2.00	7.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Revises the content of the courses or suggest new ones to develop the applied biology education graduate program.	7.77	0.83	8.0	1.50	7.00	8.50	0.00	0.00	100.00
COMPETENCY AREA D: RESEARCH IN BIOLOGY EDUCATION									
Following the efficient and effective scientific developments related to biology education	8.77	0.60	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Follows the national and international scientific research studies in the academic areas of interest.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Participates in the national and international academic organizations (conferences, symposiums, workshops, etc.) in biology education and related fields.	8.92	0.28	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Follows the current approaches, theories, research methods and techniques to form the basis of their prospective research studies.	8.92	0.28	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Follows the prominent national and international biology/science education journals to keep abreast of the education research studies that are not in the scope of their area of interest.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Reads about the topics in education and related fields to attain higher general knowledge.	8.08	1.04	8.0	2.00	7.00	9.00	0.00	7.69	92.31
Reads articles about biology to attain higher general knowledge.	8.08	0.86	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Follows the civilian constitutions (email groups, social media groups, professional networks, etc.) about biology education and related fields.	7.54	0.88	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Follows the qualified publications via the knowledge of indexes and properties of journals.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Conducting innovative, effective and efficient research to improve biology education	8.08	0.95	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Has a research plan to maintain continuity and deepens on the research area of interest which is based on his/her own educational vision.	8.31	0.95	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Conducts efficient and qualified research about biology education which will contribute to the area of specialization.	8.62	0.65	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Bases his/her research studies on the literature and social needs.	7.69	0.85	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Uses quantitative, qualitative or mixed research methods appropriately based on the nature of the research problem and research questions.	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Analyzes the collected data based on the research problem and question through the use of appropriate methods and techniques.	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Uses the latest technologies (web-based data collection tools, qualitative and quantitative	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
data analysis software, etc.) in conducting scientific research.									
Associates his/her own research with the current studies in the literature.	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Has a foreign language proficiency to be able to follow and contribute to the international literature.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Reflects his/her acquired experiences as an educator to his/her research studies.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Sharing research results with different stakeholders effectively and efficiently	8.69	0.48	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Shares completed scientific research output at national and international workshops, seminars, symposiums, etc. via written or oral presentations.	8.38	0.77	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Publishes the results of completed scientific research in books, book chapters or articles.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Selects the most appropriate journals that publish research on or related to biology education to reach appropriate target audience with his/her research.	8.15	1.21	9.0	1.50	7.50	9.00	0.00	7.69	92.31
Uses appropriate communication channels (TV / radio programs, social media, forums, Academia, Researchgate, Mendeley etc.) to deliver scientific research results and output to stakeholders.	7.46	1.27	7.0	2.00	7.00	9.00	0.00	15.38	84.62
Working effectively and efficiently in research groups by collaborating with colleagues	7.92	0.86	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Demonstrates conflict resolution skills while working in collaboration with colleagues.	7.77	0.93	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Collaborates with other researchers from the field of biology education and/or different disciplines.	8.23	0.83	8.0	1.50	7.50	9.00	0.00	0.00	100.00
Participates in national projects (supported by TÜBİTAK, BAP, NGOs, private sector etc.) as executive/researcher/consultant.	7.38	0.65	7.0	1.00	7.00	8.00	0.00	0.00	100.00
Participates in international projects as executive/researcher/consultant.	7.31	0.95	7.0	1.00	7.00	8.00	0.00	7.69	92.31
COMPETENCY AREA E: POSITIVE ATTITUDES AND VALUES TOWARD BIOLOGY EDUCATION									
Demonstrating a vision that is open to professional development	8.23	0.73	8.0	1.00	8.00	9.00	0.00	0.00	100.00
Is aware of the effects of psychological, philosophical, legal, sociological, economic and historical foundations of educational science on biology science education.	7.62	0.96	7.0	1.50	7.00	8.50	0.00	7.69	92.31
Has an individual education philosophy and vision that are supported by professional experience and open to development.	7.77	0.93	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Associates the current developments in biology education with his/her educational practices and research.	8.23	0.83	8.0	1.50	7.50	9.00	0.00	0.00	100.00
Has the qualities for pioneering/leading the process of adapting the technologies and new implementations for biology education.	7.62	0.96	7.0	1.50	7.00	8.50	0.00	7.69	92.31

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Enhances self-learning to develop his/her biology teaching methods.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Attaches importance to improving teacher training and education in the light of advanced practices and developments.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Makes inferences that will guide his/her educational vision by benefiting from the practices and experiences of his / her colleagues on biology education.	7.69	1.18	8.0	2.00	7.00	9.00	0.00	7.69	92.31
Plans professional development through identifying strengths and weaknesses through self-assessment.	8.46	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Updates teaching processes by making use of his/her professional experience.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Regards improving field knowledge as an academic responsibility.	8.69	0.75	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Contributes to his/her own professional development by following the scientific studies related to the field of expertise closely.	8.69	0.75	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Actively participates in the learning communities focusing on innovation and change in biology education.	7.69	0.85	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Respects different opinions on biology education.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Is open to innovations in biology teacher education.	8.77	0.60	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Supports research-based innovation in biology education.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Creates development opportunities to contribute to the professional development of colleagues, pre-service teachers, in-service teacher and prospective teacher educators.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Acting in accordance with professional ethics	9.00	0.00	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Prioritizes professional development to improve biology education.	8.85	0.38	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Has a heightened awareness of ethical violation issues such as plagiarism, salami-slicing, forgery, distortion, duplication, patchwriting, ghost writing, etc.-	8.92	0.28	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Informs people and / or institutions about the ethical violations faced within the area of his / her duties and responsibilities.	9.00	0.00	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Follows the protocols regarding ethical rules (obtaining consent certificate, anonymity etc.) while conducting research.	8.92	0.28	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Follows codes of conduct in jury duty and refereeing.	8.85	0.38	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Distinguishes the qualities of journals, indexes and activities in biology education and related fields.	8.54	0.97	9.0	0.50	8.50	9.00	0.00	7.69	92.31
Demonstrates self-regulation skills to balance different roles of being a researcher and an educator.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Supporting the pre-service and in-service teachers to develop positive attitudes and values for biology education	7.85	0.90	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Encourages the pre-service and in-service biology teachers to participate in events such as seminars, congresses and workshops which may contribute to their professional development.	7.77	0.93	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Designs physical and psychological environments that will motivate the pre-service biology teachers to teach biology and develop self-efficacy.	8.31	0.85	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Develops environments for the pre-service and in-service biology teachers where they can evaluate opportunities and difficulties related to teaching biology in different social , economical and physical environments.	8.38	0.77	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Has a high motivation to guide the pre-service and in-service teachers on biology teaching.	8.23	0.93	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Takes into account the belief systems of pre-service and in-service teachers and their attitudes towards education during teaching practices.	7.23	2.24	7.0	2.00	7.00	9.00	7.69	7.69	84.62
Recommends solutions to the problems experienced by pre-service and in-service teachers in teaching and learning biology.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Supporting prospective biology teacher educators to develop positive attitudes and values for biology education	7.77	0.83	8.0	1.50	7.00	8.50	0.00	0.00	100.00
Creates opportunities for the prospective teacher educators to learn about the leading national and international researchers in biology education.	7.54	0.88	7.0	1.00	7.00	8.00	0.00	7.69	92.31
Encourages the prospective teacher educators to participate in national and international academic activities like congresses, conferences, seminars and workshops.	8.31	0.85	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Gives feedback to the prospective teacher educators to improve their competencies.	8.62	0.77	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Establishes physical and psychological environments that increase the motivation of prospective teacher educators and improve their academic self-efficacy.	8.38	0.77	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Demonstrating collaboration skills for the aim of developing biology education	8.85	0.38	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Communicates in a constructive and development-oriented manner with pre-service teachers, in-service teachers, prospective teacher educators and teacher educators.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Constructs healthy, efficient and effective communication with group members to improve their skills that are open for improvement.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1–3)	(4–6)	(7–9)
Shares work among group members within the scope of his/her competencies and proficiencies.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Fulfills the responsibilities under taken within during the division of work.	8.92	0.28	9.0	0.00	9.00	9.00	0.00	0.00	100.00
Contributes to the local, national and international educational research groups by prioritizing biology education.	8.38	0.65	8.0	1.00	8.00	9.00	0.00	0.00	100.00
COMPETENCY AREA F: SUPPORTING BIOLOGY EDUCATION IN SOCIETY									
Organizing effective in-service teacher education programs for biology teachers.	7.54	0.97	7.0	1.50	7.00	8.50	0.00	7.69	92.31
Actively participates in the in-service teacher education programs for biology teachers.	7.77	0.93	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Selects appropriate in-service teacher education models by examining national and international in-service teacher education models and programs.	8.54	0.88	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Develops appropriate educational materials and technology applications to be used in the in-service teacher education programs.	8.15	1.28	9.0	2.00	7.00	9.00	0.00	7.69	92.31
Takes into account the individual differences of teachers (knowledge, belief, experience, etc.) in the implementation of in-service teacher education programs.	6.62	1.33	6.0	1.50	6.00	7.50	0.00	61.54	38.46
Plans the in-service teacher educational practices based on the needs of biology teacher.	8.31	0.95	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Takes into account the characteristics of adult education in the in-service teacher education practices.	8.00	1.29	9.0	2.00	7.00	9.00	0.00	7.69	92.31
Takes into account both theoretical and practical implementations in the in-service teacher education practices.	7.85	0.90	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Supporting stakeholder institutions of education (policy makers, NGOs, schools, etc.)	7.58	0.79	7.0	1.00	7.00	8.00	0.00	0.00	100.00
Follows the local, national and international education policies by prioritizing biology education.	7.77	0.93	7.0	2.00	7.00	9.00	0.00	0.00	100.00
Conducts research to improve local, national and international education policies in order to increase the quality of education by prioritizing biology education.	7.69	0.85	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Contributes to the document preparation processes (reports, policy recommendations, etc.) of institutions such as non-governmental organizations, public institutions by offering opinions and recommendations about the topics in education with a priority on the specialized field.	7.31	0.95	7.0	1.00	7.00	8.00	0.00	7.69	92.31
Organizes professional meetings / seminars / conferences for the stakeholders in biology education.	7.62	0.87	7.0	1.50	7.00	8.50	0.00	0.00	100.00

ITEM	M	SS	MDN	IGR	Q1	Q3	(1-3)	(4-6)	(7-9)
Actively participates in the content and curriculum development of biology education.	7.54	0.88	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Examines the applicability / adaptability of policies and practices in other countries and presents them to the attention of relevant stakeholders.	8.31	0.95	9.0	2.00	7.00	9.00	0.00	0.00	100.00
Leading the development of biology education in the society	8.00	1.00	8.0	2.00	7.00	9.00	0.00	0.00	100.00
Discloses information to the society (reports, articles, books, speeches) about the issues and solution strategies in biology education.	8.38	0.87	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Determines the requirements of biology education and engage in action (meeting, workshop, etc.) to fulfill them.	8.54	0.78	9.0	1.00	8.00	9.00	0.00	0.00	100.00
Examines the national educational processes and different implementations on-site, and presents them to the attention of relevant stakeholders.	8.08	0.76	8.0	1.50	7.50	9.00	0.00	0.00	100.00
Brings the developed implementations and materials to the use of relevant stakeholders.	8.69	0.63	9.0	0.50	8.50	9.00	0.00	0.00	100.00
Actively participates in the process of developing textbooks and/or instructional materials that can be used in biology education.	8.31	0.85	9.0	1.50	7.50	9.00	0.00	0.00	100.00
Works as a referee/editor for biology education and related studies (journals, books, projects, competitions, symposiums etc.).	7.23	0.83	7.0	1.00	7.00	8.00	0.00	15.38	84.62
Supporting the professional development of colleagues	7.31	1.65	7.0	3.50	5.50	9.00	0.00	30.77	69.23
Takes an active role in the professional development activities of working groups and NGOs related to biology / science education.	8.08	1.26	9.0	2.00	7.00	9.00	0.00	7.69	92.31
Develops course materials to support professional development and shares them with colleagues.	8.00	1.22	8.0	2.00	7.00	9.00	0.00	7.69	92.31
Shares professional knowledge and experiences in different environments (social sharing, seminars, panels, workshops etc.).	7.62	0.87	7.0	1.50	7.00	8.50	0.00	0.00	100.00
Takes an active role in providing professional development in different environments (social sharing, panel, workshop etc.).	7.62	0.77	7.0	1.00	7.00	8.00	0.00	0.00	100.00

H. Interview Booklet Used in The Delphi 4th Round

Delphi 1. Tur

Delphi 1. tur kapsamında; öncelikle 27 yayın (21 makale, 6 yayın/rapor) taranarak elde edilen bulgular sonucunda çalışma süresince, özellikle de Delphi 1. tur kapsamında yapılacak görüşmeler sürecinde dikkat edilmesi gereken konular ve görüşme yapılacak uzmanlara yöneltilecek sorular belirlenmiştir. Sonrasında 3 farklı üniversitede Biyoloji Eğitimi alanında çalışan 4 uzman ile görüşmeler tamamlanmıştır. Uzmanlarla yapılan görüşmeler sonrasında analizler yapılmış ve Biyoloji Öğretmen Eğitimcisi Yeterlik Çerçevesi Taslağı oluşturulmuştur.

Delphi 2. Tur

Bu aşamada yukarıda bahsedilen dönütler dikkate alınarak biyoloji eğitimcilerinin niteliklerine yönelik Likert tipi ölçeğin kullanıldığı anketler oluşturuldu.

Anketin Hazırlanması

Anketin oluşturulması safhasında dikkat edilen konular şu şekilde özetlenebilir:

1. Geçerlik ve güvenilirliği arttırmak amacıyla Likert tipi ölçek kullanımının uygunluğu,
2. Derecelendirme aralığının uygun şekilde belirlenmesi,
3. Nötr fikirlere sahip kişilerin fikirlerini yansıtacak ayrı bir seviyeye ihtiyaç olup olmadığıdır.

Nötr fikirler için bir seviyelendirme olmasının katılımcıların bu seviyeyi seçme eğilimlerinin arttırdığından bundan kaçınılması gerektiğine karar verilmiştir. Yine geçerlik ve güvenilirliği arttırmak amacıyla katılımcıların fikir beyan etmelerini gerektirecek derecede karşılığı bulunmayan maddelere “fikrim yok” şeklinde görüş belirtebilmeleri için böyle bir seçenek eklenmiştir. Ayrıca katılımcıların verdiği yanıtların dağılım aralığını yeterince geniş tutabilmek amacıyla dokuzlu derecelendirme aralığının kullanılmasına karar verildi (bkz. Şekil 1).

YETERLİK ALANI - A: Biyoloji Eğitimi

	Fikrim Yok	Kesinlikle Gerekli		Cok az Gerekli		Biraz Gerekli		Orduka Gerekli		Kesinlikle Gerekli
A.1 Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan konu ve kavramları analiz edebilme	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.1. Biyoloji biliminin temelinde yer alan kuram, ilke, genelleme ve modelleri açıklar.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐
A.1.2. Biyoloji bilimindeki problemlerin çözümüne yönelik deney tasarlama süreçlerini kurgular.	☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐

Şekil 1. Delphi 2. turda uygulanan anketten bir görünüm

Anketin Uygulanması ve Veri Analizi

Yukarıda bahsedilen konular dikkate alınarak oluşturulan anket, Delphi metodunda gerekliliklerinden birisi olan sınırlı bir grup uzman görüş alınmaması esasına dayanak öğretmen eğitimcileri, lisansüstü öğrencileri ve öğretmenlerden oluşan üç ayrı gruba görüşleri alınmak üzere ulaştırıldı.

Proje önerisinde her gruptan 12-16 kişinin katılması hedeflenmişti. Anketlerin ulaştırılması sonrasında yanıt vermeyebilecekler de göz önüne alınarak her gruptan daha fazla kişiyle iletişime geçilmiştir. Belirlenen kişilerle iletişime geçilip, çalışmadan bahsedilerek katılmak isteyip istemedikleri sorulmuştur. İstekli olanlara tercihlerine göre anketlerin basılı ya da elektronik sürümleri ulaştırılmıştır. İki hafta süre verilen katılımcılardan 13 öğretmen eğitimcisi, 12 lisans üstü öğrencisi ve 13 öğretmen anketleri doldurarak teslim etti.

Teslim alınan anketlerdeki veriler, öncelikle hazırlanan bir MS Excel dosyasına aktarılmıştır. Daha sonra bu veriler SPSS kullanılarak analiz edilmiştir.

Verilerin analizi aşamasındaki temel hedef, maddelerin anketten (yeterlik çerçevesinden) çıkartılıp çıkartılmayacağına karar vermek değil, Delphi 3. turda kullanılacak ankete maddelerle ilgili betimsel istatistiklerin eklenmesidir. Bu amaçla anketteki her madde için grupların bazında istatistikleri hesaplanmıştır.

Delphi 3. Tur

Bu aşamada paydaş görüşlerinin istatistiksel analizleri ve sonrasında yeterlikler ile ilgili paydaş görüşlerinin alınması amaçlanmıştır.

Anketin Hazırlanması, Uygulanması ve Veri Analiz Yöntemi

Delphi 2. turda elde edilen veriler kullanılarak her katılımcının kendi cevaplarını ve grubu ile ilgili istatistiksel verileri içeren anketler her bir katılımcıya özgü olarak oluşturulmuştur. Yeni ankete, katılımcının kendi gurubundaki kişilerin sorulara verdikleri cevapların yüzdelik dağılımları, katılımcının o soruya verdiği cevabı ve eğer fikrinde bir değişme olmuşsa yeni cevabını yazabileceği bir bölüm eklenmiştir (bkz. Şekil 2).

YETERLİK ALANI - A: Biyoloji Öğretimi

	1	2	3	4	5	6	7	8	9	Önceki Yantınız	Değiştirmek İstiyorsanız Yeni Yantınız
A.1 Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan konu ve kavramları analiz edebilme	-	-	-	-	-	20,0	20,0	10,0	50,0	7	
A.1.1. Biyoloji biliminin temelinde yer alan kuram, ilke, genelleme ve modelleri açıklar.	-	-	-	-	-	-	25,0	25,0	50,0	7	
A.1.2. Biyoloji bilimindeki problemlerin çözümüne yönelik deney tasarlama süreçlerini kurgular.	-	-	-	-	9,1	-	27,3	36,4	27,3	8	

Şekil 2: Delphi 3. turda kullanılan anketten örnek bir madde

Araştırma kapsamında Delphi Metodunun kullanılmasındaki temel amaç katılımcıların biyoloji öğretmen eğitimcisi yeterlikleri konusundaki görüşlerde ortaklaşmasını sağlamaktır. Bu nedenle, veri analizi sürecindeki temel hedef katılımcıların görüşlerindeki ortaklaşmanın sağlanıp sağlanmadığının incelenmesidir. Bu kapsamda yapılan ilk çalışma Delphi 2 ve 3 verilerinin bütünsel olarak araştırılmasıdır. Bu inceleme sırasında üç temel kriter belirlenmiştir. Kriterler şu şekildedir; (1)çeyrekler açıklığı değerinin 2 ve altında olması, (2) medyan

değerinin 7 ve üzeri olması ve (3) medyanın bulunduğu üç nokta aralığında ([1-3], [4-6], [7-9]) cevap verenlerin oranının %80 ve üzerinde olması bakılarak değerlendirilmiştir.

Delphi 2 yukarıda belirtilen kriterlerden en az birine uymayan, dolayısıyla bu maddelerin gerekliliği konusunda fikir birliğine varılma derecesi diğerleri kadar kuvvetli olmayan 32 madde bulunmaktadır. Bu maddeler, hangi kriterlere uymadıklarına göre incelendiklerinde; öncelikle hepsinin medyanın bulunduğu üç nokta aralığında ([1-3], [4-6], [7-9]) cevap verenlerin oranının en az %80 olması gerekliliğini sağlamadığı görülmektedir. Bunun dışında bu maddelerden hiçbirinin medyan değeri 7'nin (Mdn = 6,5) altında değildir. Ayrıca 32 madde içinden 13 tanesinin de çeyrekler açıklığı (IQR) değeri 2'nin üstündedir. Detaylı bilgi Tablo 1'de sunulmuştur.

Tablo 1: Delphi 2'de fikir birliğine varılamayan maddeler ve göstergeleri

Maddeler	M	SD	MEDIAN	IGR	%(4-6)	%(7-9)
A.1.7	7,16	1,60	7,0	3,00	28,95	65,79
A.2	7,67	1,53	8,0	2,50	24,24	75,76
A.2.1	7,57	1,75	9,0	3,00	25,71	71,43
A.2.6	7,35	1,48	7,0	3,00	24,32	72,97
A.3.1	7,51	1,63	8,0	3,00	24,32	72,97
A.4.4	6,92	1,60	7,0	2,00	28,95	68,42
A.4.5	7,74	1,41	8,0	2,00	21,05	78,95
A.4.6	7,29	1,35	7,0	3,00	28,95	71,05
B.1.5	7,64	1,36	8,0	2,00	22,22	77,78
B.5.2	7,35	1,67	8,0	2,00	16,22	78,38
B.7.1	7,71	1,47	8,0	2,00	17,65	79,41
B.7.4	7,50	1,48	8,0	2,00	17,65	79,41
C.2.11	7,26	1,46	7,0	3,00	28,57	71,43
D.1.7	7,14	1,67	7,0	3,00	27,03	70,27
D.3.4	7,16	1,59	7,0	3,50	29,73	70,27
E.3.3	7,58	1,43	8,0	2,00	21,05	78,95
E.3.5	7,27	1,77	7,0	2,50	21,62	75,68
E.4.1	7,27	1,45	7,0	1,00	18,92	78,38
F.1.	6,91	1,23	7,0	1,25	31,82	68,18
F.1.3	7,56	1,40	8,0	2,00	22,22	77,78
F.1.4	7,09	1,40	7,0	3,00	40,00	60,00
F.1.5	7,46	1,54	8,0	2,00	20,00	77,14
F.2.	7,00	1,41	7,0	2,00	24,00	72,00
F.2.1	7,39	1,44	7,5	2,00	22,22	77,78
F.2.2	7,11	1,41	7,0	2,00	27,03	72,97
F.2.3	6,78	1,38	7,0	2,00	38,89	61,11
F.2.4	6,97	1,40	7,0	2,00	32,43	67,57
F.2.5	7,16	1,24	7,0	1,50	24,32	75,68
F.2.6	7,43	1,34	7,0	2,00	21,62	78,38
F.4.	6,90	1,45	7,0	2,00	30,00	70,00
F.4.1	7,05	1,56	7,0	3,00	35,14	64,86
F.4.2	7,37	1,40	7,5	2,25	23,68	76,32

Öte yandan Tablo 2’de gösterildiği gibi Delphi 3’de bu maddelerden 24 tanesinin gerekliliği üzerinde fikir birliği sağlandığı görülmektedir. Ancak 8 madde konusunda fikir birliğini bozabilecek derecede düşünceler olabileceği ortaya çıkmıştır. Delphi 2. Tur analizlerinde yapıldığı gibi bu maddeler, hangi kriterlere uymadıklarına göre incelenmiştir. Önceki turda olduğu gibi 8 maddenin hepsi medyanın bulunduğu üç nokta aralığında ([1-3], [4-6], [7-9]) cevap verenlerin oranının en az %80 olması gerekliliğini sağlamamaktadır. Belirtilen 8 maddeden sadece üçünün çeyrekler açıklığı (IQR) değeri 2’nin üstündedir. Bunun yanı sıra, maddelerin hepsi medyan değerinin 7’nin üstünde olması kriterini sağlamaktadır.

Tablo 2: Delphi 3’de fikir birliğine varılamayan maddeler ve göstergeleri

	M	SD	MDN	IGR	%(4-6)	%(7-9)
A.1.7	7,19	1,45	7,0	2,75	30,56	66,67
A.4.4	7,11	1,53	7,0	1,00	19,44	77,78
A.4.6.	7,47	1,30	7,5	2,00	22,22	77,78
F.1.4	7,36	1,40	7,0	3,00	27,78	72,22
F.2.2.	7,17	1,42	7,0	1,75	25,00	75,00
F.2.3	6,86	1,31	7,0	2,00	33,33	66,67
F.2.4	7,19	1,31	7,0	1,00	22,22	77,78
F.4.1	7,33	1,47	7,5	2,75	25,00	75,00

Delphi 2. tur sonrasında 32 maddede istendik kriterler sağlanamamışken bu sayının Delphi 3. turda 8’e düşmüş olması, araştırma kapsamında hedeflenen katılımcıların biyoloji öğretmen eğitimcisi yeterlikleri konusundaki görüşlerde ortaklaşmanın sağlanması amacına uygunluğu gösteren en önemli işarettir.

Araştırma kapsamında öğretmen eğitimcisi, lisans üstü öğrenci ve öğretmen olmak üzere üç farklı gruptan veri toplanmıştır. Bu nedenle, Delphi 3. turda elde edilen veriler için detaylı olarak gruplar grup içinde fikir birliğine varılamayan madde olup olmadığı yönünden de incelenmiştir.

Öğretmen eğitimcilerinin olduğu grupta toplam 8, lisans üstü öğrenci grubunda 14 ve öğretmen grubunda 4 maddede fikir birliğine varılamadığı saptanmıştır. Tablo 3’te tüm bilgiler özetlenmiştir.

Tablo 3: Delphi 3’de gruplar bazında fikir birliğine varılamayan maddeler ve göstergeleri

Madde	Delphi 3. Tur (Tüm Grup)	Öğretmen Eğitimcileri İçinde	Lisans Üstü Öğrenciler İçinde	Öğretmenler İçinde
A.1.7	*	*		*
A.2.6				*
A.4			*	
A.4.4.	*	*	*	
A.4.5			*	
A.4.6.	*		*	
B.5.2			*	
C.2.11			*	
C.3			*	
D.1.7.		*		

Madde	Delphi 3. Tur (Tüm Grup)	Öğretmen Eğitmcileri İçinde	Lisans Üstü Öğrenciler İçinde	Öğretmenler İçinde
D.2.3.			*	
E.3.3.			*	
F.1.		*	*	
F.1.4	*			*
F.2.2.	*		*	
F.2.3	*	*	*	
F.2.4	*	*	*	
F.2.5.		*	*	
F.4.				*
F.4.1	*	*		

* Gruplar içinde fikir birliğine varılmadığını göstermektedir.

DELPHI 3. TUR KATILIMCILARININ ÜZERİNDE FİKİR BİRLİĞİNE VARAMADIKLARI MADDELER ve İLGİLİ VERİLER

A.1.7. Biyoloji biliminin tarihsel gelişim süreçlerini açıklar.

YETERLİK ALANI - A: Biyoloji Öğretimi

**A.1. Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan
konu ve kavramları analiz edebilme**

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- ÖE ve Ö gruplarında fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,16	1,60	7,0	3,00	6,00	9,00	5,26	28,95	65,79
Delphi 3. Tur	7,19	1,45	7,0	2,75	6,00	8,75	2,78	30,56	66,67
Öğretim Elemanı	7,42	1,16	7,0	2,50	6,50	8,50	0,00	25,00	75,00
Lisans Üstü Öğrenci	8,00	1,18	8,0	2,00	7,00	9,00	0,00	18,18	81,82
Öğretmen	6,31	1,49	6,0	1,50	5,50	7,00	7,69	46,15	46,15

GÖRÜŞLER:

A.4.4. Biyoloji öğretim programlarını farklı ülkelerin biyoloji öğretim programları ile karşılaştırır

YETERLİK ALANI - A: Biyoloji Öğretimi

A.4. Biyoloji öğretim programlarını değerlendirebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- ÖE ve LÜÖ gruplarında fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	6,92	1,60	7,0	2,00	6,00	8,00	2,63	28,95	68,42
Delphi 3. Tur	7,11	1,53	7,0	1,00	7,00	8,00	2,78	19,44	77,78
Öğretim Elemanı	7,08	1,93	7,0	2,50	6,50	8,50	8,33	16,67	75,00
Lisans Üstü Öğrenci	6,91	1,51	7,0	2,00	6,00	8,00	0,00	27,27	72,73
Öğretmen	7,31	1,18	7,0	1,50	7,00	8,50	0,00	15,38	84,62

GÖRÜŞLER:

A.4.6. Biyoloji öğretim programı ile biyolojinin yakın ilişkili olduğu alanların (fen bilgisi, fizik, kimya) öğretim programları arasındaki ilişkiyi açıkla.

YETERLİK ALANI - A: Biyoloji Öğretimi

A.4 Biyoloji öğretim programlarını değerlendirebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- LÜÖ grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,29	1,35	7,0	3,00	6,00	9,00	0,00	28,95	71,05
Delphi 3. Tur	7,47	1,30	7,5	2,00	7,00	9,00	0,00	22,22	77,78
Öğretim Elemanı	7,83	1,53	8,0	1,75	7,50	9,00	0,00	16,67	83,33
Lisans Üstü Öğrenci	7,09	1,30	7,0	2,00	6,00	8,00	0,00	36,36	63,64
Öğretmen	7,46	1,05	7,0	1,50	7,00	8,50	0,00	15,38	84,62

GÖRÜŞLER:

F.1.4. Hizmet içi eğitim uygulamalarında öğretmenlerin bireysel farklılıklarını (bilgi, inanış, deneyim vb.) dikkate alır.

YETERLİK ALANI – F: Toplumda Biyoloji Eğitimi Destekleme
F.1. Biyoloji öğretmenlerine yönelik etkili hizmet içi eğitim programları düzenleyebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- Ö grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,09	1,40	7,0	3,00	6,00	8,50	0,00	40,00	60,00
Delphi 3. Tur	7,36	1,40	7,0	3,00	6,00	9,00	0,00	27,78	72,22
Öğretim Elemanı	7,83	1,47	8,0	2,00	7,00	9,00	0,00	8,33	91,67
Lisans Üstü Öğrenci	7,73	1,10	7,0	2,00	7,00	9,00	0,00	9,09	90,91
Öğretmen	6,62	1,33	6,0	1,50	6,00	7,50	0,00	61,54	38,46

GÖRÜŞLER:

F.2.2. Biyoloji eğitimi önceliğinde eğitimin niteliğini artırmaya yönelik yerel, ulusal ve uluslararası eğitim politikalarını geliştirici araştırmalar yapar.

YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme
F.2. Eğitimin paydaş kurumlarını (politika yapıcı, STK, okul vb.) destekleme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- Ö grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,11	1,41	7,0	2,00	6,00	8,00	0,00	27,03	72,97
Delphi 3. Tur	7,17	1,42	7,0	1,75	6,25	8,00	0,00	25,00	75,00
Öğretim Elemanı	7,58	1,44	7,5	2,00	7,00	9,00	0,00	8,33	91,67
Lisans Üstü Öğrenci	6,09	1,45	6,0	2,00	5,00	7,00	0,00	72,73	27,27
Öğretmen	7,69	0,85	7,0	1,50	7,00	8,50	0,00	0,00	100,00

GÖRÜŞLER:

F.2.3. Başta uzmanlaştığı alan olmak üzere eğitim ile ilgili alanlarda sivil toplum kuruluşları, kamu kurumları vb. kurumların doküman hazırlama çalışmalarına (rapor, politika önerileri vb.) görüş ve önerileriyle katkı sunar.

YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme
F.2. Eğitimin paydaş kurumlarını (politika yapıcı, STK, okul vb.) destekleme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- ÖE ve LÜÖ gruplarında fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	6,78	1,38	7,0	2,00	6,00	8,00	0,00	38,89	61,11
Delphi 3. Tur	6,86	1,31	7,0	2,00	6,00	8,00	0,00	33,33	66,67
Öğretim Elemanı	7,08	1,44	7,0	2,00	6,00	8,00	0,00	33,33	66,67
Lisans Üstü Öğrenci	6,09	1,30	6,0	2,00	5,00	7,00	0,00	63,64	36,36
Öğretmen	7,31	0,95	7,0	1,00	7,00	8,00	0,00	7,69	92,31

GÖRÜŞLER:

F.2.4. Biyoloji eğitimiyle ilgili paydaşlara yönelik mesleki toplantı/seminer/konferans düzenler.

YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme
F.2. Eğitimin paydaş kurumlarını (politika yapıcı, STK, okul vb.) destekleme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- ÖE ve LÜÖ gruplarında fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	6,97	1,40	7,0	2,00	6,00	8,00	0,00	32,43	67,57
Delphi 3. Tur	7,19	1,31	7,0	1,00	7,00	8,00	0,00	22,22	77,78
Öğretim Elemanı	7,42	1,62	8,0	2,50	6,50	8,50	0,00	25,00	75,00
Lisans Üstü Öğrenci	6,45	1,13	7,0	2,00	5,00	7,00	0,00	45,45	54,55
Öğretmen	7,62	0,87	7,0	1,50	7,00	8,50	0,00	0,00	100,00

GÖRÜŞLER:

F.4.1. Biyoloji /fen eğitimiyle ilgili çalışma gruplarının ve STK'ların mesleki gelişimle ilgili faaliyetlerinde aktif rol alır.

YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme
F.4. Meslektaşlarının mesleki gelişimini destekleyebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Tüm grup bazında fikir birliği sağlanamaması
- ÖE grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,05	1,56	7,0	3,00	6,00	8,00	0,00	35,14	64,86
Delphi 3. Tur	7,33	1,47	7,5	2,75	6,25	9,00	0,00	25,00	75,00
Öğretim Elemanı	6,42	1,62	6,0	2,75	5,00	7,50	0,00	58,33	41,67
Lisans Üstü Öğrenci	7,45	1,04	8,0	1,00	7,00	8,00	0,00	9,09	90,91
Öğretmen	8,08	1,26	9,0	2,00	7,00	9,00	0,00	7,69	92,31

GÖRÜŞLER:

**DELPHI 3. TURDA ALT GRUPLAR BAZINDA EN AZ BİR GRUPTA FİKİR BİRLİĞİ
SAĞLANAMAYAN MADDELERE ÖRNEKLER**

A.2.6. Biyoloji biliminin gelişimindeki tarihsel süreçlere yönelik bilgi birikimini öğretim süreçlerine yansıtır.

YETERLİK ALANI - A. Biyoloji Öğretimi

A.2. Biyoloji öğrenme ve öğretme yaklaşımlarını uygulayabilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- Ö grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,35	1,48	7,0	3,00	6,00	9,00	2,70	24,32	72,97
Delphi 3. Tur	7,56	1,23	7,0	2,00	7,00	9,00	0,00	16,67	83,33
Öğretim Elemanı	7,83	1,27	8,0	2,00	7,00	9,00	0,00	16,67	83,33
Lisans Üstü Öğrenci	8,36	0,81	9,0	1,00	8,00	9,00	0,00	0,00	100,00
Öğretmen	6,62	0,87	7,0	1,00	6,00	7,00	0,00	30,77	69,23

GÖRÜŞLER:

A.4. Biyoloji ğretim programlarını deęerlendirebilme

YETERLİK ALANI - A: Biyoloji Öğretimi

Saęlanamayan Kriterler (Delphi 3 verilerine gre):

- L grubunda fikir birlięi saęlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,58	1,32	7,5	2,00	7,00	9,00	0,00	16,67	83,33
Delphi 3. Tur	7,83	1,27	8,0	2,00	7,00	9,00	0,00	14,29	85,71
Öğretim Elemanı	8,25	1,54	9,0	1,50	8,00	9,00	0,00	8,33	91,67
Lisans Üstü Öğrenci	7,30	1,16	7,0	2,25	6,00	8,25	0,00	30,00	70,00
Öğretmen	7,85	0,99	8,0	2,00	7,00	9,00	0,00	7,69	92,31

GÖRÜŞLER:

A.4.5. Biyoloji öğretim programlarının içeriği, yapısı ve uygulamaları ile ilgili sorunları tespit ederek giderme yolları bulur.

YETERLİK ALANI - A: Biyoloji Öğretimi

A.4. Biyoloji öğretim programlarını değerlendirebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- LÜÖ grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,74	1,41	8,0	2,00	7,00	9,00	0,00	21,05	78,95
Delphi 3. Tur	8,00	1,26	8,5	2,00	7,00	9,00	0,00	13,89	86,11
Öğretim Elemanı	8,00	1,48	8,5	1,75	7,50	9,00	0,00	8,33	91,67
Lisans Üstü Öğrenci	7,55	1,29	7,0	3,00	6,00	9,00	0,00	27,27	72,73
Öğretmen	8,38	0,96	9,0	1,00	8,00	9,00	0,00	7,69	92,31

GÖRÜŞLER:

B.5.2. Öğretmenlerin ve öğretmen adaylarının biyoloji eğitimine yönelik teknolojik araçlara hâkimiyet düzeylerini tespit eder.

YETERLİK ALANI - B: Biyoloji Öğretmeni Yetiştirme ve Geliştirme
B.5. Biyoloji öğretmeni ve öğretmen adaylarına biyoloji öğretiminde teknolojinin uygun kullanımı için rehberlik edebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- LÜÖ grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,35	1,67	8,0	2,00	7,00	9,00	5,41	16,22	78,38
Delphi 3. Tur	7,47	1,59	7,5	2,00	7,00	9,00	5,56	5,56	88,89
Öğretim Elemanı	7,67	1,72	8,0	2,00	7,00	9,00	8,33	0,00	91,67
Lisans Üstü Öğrenci	6,45	1,69	7,0	1,00	6,00	7,00	9,09	18,18	72,73
Öğretmen	8,15	0,90	8,0	2,00	7,00	9,00	0,00	0,00	100,00

GÖRÜŞLER:

C.2.11. Biyoloji eğitiminde yapılan lisansüstü çalışmalar için oluşturulan jüri ve komisyonlarda görev alır.

YETERLİK ALANI - C: Biyoloji Öğretmen Eğitimcisi Yetiştirme
C.2. Biyoloji eğitimi geliştirmeye yönelik araştırmacı yetiştirme sürecini yönetebilme ve destekleyebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- LÜÖ grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,26	1,46	7,0	3,00	6,00	9,00	0,00	28,57	71,43
Delphi 3. Tur	7,56	1,38	8,0	2,00	7,00	9,00	0,00	16,67	83,33
Öğretim Elemanı	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
Lisans Üstü Öğrenci	7,09	1,38	7,0	2,00	6,00	8,00	0,00	27,27	72,73
Öğretmen	7,38	1,19	7,0	1,50	7,00	8,50	0,00	15,38	84,62

GÖRÜŞLER:

C.3 Biyoloji eğitimi alanında lisansüstü eğitim programları geliştirebilme

YETERLİK ALANI - C: Biyoloji Öğretmen Eğitimcisi Yetiştirme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- LÜÖ grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,67	1,15	7,0	2,00	7,00	9,00	0,00	14,29	85,71
Delphi 3. Tur	8,03	1,03	8,0	2,00	7,00	9,00	0,00	5,88	94,12
Öğretim Elemanı	8,64	0,67	9,0	1,00	8,50	9,00	0,00	0,00	100,00
Lisans Üstü Öğrenci	7,70	1,25	7,5	2,25	6,75	9,00	0,00	20,00	80,00
Öğretmen	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00

GÖRÜŞLER:

D.1.7. Biyoloji eğitimi ve ilgili alanlardaki sivil oluşumları (e-posta grupları, sosyal medya grupları, mesleki ağlar vb.) takip eder.

YETERLİK ALANI - D: Biyoloji Eğitiminde Araştırma

D.1. Biyoloji eğitimi ile ilgili verimli ve etkili bilimsel gelişmeleri takip edebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- ÖE grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,14	1,67	7,0	3,00	6,00	9,00	2,70	27,03	70,27
Delphi 3. Tur	7,36	1,55	7,0	2,00	7,00	9,00	2,78	11,11	86,11
Öğretim Elemanı	7,08	2,19	7,0	3,50	6,00	9,00	8,33	16,67	75,00
Lisans Üstü Öğrenci	7,45	1,44	8,0	2,00	7,00	9,00	0,00	18,18	81,82
Öğretmen	7,54	0,88	7,0	1,50	7,00	8,50	0,00	0,00	100,00

GÖRÜŞLER:

D.2.3. Araştırma çalışmalarını, ilgili alan yazın ve toplumsal ihtiyaçlar çerçevesinde temellendirir.

YETERLİK ALANI - 2: Biyoloji Eğitiminde Araştırma

D.2. Biyoloji eğitimi geliştirmek için yenilikçi, etkili ve verimli araştırmalar yapabilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- LÜÖ grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,39	1,31	7,0	2,00	7,00	9,00	0,00	18,42	81,58
Delphi 3. Tur	7,61	1,25	7,0	2,00	7,00	9,00	0,00	11,11	88,89
Öğretim Elemanı	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
Lisans Üstü Öğrenci	6,82	0,98	7,0	1,00	6,00	7,00	0,00	27,27	72,73
Öğretmen	7,69	0,85	7,0	1,50	7,00	8,50	0,00	0,00	100,00

GÖRÜŞLER:

E.3.3. Öğretmenlerin ve öğretmen adaylarının sosyal, ekonomik ve fiziki olarak farklı çalışma ortamlarında biyoloji öğretmeyle ilgili fırsatları ve zorlukları değerlendirebilecekleri ortamlar oluşturur.

YETERLİK ALANI - E: Biyoloji Eğitime Yönelik Olumlu Tutum ve Değerler
E.3. Öğretmen ve öğretmen adaylarının biyoloji eğitime yönelik olumlu tutum ve değerler geliştirmelerini destekleyebilme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- LÜÖ grubunda fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,58	1,43	8,0	2,00	7,00	9,00	0,00	21,05	78,95
Delphi 3. Tur	7,86	1,31	8,0	2,00	7,00	9,00	0,00	11,11	88,89
Öğretim Elemanı	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
Lisans Üstü Öğrenci	7,18	1,47	7,0	3,00	6,00	9,00	0,00	27,27	72,73
Öğretmen	8,38	0,77	9,0	1,00	8,00	9,00	0,00	0,00	100,00

GÖRÜŞLER:

F.1. Biyoloji öğretmenlerine yönelik etkili hizmet içi eğitim programları düzenleyebilme

YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- ÖE ve LÜÖ gruplarında fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	6,91	1,23	7,0	1,25	6,00	7,00	0,00	31,82	68,18
Delphi 3. Tur	7,29	1,15	7,0	1,00	7,00	8,00	0,00	20,00	80,00
Öğretim Elemanı	7,25	1,48	7,0	2,50	6,50	8,50	0,00	25,00	75,00
Lisans Üstü Öğrenci	7,00	0,94	7,0	1,25	6,00	7,25	0,00	30,00	70,00
Öğretmen	7,54	0,97	7,0	1,50	7,00	8,50	0,00	7,69	92,31

GÖRÜŞLER:

F.2.5. Biyoloji eğitimiyle ilgili içerik ve program geliştirme süreçlerine aktif katılır.

YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme

F.2. Eğitimin paydaş kurumlarını (politika yapıcı, STK, okul vb.) destekleme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- ÖE ve LÜÖ gruplarında fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	7,16	1,24	7,0	1,50	7,00	8,00	0,00	24,32	75,68
Delphi 3. Tur	7,25	1,23	7,0	1,00	7,00	8,00	0,00	19,44	80,56
Öğretim Elemanı	7,42	1,51	8,0	2,50	6,50	8,50	0,00	25,00	75,00
Lisans Üstü Öğrenci	6,73	1,19	7,0	1,00	6,00	7,00	0,00	36,36	63,64
Öğretmen	7,54	0,88	7,0	1,50	7,00	8,50	0,00	0,00	100,00

GÖRÜŞLER:

F.4. Meslektaşlarının mesleki gelişimini destekleyebilme.

YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme

Sağlanamayan Kriterler (Delphi 3 verilerine göre):

- ÖE gruplarında fikir birliği sağlanamaması

Nicel Veriler

	M	SD	Mdn	IQR	Q1	Q3	%[1-3]	%[4-6]	%[7-9]
Delphi 2. Tur	6,90	1,45	7,0	2,00	6,00	8,00	0,00	30,00	70,00
Delphi 3. Tur	7,26	1,31	7,0	1,00	7,00	8,00	0,00	20,00	80,00
Öğretim Elemanı	7,42	1,38	7,0	1,75	7,00	8,50	0,00	8,33	91,67
Lisans Üstü Öğrenci	7,00	0,67	7,0	0,50	6,75	7,25	0,00	20,00	80,00
Öğretmen	7,31	1,65	7,0	3,50	5,50	9,00	0,00	30,77	69,23

GÖRÜŞLER:

BIYOLOJİ ÖĞRETMEN EĞİTİMCİSİ YETERLİKLERİ TASLAĞI
YETERLİK ALANI - A: Biyoloji Öğretimi

A.1. Biyoloji öğretim programlarında (ortaöğretim düzeyi) yer alan konu ve kavramları analiz edebilme
A.1.1. Biyoloji biliminin temelinde yer alan kuram, ilke, genelleme ve modelleri açıklar.
A.1.2. Biyoloji bilimindeki problemlerin çözümüne yönelik deney tasarlama süreçlerini kurgular.
A.1.3. Biyoloji bilimine, bilimin doğasının gerektirdiği bir bakış açısı ile yaklaşır.
A.1.4. Biyoloji müfredatında yer alan konular ile ortaokul ve üniversite düzeyindeki konu ve kavramlar arasındaki ilişkiyi açıklar.
A.1.5. Biyolojinin alt dallarındaki kavramlar arasındaki bağlantıları kurabilecek düzeyde biyolojik okuryazarlığa sahiptir.
A.1.5. Biyolojinin, yakın ilişkili olduğu alanlardan nasıl faydalandığını açıklar.
A.1.6. Biyoloji biliminin tarihsel gelişim süreçlerini açıklar.
A.2. Ortaöğretim düzeyindeki öğrencilerin biyoloji okuryazarlık düzeylerini geliştirme
A.2.1. Biyoloji öğretmenliği tecrübesine sahiptir.
A.2.2. Öğrencilerin bilimsel araştırma ve süreç becerilerini geliştirmeye yönelik proje, deney, etkinlikler kurgular.
A.2.3. Öğrencilerin biyoloji bilgilerini geliştirmek adına biyoloji konularına uygun laboratuvar yöntem ve tekniklerini kullanır.
A.2.4. Öğretim süreçlerini, bilimsel bilginin özellikleri çerçevesinde kurgular.
A.2.5. Öğretim süreçlerinde biyolojinin toplum, insan ve çevre arasındaki ilişkisine yer verir.
A.2.6. Biyoloji biliminin gelişimindeki tarihsel süreçlere yönelik bilgi birikimini öğretim süreçlerine yansıtır.
A.3. Biyoloji öğrenme ve öğretme yaklaşımlarını uygulayabilme
A.3.1. Ortaöğretim düzeyindeki öğrencilerin bireysel ve grup ihtiyaçlarını tespit ederek öğretim sürecine entegre edebilir.
A.3.2. Alan eğitimindeki temel yaklaşım, öğrenme kuramları, öğrenme stratejileri ve öğretim metotları ile bunların birbirileri ve kendi içlerinde var olan bağlantılarını açıklar.
A.3.3. Öğrenme ve öğretme yaklaşımlarını belirlerken biyoloji/fen eğitimine özgü model, kuram ve kavramsal çerçevelerden yararlanır.
A.3.4. Biyoloji öğretiminde bilimsel süreç becerilerinin gelişimini odağa alır.
A.3.5. Biyoloji öğretiminde kullanılan laboratuvar etkinliklerini öğretim süreçlerinde etkin kullanır.
A.3.6. Biyoloji eğitimi süreçlerinde güncel kaynaklar, araç-gereçler ile bilgi ve iletişim teknolojilerini kullanır.
A.3.7. Biyoloji öğretimi sürecinde öğrencilerin yaşadıkları güçlükleri ve kavram yanılgılarını ders tasarımlarında dikkate alır.
A.3.8. Biyoloji öğretiminde farklı ölçme ve değerlendirme yaklaşım ve metotlarını kullanır.
A.4. Biyoloji öğretim programlarını değerlendirebilme
A.4.1. Biyoloji öğretim programlarının vizyonunu, felsefesini, yapısını ve kapsamını irdeler.
A.4.2. Biyoloji öğretim programlarındaki konu içeriklerinin dağılım ve sıralamasını irdeler.
A.4.3. Biyoloji öğretim programlarındaki kazanımların içerik ve sınırlılıklarını irdeler.
A.4.4. Biyoloji öğretim programlarını farklı ülkelerin biyoloji öğretim programları ile karşılaştırır.
A.4.5. Biyoloji öğretim programlarının içeriği, yapısı ve uygulamaları ile ilgili sorunları tespit ederek giderme yolları bulur.
A.4.6. Biyoloji öğretim programı ile biyolojinin yakın ilişkili olduğu alanların (fen bilgisi, fizik, kimya) öğretim programları arasındaki ilişkiyi açıklar.

YETERLİK ALANI - B: Biyoloji Öğretmeni Yetiştirme ve Geliştirme

B.1. Biyoloji öğretmeni yetiştirme program(lar)ını değerlendirme ve öğretmen yetiştirme sürecine entegre etme
B.1.1. Görev yaptığı bölümdeki öğretmen yetiştirme programının yapısını, kapsamını, felsefesini ve yaklaşımını açıklar.
B.1.2. Uluslararası ve ulusal ölçekteki diğer öğretmen yetiştirme programları ile uyguladığı öğretmen yetiştirme programını karşılaştırır.
B.1.3. Görev yaptığı bölümdeki öğretmen yetiştirme programlarının gelişimini destekler. (ders önerme, mevcut derslerin içeriklerini güncelleme vs.)
B.1.4. Uyguladığı biyoloji öğretmeni yetiştirme programı ile ilgili sorunları tespit ederek geliştirilebilmesi için değişiklik önerilerinde bulunur.
B.1.5. Meslektaşları ile ortak bir çizgide ilerlemek adına, öğretmen adaylarının aldıkları derslerin kapsamına ve içerikleri açıklar.
B.2. Biyoloji öğretmeni ve öğretmen adaylarına uygun öğrenme ve öğretme yaklaşımlarını yerinde ve zamanında kullanmaları konusunda rehberlik edebilme
B.2.1. Öğretmenlerin ve öğretmen adaylarının, öğretim yöntem ve teknikleriyle ilgili bilgi ve becerilerini geliştirebilecekleri öğrenme fırsatları oluşturur.
B.2.2. Öğretmenlere ve öğretmen adaylarına, biyoloji öğretiminde farklı öğrenme ve öğretme yaklaşımlarının etkili bir şekilde kullanıldığı örnekler sunar.
B.2.3. Öğretmenlerin ve öğretmen adaylarının, biyolojiyi öğretirken alana özgü model, kuram ve kavramsal çerçevelerden yararlanabilecekleri fırsatlar oluşturur.
B.2.4. Öğretmen ve öğretmen adaylarının alan eğitimindeki temel yaklaşımlar, öğrenme kuramları, öğrenme stratejilerini ve öğretim metotları ile bunların birbirileri ve kendi içlerinde var olan bağlantıları içselleştirecekleri öğrenme ortamları oluşturur.
B.2.5. Öğretmen ve öğretmen adaylarının biyoloji okuryazarlığı yüksek bireyler (9-12. sınıf öğrencileri) yetiştirme becerilerini geliştirici öğrenme ortamları oluşturur.
B.2.6. Öğretmenlerin ve öğretmen adaylarının hazırladıkları ders planlarıyla ilgili uygulama öncesinde ve sonrasında öğrenme/öğretme yaklaşımları temelinde dönütler verir.
B.3. Biyoloji öğretmeni ve öğretmen adaylarına; uygun öğretim materyali seçme, tasarlama, kullanma ve geliştirme konusunda rehberlik edebilme
B.3.3. Öğretmenlere ve öğretmen adaylarına, biyoloji öğretiminde kullanılacak öğretim materyalleri repertuarlarını geliştirmeleri için uygun kaynaklar önerir.
B.3.4. Öğretmen ve öğretmen adaylarına biyoloji öğretiminde kullanılabilecek öğretim materyallerinden örnekler sunar.
B.3.5. Öğretmenlere ve öğretmen adaylarına öğretim materyallerinin öğrencilerin farklı bilimsel düşünme ve öğrenme biçimlerini geliştirecek çeşitlilikte olmasını vurgular.
B.3.6. Öğretmenlere ve öğretmen adaylarına biyoloji öğretiminde ilgili konulara ve kavramlara yönelik güncel ve uygun materyal seçimi için örnekler sunar.
B.3.7. Öğretmenlere ve öğretmen adaylarına biyoloji öğretiminde kullanılabilecek materyal tasarlama konusunda dönüt verebileceği öğrenme fırsatları oluşturur.
B.4. Biyoloji öğretmen ve öğretmen adaylarına biyoloji öğretiminde uygun ölçme ve değerlendirme yöntemlerini kullanma konusunda rehberlik edebilme
B.4.1. Öğretmenlerin ve öğretmen adaylarının biyoloji biliminin kapsadığı işlemsel ve kavramsal bilgi ve bilimsel süreç becerilerini ölçmeye yönelik ölçme ve değerlendirme yöntemlerine hâkimiyet düzeylerini tespit eder.
B.4.2. Öğretmenlere ve öğretmen adaylarına kavram ve bilimsel süreç becerilerini ölçmeye yönelik ölçme ve değerlendirme yöntem-teknik repertuarlarını geliştirmeleri için uygun kaynaklar önerir.
B.4.3. Öğretmen ve öğretmen adaylarına sunduğu eğitimlerde biyoloji öğretiminde kullanılan ölçme ve değerlendirme yöntemlerine yönelik örneklerle yer verir.
B.4.4. Öğretmenlere ve öğretmen adaylarına biyoloji öğretiminde kullanacakları kavram ve bilimsel süreç becerileri ölçmeye yönelik uygun ölçme ve değerlendirme örnekleri sunar.

B.4.5. Öğretmenlere ve öğretmen adayları için biyoloji biliminin kapsadığı kavram ve bilimsel süreç becerilerini ölçmeye dönük farklı soru, görev, araç vb. tasarlayacakları uygun öğrenme fırsatları oluşturur.
B. 5. Biyoloji öğretmeni ve öğretmen adaylarına biyoloji öğretiminde teknolojinin uygun kullanımı için rehberlik edebilme
B.5.1. Öğretmenler ve öğretmen adaylarıyla, biyoloji öğretiminde kullanılan teknolojilerin genel olarak ve konu/kavram/kazanım özelinde imkân ve sınırlıklarını değerlendirir.
B.5.2. Öğretmenlerin ve öğretmen adaylarının biyoloji eğitimine yönelik teknolojik araçlara hâkimiyet düzeylerini tespit eder.
B.5.3. Öğretmenlerin ve öğretmen adaylarının biyoloji eğitiminde kullanacakları teknolojik araçlarla ilgili repertuvarlarını geliştirmeleri için uygun kaynaklar önerir.
B.5.4. Öğretmen ve öğretmen adaylarına sunduğu eğitimlerde biyoloji öğretiminde kullanılan teknolojik araç-gereçlerin kullanımına yönelik örneklerle yer verir.
B.5.5. Öğretmenlere ve öğretmen adaylarına biyoloji öğretiminde kullanabilecekleri teknolojik araçlar konusunda konu/kavram/kazanım temelli çeşitli örnekler sunar.
B.5.6. Öğretmenler ve öğretmen adayları için teknolojinin biyolojideki konu/kavram/kazanımların öğretiminde kullanılmasını içeren uygulamalar tasarlamaya dönük dönüt verebileceği öğrenme ortamları oluşturur.
B.6. Biyoloji öğretmeni ve öğretmen adaylarına öğrencilerin bilimsel düşünme ve öğrenme biçimlerini biyoloji öğretiminde etkili kullanmada rehberlik edebilme
B.6.1. Öğretmenlere ve öğretmen adaylarına, öğrencilerin biyolojideki çeşitli konu ve kavramlarla ilgili düşünme ve öğrenme biçimlerinin (kavram yanılgıları, güçlükleri, çözüm yaklaşımları vs.) teşhisiyle ilgili farklı yöntem ve araçların kullanımına yönelik öğrenme fırsatları oluşturur.
B.6.2. Öğretmenlere ve öğretmen adaylarına, öğrencilerin biyolojideki çeşitli konu ve kavramlardaki düşünme ve öğrenme biçimleriyle ilgili araştırma ve uygulama temelli öğrenme fırsatları oluşturur.
B.6.3. Öğretmenlere ve öğretmen adaylarına öğrencilerin biyolojideki çeşitli konu ve kavramlarla ilgili düşünme ve öğrenme biçimlerinin dikkate alındığı ders tasarlama ve uygulamalarıyla ilgili dönüt verebileceği fırsatlar oluşturur.
B.7. Biyoloji öğretmen ve öğretmen adaylarının biyoloji öğretimiyle ilgili mesleki gelişimlerini izleyebilme ve değerlendirebilme
B.7.1. Öğretmenlerin ve öğretmen adaylarının mesleki gelişimlerine yönelik faaliyet, uygulama ve ders pratiklerini değerlendirirken/gözlemlerken kullanmak üzere araçlar (gözlem formları, öz değerlendirme formları, mülakat protokolleri vs.) geliştirir.
B.7.2. Öğretmenlerin ve öğretmen adaylarının biyoloji öğretimiyle ilgili yeterliklerini belirleme ve gelişimlerini izlemeye yönelik geliştirilen yöntem ve araçlardan yararlanır.
B.7.3. Öğretmenlerin ve öğretmen adaylarının biyoloji öğretimiyle ilgili uygulamalarını düzenli olarak gözlemleyebileceği durumlar oluşturur.
B.7.4. Öğretmenlerin ve öğretmen adaylarının biyoloji öğretimiyle ilgili mesleki gelişimlerine yönelik izleme ve değerlendirme raporları hazırlar.
B.7.5. Öğretmenlere ve öğretmen adaylarına biyoloji öğretimi uygulamalarıyla ilgili zamanında ve yapıcı geri bildirim verir.
B.7.6. Uygulama öğretmenlerinden/mentor öğretmenlerden aldığı dönütleri öğretmenlerin ve öğretmen adaylarının mesleki gelişimlerini izleme ve değerlendirmede kullanır.
B.8. Biyoloji öğretmeni adaylarına etkili mentorluk yapabilmeleri için uygulama öğretmenlerine rehberlik edebilme
B.8.1. Uygulama öğretmenlerinin mentorlukla ilgili iyileştirilmeye muhtaç yönlerini belirler.
B.8.2. Uygulama öğretmenleri için mentorlukla ilgili ihtiyaç duyulan konularda seminerler/eğitimler düzenler.
B.8.3. Uygulama öğretmenlerini biyoloji eğitimiyle ilgili gelişmeleri takip etmelerine teşvik edici öğrenme ortamları oluşturur.

B.8.4. Uygulama öğretmenlerinin mesleki gelişimlerine katkıda bulunabilecek kaynakları ve araçları paylaşır/önerir.
B.8.5. Uygulama öğretmenlerini mesleki gelişimlerine katkı sağlayabilecek ulusal ve uluslararası sempozyum, konferans, çalıştay, kongrelere katılma konusunda teşvik eder.
B.9. Biyoloji öğretmeni ve öğretmen adaylarını biyolojiyi öğretimi konusunda rol model olma
B.9.1. Öğretmen ve öğretmen adaylarına; biyoloji programının felsefesi, ünite kapsamaları, konu ve kazanım dağılımı, etkinlik örnekleri vb. açılardan irdelemelerini destekleyici öğrenme ortamları sunar.
B.9.2. Biyoloji öğretimi uygulamalarında öğrencilerin (A-12 sınıf düzeyi) ve öğretmen adaylarının düşünme ve öğrenme biçimlerini dikkate alır.
B.9.3. Öğretmen ve öğretmen adaylarının; farklı öğretim strateji, yöntem ve tekniklerin yerinde ve zamanında kullanımını gözlemleyecekleri uygulamalara derslerinde yer verir.
B.9.4. Öğretmen ve öğretmen adaylarının; amaca uygun öğretim materyallerinin kullanımını gözlemleyecekleri uygulamalara derslerinde yer verir.
B.9.5. Öğretmen ve öğretmen adaylarının, biyoloji öğretiminde öğretim teknolojilerinin yerinde ve etkili kullanımını gözlemleyecekleri uygulamalara derslerinde yer verir.
B.9.6. Öğretmenlerin ve öğretmen adaylarının öğrenmelerini değerlendirmek amacıyla, geçerli ve güvenilir ölçme araçları kullanır.
B.9.7. Biyoloji öğretmen ve öğretmen adaylarının biyoloji okuryazarlıklarını geliştirme süreçlerinde teşvik edici uygulamalara derslerinde yer verir.
B.9.8. Yürüttüğü araştırmalarda edindiği deneyimleri öğretmen ve öğretmen adayı eğitimi sürecinde kullanır.

YETERLİK ALANI - C: Biyoloji Öğretmen Eğitimcisi Yetiştirme

C.1. Aday öğretmen eğitimcilerini biyoloji öğretmeni yetiştirme ve eğitimi konusunda destekleyebilme
C.1.1. Biyoloji öğretmen eğitimcisi adaylarının; alan eğitimindeki temel yaklaşımlar, öğrenme kuramları, öğrenme stratejileri, öğretim metotları ile bunların birbirileri ve kendi içlerinde var olan bağlantılarını öğrenebilecekleri öğretim ortamları tasarlar.
C.1.2. Biyoloji öğretmen eğitimcisi adaylarına, öğretmenlerin ve öğretmen adaylarının eğitimleri sürecinde karşılaşılan sorunlar ile bu sorunların çözümü yolunda rehberlik eder.
C.1.3. Biyoloji öğretmen eğitimcisi adaylarını, öğretmen ve öğretmen adaylarının eğitimi süreçlerine dahil eder.
C.2. Biyoloji eğitimini geliştirmeye yönelik araştırmacı yetiştirme sürecini yönetebilme ve destekleyebilme
C.2.1 Biyoloji eğitimi ile ilgili lisansüstü düzeyde ders verir.
C.2.2. Öğretmen eğitimcisi adaylarının, alan eğitimindeki temel ve güncel araştırma alanlarını odağa almalarında rehberlik eder.
C.2.3. Öğretmen eğitimcisi adaylarının araştırma yöntem ve tekniklerine yönelik bilgi ve becerilerini geliştirmeleri için fırsatlar oluşturur.
C.2.4. Öğretmen eğitimcisi adaylarının alan yazını takip etme ve alan yazıma katkı sunma becerilerini geliştirmelerinde danışmanlık yapar.
C.2.5. Öğretmen eğitimcisi adaylarının uzmanlaşmak istedikleri alanda gelişmelerini desteklemek amacıyla danışmanlık yapar.
C.2.6. Öğretmen eğitimcisi adaylarının bağımsız araştırma yapabilme becerilerini geliştirmeleri adına danışmanlık yapar.
C.2.7. Öğretmen eğitimcisi adaylarının yenilikçi, etkili ve verimli araştırma çalışmaları yürütmeleri süreçlerinde danışmanlık yapar.
C.2.8. Öğretmen eğitimcisi adaylarının hazırladığı araştırmalarının raporlaştırılarak sunulması sürecinde danışmanlık yapar.
C.2.9. Öğretmen eğitimcisi adaylarının; eğitim ve ilgili alanlarda düzenlenen ulusal ve uluslararası (konferans, sempozyum, çalıştay vb.) etkinliklere katılımlarını teşvik eder.

C.2.10. Öğretmen eğitimcisi adaylarının bilimsel etik anlayışlarını geliştirmelerine destek olur.
C.2.11. Biyoloji eğitiminde yapılan lisansüstü çalışmalar için oluşturulan jüri ve komisyonlarda görev alır.
C.3. Biyoloji eğitimi alanında lisansüstü eğitim programları geliştirebilme
C.3.1. Ulusal ve uluslararası lisansüstü biyoloji eğitimi programlarını karşılaştırarak uygulamakta olduğu programın içerik ve sınırlılıklarını irdeler.
C.3.2. Uygulamakta olduğu lisansüstü biyoloji eğitimi programıyla ilgili sorunları tespit ederek programın felsefesine ve yapısına yönelik değişiklik önerilerinde bulunur.
C.3.3. Uygulamakta olduğu lisansüstü biyoloji eğitimi programını geliştirmek için ilgili derslerin içeriklerini günceller veya yeni dersler önerir.
C.3.4. Öğretmenlerin ve öğretmen adaylarının hazırladıkları ders planlarıyla ilgili uygulama öncesinde ve sonrasında öğrenme/öğretme yaklaşımları temelinde dönütler verir.
YETERLİK ALANI - D: Biyoloji Eğitiminde Araştırma
D.1. Biyoloji eğitimi ile ilgili verimli ve etkili bilimsel gelişmeleri takip edebilme
D.1.1. Akademik ilgi alanlarındaki ulusal ve uluslararası bilimsel çalışmaları takip eder.
D.1.2. Biyoloji eğitimi ve ilgili alanlarda düzenlenen ulusal ve uluslararası (konferans, sempozyum, çalıştay vb.) etkinliklere katılır.
D.1.3. Yapacağı araştırmalara temel oluşturacak güncel yaklaşım, kuram, araştırma yöntem ve tekniklerini takip eder.
D.1.4. Biyoloji /fen eğitimiyle ilgili çalışmaların yayınlandığı tanınmış ulusal ve uluslararası süreli yayınlarda yer alan, akademik ilgili alanları dışındaki eğitim araştırmalarının yoğunluk kazandığı alanları takip eder.
D.1.5. Eğitim ve eğitimle ilişkili farklı disiplinlere ait genel kültür okumaları yapar.
D.1.6. Biyoloji ile ilgili alanlarda genel kültür okumaları yapar.
D.1.7. Biyoloji eğitimi ve ilgili alanlardaki sivil oluşumları (e-posta grupları, sosyal medya grupları, mesleki ağlar vb.) takip eder.
D.1.8. Yayın indekslerini ve özellikleri bilerek nitelikli yayınları takip eder.
D.2. Biyoloji eğitimini geliştirmek için yenilikçi, etkili ve verimli araştırmalar yapabilme
D.2.1. Sahip olduğu eğitim vizyonundan hareketle oluşturduğu uzmanlık alanlarında süreklilik ve derinleşmenin hedeflendiği bir araştırma planı vardır.
D.2.2. Biyoloji eğitimi ile ilgili, uzmanlaştığı alana katkı sağlayacak verimli ve nitelikli araştırmalar yapar.
D.2.3. Araştırma çalışmalarını, ilgili alan yazın ve toplumsal ihtiyaçlar çerçevesinde temellendirir.
D.2.4. Belirlenen araştırma problemi ve sorularının doğasına uygun nicel, nitel veya karma araştırma yöntemlerini kullanır.
D.2.5. Belirlenen araştırma problemi ve soruları için derlediği verileri uygun yöntem ve tekniklerle analiz eder.
D.2.6. Bilimsel araştırmalarında güncel teknolojilerden (Web tabanlı veri toplama araçları, nitel ve nicel veri analiz yazılımları vb.) yararlanır.
D.2.7. Araştırmalarını güncel çalışmalara atıfta bulunarak ilgili alan yazınla ilişkilendirir.
D.2.8. Literatürü takip edebilecek ve uluslararası literatüre katkı sağlayabilecek düzeyde yabancı dil yeterliliğine sahiptir.
D.2.9. Eğitimci kimliği ile edinmiş olduğu deneyimleri araştırmalarına yansıtır.
D.3. Araştırma sonuçlarını farklı paydaşlar ile etkili ve verimli olarak paylaşabilme
D.3.1. Tamamladığı bilimsel araştırma çıktılarını ulusal ve uluslararası çalıştay, seminer, sempozyum vb. etkinliklerde yazılı ve sözlü olarak paylaşır.
D.3.2. Tamamladığı bilimsel araştırma çıktılarını raporlaştırır, kitap, kitap bölümü veya makale olarak yayımlar.
D.3.3. Çalışmalarını yayına dönüştürürken biyoloji eğitimi ve ilgili alanlarda çalışmaların yayınlandığı, belirlenen hedef kitleye ulaşabilecek en uygun dergileri seçer.
D.3.4. Bilimsel araştırma sonuçlarını ve çıktılarını ilgili paydaşlara ulaştırmak için uygun iletişim

kanallarını (TV/radyo programı, sosyal medya, forumlar, Academia, Researchgate, Mendeley vb.) kullanır.
D.4. Meslektaşlarıyla işbirliği yaparak araştırma gruplarında etkin ve verimli çalışabilme
D.4.1. Meslektaşlarıyla ortak yürüttüğü çalışmalarda çatışma çözümü becerilerini sergiler.
D.4.2. Araştırma çalışmalarında biyoloji eğitimi alanından ve/veya farklı disiplinlerden araştırmacılarla işbirliği yapar.
D.4.3. Ulusal projelerde (TÜBİTAK, BAP, STK, özel sektör vb. tarafından desteklenen) yürütücü/araştırmacı/danışman olarak görev alır.
D.4.4. Uluslararası projelerde yürütücü/araştırmacı/danışman olarak görev alır.
YETERLİK ALANI - E: Biyoloji Eğitimine Yönelik Olumlu Tutum ve Değerler
E.1. Mesleki gelişime açık bir vizyon sergileyebilme
E.1.1. Eğitim biliminin psikolojik, felsefi, hukuksal, sosyolojik, ekonomik ve tarihi temellerinin biyoloji/fen eğitimine etkilerinin farkındadır.
E.1.2. Mesleki deneyimleriyle desteklenen gelişime açık bireysel eğitim felsefesine ve vizyonuna sahiptir.
E.1.3. Biyoloji eğitimine yönelik dünyadaki güncel gelişmeleri sunduğu eğitim uygulamaları ve araştırmalarıyla ilişkilendirir.
E.1.4. Biyoloji öğretimi için geliştirilen teknolojilerin ve yeni düzenlemelerin uyarlanmasında öncülük/liderlik edecek niteliklere sahiptir.
E.1.5. Biyoloji öğretim yöntemlerini geliştirmek adına bireysel öğrenmesini geliştirir.
E.1.6. Öğretmen yetiştirme ve eğitiminin, gelişmiş uygulamalar ve gelişmeler ışığında iyileştirilmesini önemser.
E.1.7. Meslektaşlarının biyoloji eğitimiyle ilgili uygulamalarından ve deneyimlerinden yararlanarak kendi eğitim vizyonuna yön verecek çıkarımlarda bulunur.
E.1.8. Öz değerlendirme yoluyla güçlü ve gelişmeye açık olduğu yönlerini belirleyip mesleki gelişimini planlar.
E.1.9. Mesleki deneyimlerinden faydalananarak öğretim süreçlerini günceller.
E.1.10. Alan bilgisini geliştirmeyi akademik bir sorumluluk olarak görür.
E.1.11. Uzmanlık alanı ile ilgili bilimsel çalışmaları yakından takip ederek mesleki gelişimine katkı sağlar.
E.1.12. Biyoloji eğitiminde yenilik ve değişime odaklanan öğrenme topluluklarına aktif katılım sağlar.
E.1.13. Biyoloji eğitimine yönelik farklı görüşlere saygı gösterir.
E.1.14. Biyoloji öğretmen eğitimi alanındaki yeniliklere açıktır.
E.1.15. Biyoloji eğitiminde araştırma tabanlı yenilikleri destekler.
E.1.16. Meslektaşları, öğretmenler, öğretmen adayları ve öğretmen eğitimcisi adaylarının mesleki gelişimlerine katkı sağlamak adına gelişim fırsatları yaratır.
E.2. Meslek etiğine uygun davranış sergileme
E.2.1. Mesleki gelişimini biyoloji eğitimi iyileştirmek adına önceliklendirir.
E.2.2. İntihal, dilimleme, sahtecilik, çarpıtma, duplikasyon, hediye yazarlık, gölge yazarlık vb. etik ihlalleri konusunda farkındalığı yüksektir.
E.2.3. Görev ve sorumlulukları çerçevesinde karşılaştığı etik ihlallerini ilgili kişi ve/veya birimlere bildirir.
E.2.4. Araştırmalarını yürütürken etik kurallara ilişkin protokolleri (muafakat belgesi alma, anonimlik vb.) izler.
E.2.5. Jüri görevleri ve hakemliklerde ilgili etik kuralları takip eder.
E.2.6. Biyoloji eğitimi ve ilgili alanlardaki dergilerin, indekslerin ve etkinliklerin niteliğini ayırt eder.
E.2.7. Araştırmacı, eğitimci gibi farklı rolleri arasında dengeli dağılım sağlayacak özdüzenleme becerisi sergiler.
E.3. Öğretmen ve öğretmen adaylarının biyoloji eğitimine yönelik olumlu tutum ve değerler geliştirmelerini destekleyebilme

E.3.1. Biyoloji öğretmeni ve öğretmen adaylarının mesleki gelişimlerine katkıda bulunabilecek seminer, kongre ve çalıştay gibi etkinliklere katılımını teşvik eder.
E.3.2. Biyoloji öğretmeni adaylarının biyoloji öğretimine yönelik motivasyonlarını artıracak ve öz-yeterlik algılarını geliştirecek fiziksel ve psikolojik ortamlar tasarlar.
E.3.3. Öğretmenlerin ve öğretmen adaylarının sosyal, ekonomik ve fiziki olarak farklı çalışma ortamlarında biyoloji öğretmeyle ilgili fırsatları ve zorlukları değerlendirebilecekleri ortamlar oluşturur.
E.3.4. Öğretmen ve öğretmen adaylarına biyoloji öğretimi konusunda rehberlik etmek adına yüksek motivasyon sergiler.
E.3.5. Öğretmen ve öğretmen adaylarının inanç sistemleri, eğitim ve öğretime yönelik tutumları vb. süreçleri sunduğu eğitimlerde göz önünde bulundurulur.
E.3.6. Öğretmen ve öğrencilerin biyoloji öğretimi ve öğrenimi konusunda yaşadığı problemlerin çözümüne yönelik önerilerde bulunur.
E.4. Aday öğretmen eğitimcilerinin biyoloji eğitimine yönelik olumlu tutum ve değerler geliştirmelerini destekleyebilme
E.4.1. Aday öğretmen eğitimcilerinin, biyoloji eğitimi alanında ulusal ve uluslararası boyutta önde gelen araştırmacıların çalışmalarını tanıyabilecekleri fırsatlar oluşturur.
E.4.2. Aday öğretmen eğitimcilerinin ulusal ve uluslararası kongre, konferans, seminer, çalıştay vb. ortamlara katılımını teşvik eder.
E.4.3. Aday öğretmen eğitimcilerinin yaptıkları çalışmaları geliştirebilmeleri için geri bildirimlerde bulunur.
E.4.4. Aday öğretmen eğitimcilerinin motivasyonlarını artıracak ve akademik öz-yeterlik algılarını geliştirecek fiziksel ve psikolojik ortamlar oluşturur.
E.5. Biyoloji eğitiminin gelişimine yönelik işbirliği becerisi sergileme
E.5.1. Öğretmen adayı, öğretmen, öğretmen eğitimcisi adayı ve meslektaşları ile yapıcı ve gelişim odaklı iletişim kurar.
E.5.2. Ortak çalışmalar yürüttüğü kişilerin gelişime açık yönlerini ileri götürmek amacı ile sağlıklı, verimli ve etkili iletişim geliştirir.
E.5.3. Ortak çalışmalar yürüttüğü grup üyeleri ile yeterlikleri ve yetkinlikleri kapsamında işbölümü yapabilir.
E.5.4. Ortak çalışmalarda ele alınan işbölümü kapsamında sorumluluklarını yerine getirir.
E.5.5. Biyoloji eğitimi önceliğinde yerel, ulusal ve uluslararası eğitim araştırmaları kapsamında çalışma gruplarına katkı sağlar.
YETERLİK ALANI - F: Toplumda Biyoloji Eğitimi Destekleme
F.1. Biyoloji öğretmenlerine yönelik etkili hizmet içi eğitim programları düzenleyebilme
F.1.1. Biyoloji öğretmenlerine yönelik hizmet içi eğitim programlarında aktif rol alır.
F.1.2. Ulusal ve uluslararası hizmet içi eğitim modellerini ve programlarını irdeleyerek amaca uygun modeli seçer.
F.1.3. Hizmet içi eğitim programlarında kullanılmak üzere amaca uygun öğretim materyalleri ve teknoloji uygulamaları geliştirir.
F.1.4. Hizmet içi eğitim uygulamalarında öğretmenlerin bireysel farklılıklarını (bilgi, inanış, deneyim vb.) dikkate alır.
F.1.5. Biyoloji öğretmenlerinin hizmet içi eğitim ihtiyaçlarını temel alarak eğitim sürecini planlar.
F.1.6. Rol aldığı hizmet içi eğitim uygulamalarında yetişkin eğitiminin özelliklerini dikkate alır.
F.1.7. Rol aldığı hizmet içi eğitim uygulamalarında teori ve pratiği birlikte ele alır.
F.2. Eğitimin paydaş kurumlarını (politika yapıcı, STK, okul vb.) destekleme
F.2.1. Biyoloji eğitimi önceliğinde yerel, ulusal ve uluslararası eğitim politikalarını takip eder.
F.2.2. Biyoloji eğitimi önceliğinde eğitimin niteliğini artırmaya yönelik yerel, ulusal ve uluslararası eğitim politikalarını geliştirici araştırmalar yapar.

F.2.3. Başta uzmanlaştığı alan olmak üzere eğitim ile ilgili alanlarda sivil toplum kuruluşları, kamu kurumları vb. kurumların doküman hazırlama çalışmalarına (rapor, politika önerileri vb.) görüş ve önerileriyle katkı sunar.
F.2.4. Biyoloji eğitimiyle ilgili paydaşlara yönelik mesleki toplantı/seminer/konferans düzenler.
F.2.5. Biyoloji eğitimiyle ilgili içerik ve program geliştirme süreçlerine aktif katılır.
F.2.6. Diğer ülkelerdeki eğitim politikalarını ve uygulamalarını irdeleyerek bunların ülkemizde uygulanabilirliğini/uyarlanabilirliğini ilgili paydaşların dikkatine sunar.
F.3. Toplumda biyoloji eğitiminin gelişimine liderlik etme
F.3.1. Biyoloji eğitimindeki sorunlar ve çözüm yolları konusunda toplumu aydınlatıcı paylaşımlarda (rapor, makale, kitap, konuşma) bulunur.
F.3.2. Biyoloji eğitimiyle ilgili sahadaki ihtiyaçları tespit eder ve bunları gidermeye yönelik faaliyetlerde (toplantı, çalıştay vb.) bulunur.
F.3.3. Ülkemizdeki eğitim süreçleri ve farklı uygulamaları yerinde inceleyerek ilgili paydaşların dikkatine sunar.
F.3.4. Geliştirdiği örnek uygulamaları ve materyalleri ilgili paydaşların kullanımına sunar.
F.3.5. Biyoloji eğitiminde kullanılabilecek ders kitabı hazırlama ve/veya öğretim materyalleri geliştirme süreçlerine aktif katılır.
F.3.6. Biyoloji eğitimi ve ilgili alanlarda yapılan çalışmalar (dergi, kitap, proje, yarışma, sempozyum vb.) için hakemlik/editörlük yapar.
F. 4. Meslektaşlarının mesleki gelişimini destekleyebilme
F.4.1. Biyoloji /fen eğitimiyle ilgili çalışma gruplarının ve STK'ların mesleki gelişimle ilgili faaliyetlerinde aktif rol alır.
F.4.2. Mesleki gelişimi destekleyecek ders malzemeleri geliştirir ve meslektaşlarıyla paylaşır.
F.4.3. Mesleki bilgi ve deneyimlerini farklı ortamlarda (sosyal paylaşım, seminer, panel, çalıştay vb.) paylaşır.
F.4.4. Mesleki gelişim sağlayacak konuların farklı ortamlarda (sosyal paylaşım, panel, çalıştay vb.) ele alınmasında aktif rol alır.

DELPHI 2. TUR ANALİZ SONUÇLARI

(Not. Boyalı hücreler ilgili kriter için belirlenen eşit değerinin altında kaldığını göstermektedir.)

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,24	1,23	9,0	1,50	8,00	9,00	0,00	15,15	84,85
A.1.1	8,13	1,21	9,0	2,00	7,00	9,00	0,00	10,53	89,47
A.1.2	8,16	1,12	9,0	2,00	7,00	9,00	0,00	5,41	94,59
A.1.3	8,65	0,68	9,0	0,50	9,00	9,00	0,0	0,0	100,0
A.1.4	8,32	1,11	9,0	1,50	8,00	9,00	0,00	8,11	91,89
A.1.5	8,42	0,87	9,0	1,75	7,50	9,00	0,00	0,00	100,00
A.1.6	7,89	1,05	8,0	2,00	7,00	9,00	0,00	8,11	91,89
A.1.7	7,16	1,60	7,0	3,00	6,00	9,00	5,26	28,95	65,79
A.2	7,67	1,53	8,0	2,50	7,00	9,00	0,00	24,24	75,76
A.2.1	7,57	1,75	9,0	3,00	6,00	9,00	2,86	25,71	71,43
A.2.2	7,87	1,23	8,0	2,00	7,00	9,00	0,00	10,53	89,47
A.2.3	7,97	1,26	9,0	2,00	7,00	9,00	0,00	13,16	86,84
A.2.4	8,03	1,15	9,0	2,00	7,00	9,00	0,00	7,89	92,11
A.2.5	8,18	1,11	9,0	1,25	8,00	9,00	0,0	10,5	89,5
A.2.6	7,35	1,48	7,0	3,00	6,00	9,00	2,70	24,32	72,97
A.3	8,07	1,57	9,0	2,00	7,00	9,00	3,70	11,11	85,19
A.3.1	7,51	1,63	8,0	3,00	6,00	9,00	2,70	24,32	72,97
A.3.2	7,55	1,41	7,5	2,00	7,00	9,00	0,00	18,42	81,58
A.3.3	7,83	1,18	8,0	2,00	7,00	9,00	0,00	8,33	91,67
A.3.4	7,82	1,39	8,0	2,00	7,00	9,00	0,00	15,79	84,21
A.3.5	7,84	1,24	8,0	2,00	7,00	9,00	0,00	16,22	83,78
A.3.6	8,13	1,09	9,0	2,00	7,00	9,00	0,00	7,89	92,11
A.3.7	8,26	1,13	9,0	2,00	7,00	9,00	0,0	13,2	86,8
A.3.8	7,92	1,28	8,5	2,00	7,00	9,00	0,00	15,79	84,21
A.4	7,58	1,32	7,5	2,00	7,00	9,00	0,00	16,67	83,33
A.4.1	7,97	1,22	8,0	2,00	7,00	9,00	0,00	15,79	84,21
A.4.2	7,89	1,18	8,0	2,00	7,00	9,00	0,00	13,16	86,84
A.4.3	8,00	1,19	8,0	2,00	7,00	9,00	0,00	10,53	89,47
A.4.4	6,92	1,60	7,0	2,00	6,00	8,00	2,63	28,95	68,42
A.4.5	7,74	1,41	8,0	2,00	7,00	9,00	0,00	21,05	78,95
A.4.6	7,29	1,35	7,0	3,00	6,00	9,00	0,00	28,95	71,05
B.1	7,77	1,31	7,5	2,00	7,00	9,00	0,00	11,54	88,46
B.1.1	7,71	1,31	8,0	2,00	7,00	9,00	0,00	15,79	84,21
B.1.2	7,32	1,36	7,0	1,50	7,00	8,00	0,00	18,92	81,08
B.1.3	7,97	1,33	8,0	2,00	7,00	9,00	0,00	13,16	86,84
B.1.4	7,92	1,34	8,5	2,00	7,00	9,00	0,00	13,89	86,11

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,24	1,23	9,0	1,50	8,00	9,00	0,00	15,15	84,85
B.1.5	7,64	1,36	8,0	2,00	7,00	9,00	0,00	22,22	77,78
B.2	7,84	1,46	8,0	2,00	7,00	9,00	0,00	16,00	84,00
B.2.1	8,21	1,17	9,0	1,00	8,00	9,00	0,00	10,53	89,47
B.2.2	8,21	1,19	9,0	2,00	7,00	9,00	0,00	7,89	92,11
B.2.3	8,16	1,24	9,0	2,00	7,00	9,00	0,00	13,51	86,49
B.2.4	8,11	1,23	9,0	2,00	7,00	9,00	0,00	10,53	89,47
B.2.5	8,21	1,17	9,0	1,25	8,00	9,00	0,00	7,89	92,11
B.2.6.	7,97	1,26	9,0	2,00	7,00	9,00	0,00	10,81	89,19
B.3	7,85	1,03	8,0	2,00	7,00	9,00	0,00	11,11	88,89
B.3.1	8,05	1,29	8,5	2,00	7,00	9,00	2,63	7,89	89,47
B.3.2	8,00	1,34	9,0	2,00	7,00	9,00	2,63	7,89	89,47
B.3.3	8,03	1,40	9,0	2,00	7,00	9,00	2,63	10,53	86,84
B.3.4	7,87	1,46	9,0	2,00	7,00	9,00	2,63	13,16	84,21
B.3.5	7,79	1,42	8,0	2,00	7,00	9,00	2,63	13,16	84,21
B.4	8,08	1,25	9,0	1,75	7,50	9,00	0,00	16,67	83,33
B.4.1	7,55	1,48	8,0	2,00	7,00	9,00	0,00	18,42	81,58
B.4.2	8,00	1,27	9,0	2,00	7,00	9,00	0,00	13,16	86,84
B.4.3	7,89	1,48	9,0	2,00	7,00	9,00	2,63	13,16	84,21
B.4.4	7,87	1,55	9,0	2,00	7,00	9,00	2,63	15,79	81,58
B.4.5	7,89	1,50	9,0	2,00	7,00	9,00	2,63	10,53	86,84
B.5.	7,84	1,07	8,0	2,00	7,00	9,00	0,00	8,00	92,00
B.5.1.	7,42	1,35	7,0	2,00	7,00	9,00	2,63	13,16	84,21
B.5.2	7,35	1,67	8,0	2,00	7,00	9,00	5,41	16,22	78,38
B.5.3	7,61	1,65	8,0	2,00	7,00	9,00	5,26	13,16	81,58
B.5.4	7,62	1,44	8,0	2,00	7,00	9,00	2,70	16,22	81,08
B.5.5.	7,62	1,62	8,0	2,00	7,00	9,00	5,41	8,11	86,49
B.5.6.	7,68	1,63	8,0	2,00	7,00	9,00	5,41	10,81	83,78
B.6.	7,75	1,11	8,0	2,00	7,00	9,00	0,00	14,29	85,71
B.6.1.	8,11	1,14	9,0	2,00	7,00	9,00	0,00	11,11	88,89
B.6.2.	8,05	1,15	8,0	1,50	8,00	9,00	0,00	10,81	89,19
B.6.3.	8,24	1,22	9,0	1,00	8,00	9,00	2,63	5,26	92,11
B.7.	7,63	1,13	7,5	2,00	7,00	9,00	0,00	12,50	87,50
B.7.1	7,71	1,47	8,0	2,00	7,00	9,00	2,94	17,65	79,41
B.7.2.	7,71	1,47	8,0	2,00	7,00	9,00	2,94	14,71	82,35
B.7.3.	7,62	1,46	8,0	2,00	7,00	9,00	2,94	14,71	82,35
B.7.4.	7,50	1,48	8,0	2,00	7,00	9,00	2,94	17,65	79,41
B.7.5.	8,03	1,14	9,0	2,00	7,00	9,00	0,00	8,11	91,89

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,24	1,23	9,0	1,50	8,00	9,00	0,00	15,15	84,85
B.7.6.	7,81	1,26	8,0	2,00	7,00	9,00	0,00	16,67	83,33
B.8.	7,15	1,38	7,0	1,25	7,00	8,00	0,00	15,38	84,62
B.8.1	7,63	1,33	8,0	2,00	7,00	9,00	0,00	17,14	82,86
B.8.2	7,53	1,40	8,0	2,00	7,00	9,00	0,00	19,44	80,56
B.8.3	7,69	1,58	8,0	2,00	7,00	9,00	2,78	13,89	83,33
B.8.4	7,89	1,30	8,0	2,00	7,00	9,00	0,00	11,11	88,89
B.8.5	7,72	1,43	8,0	2,00	7,00	9,00	0,00	16,67	83,33
B.9	8,12	1,18	8,5	2,00	7,00	9,00	0,00	3,85	96,15
B.9.1	8,13	1,17	9,0	2,00	7,00	9,00	0,00	7,89	92,11
B.9.2	7,71	1,21	8,0	2,00	7,00	9,00	0,00	13,16	86,84
B.9.3	8,11	1,13	9,0	2,00	7,00	9,00	0,00	10,53	89,47
B.9.4	7,97	1,17	8,0	2,00	7,00	9,00	0,00	7,89	92,11
B.9.5	7,95	1,31	8,0	2,00	7,00	9,00	2,63	7,89	89,47
B.9.6	8,27	1,24	9,0	1,00	8,00	9,00	2,70	2,70	94,59
B.9.7	8,18	1,27	9,0	1,25	8,00	9,00	2,63	5,26	92,11
B.9.8	8,03	1,35	8,5	2,00	7,00	9,00	2,63	7,89	89,47
C.1	7,79	1,38	8,0	2,00	7,00	9,00	0,00	12,50	87,50
C.1.1	7,86	1,16	8,0	2,00	7,00	9,00	0,00	13,51	86,49
C.1.2	8,08	1,19	9,0	2,00	7,00	9,00	0,00	8,11	91,89
C.1.3.	8,20	1,21	9,0	2,00	7,50	9,00	0,00	8,57	91,43
C.2.	8,30	0,99	9,0	1,00	8,00	9,00	0,00	7,41	92,59
C.2.1	7,83	1,25	8,0	2,00	7,00	9,00	0,00	11,43	88,57
C.2.2.	7,97	1,21	8,0	2,00	7,00	9,00	0,00	10,81	89,19
C.2.3	8,19	1,17	9,0	1,50	8,00	9,00	0,00	8,11	91,89
C.2.4.	8,33	0,93	9,0	1,00	8,00	9,00	0,00	5,56	94,44
C.2.5	8,24	1,12	9,0	1,00	8,00	9,00	0,00	10,81	89,19
C.2.6.	8,32	1,03	9,0	1,00	8,00	9,00	0,00	5,41	94,59
C.2.7.	8,13	1,26	9,0	2,00	7,00	9,00	0,00	10,53	89,47
C.2.8	7,92	1,32	8,5	2,00	7,00	9,00	0,00	15,79	84,21
C.2.9	7,97	1,28	8,5	2,00	7,00	9,00	0,00	13,16	86,84
C.2.10	8,24	1,10	9,0	2,00	7,00	9,00	0,00	7,89	92,11
C.2.11	7,26	1,46	7,0	3,00	6,00	9,00	0,00	28,57	71,43
C.3.	7,67	1,15	7,0	2,00	7,00	9,00	0,00	14,29	85,71
C.3.1	7,89	1,05	8,0	2,00	7,00	9,00	0,00	5,41	94,59
C.3.2.	7,83	1,08	8,0	2,00	7,00	9,00	0,00	8,33	91,67
C.3.3.	7,91	1,09	8,0	2,00	7,00	9,00	0,00	8,57	91,43
D.1.	8,29	1,12	9,0	1,75	7,50	9,00	0,00	7,14	92,86

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,24	1,23	9,0	1,50	8,00	9,00	0,00	15,15	84,85
D.1.1.	8,34	1,12	9,0	1,00	8,00	9,00	0,00	7,89	92,11
D.1.2	8,21	1,21	9,0	2,00	7,00	9,00	0,00	10,53	89,47
D.1.3.	8,55	1,06	9,0	0,00	9,00	9,00	0,0	5,3	94,7
D.1.4.	8,18	1,23	9,0	2,00	7,00	9,00	0,00	7,89	92,11
D.1.5.	7,74	1,33	8,0	2,00	7,00	9,00	0,00	18,42	81,58
D.1.6.	7,86	1,08	8,0	2,00	7,00	9,00	0,00	5,41	94,59
D.1.7.	7,14	1,67	7,0	3,00	6,00	9,00	2,70	27,03	70,27
D.1.8.	7,97	1,65	9,0	2,00	7,00	9,00	2,6	10,5	86,8
D.2.	7,96	1,34	8,5	2,00	7,00	9,00	0,00	7,69	92,31
D.2.1	8,00	1,19	8,0	2,00	7,00	9,00	0,00	7,89	92,11
D.2.2.	8,16	1,20	9,0	1,00	8,00	9,00	0,00	7,89	92,11
D.2.3.	7,39	1,31	7,0	2,00	7,00	9,00	0,00	18,42	81,58
D.2.4.	7,87	1,46	8,5	2,00	7,00	9,00	0,00	13,16	86,84
D.2.5.	8,08	1,30	9,0	2,00	7,00	9,00	0,00	7,89	92,11
D.2.6.	8,08	1,34	9,0	1,25	8,00	9,00	0,00	13,16	86,84
D.2.7	8,17	1,30	9,0	1,00	8,00	9,00	0,00	8,33	91,67
D.2.8.	7,97	1,48	9,0	2,00	7,00	9,00	0,00	18,42	81,58
D.2.9.	7,74	1,41	8,0	2,00	7,00	9,00	0,00	18,42	81,58
D.3.	7,88	1,13	8,0	2,00	7,00	9,00	0,00	12,00	88,00
D.3.1.	7,97	1,26	8,0	2,00	7,00	9,00	0,00	13,16	86,84
D.3.2.	8,11	1,23	9,0	2,00	7,00	9,00	0,00	7,89	92,11
D.3.3.	7,74	1,64	8,0	2,00	7,00	9,00	2,63	13,16	84,21
D.3.4.	7,16	1,59	7,0	3,50	6,00	9,00	0,00	29,73	70,27
D.4.	7,65	0,94	7,5	1,25	7,00	8,00	0,00	7,69	92,31
D.4.1.	7,58	1,08	7,0	2,00	7,00	9,00	0,00	5,26	94,74
D.4.2.	7,81	1,10	8,0	2,00	7,00	9,00	0,00	10,81	89,19
D.4.3.	7,46	1,17	7,0	1,00	7,00	8,00	0,00	13,51	86,49
D.4.4.	7,30	1,20	7,0	1,00	7,00	8,00	0,00	18,92	81,08
E.1.	7,93	1,09	8,0	2,00	7,00	9,00	0,00	10,71	89,29
E.1.1.	7,89	1,15	8,0	2,00	7,00	9,00	0,00	13,51	86,49
E.1.2.	7,89	1,16	8,0	2,00	7,00	9,00	0,00	10,53	89,47
E.1.3.	8,11	0,98	8,0	1,25	8,00	9,00	0,00	5,26	94,74
E.1.4.	7,42	1,32	7,0	2,00	7,00	9,00	0,00	19,44	80,56
E.1.5.	8,05	1,11	8,5	2,00	7,00	9,00	0,00	7,89	92,11
E.1.6.	8,13	1,07	8,5	2,00	7,00	9,00	0,00	7,89	92,11
E.1.7.	7,87	1,14	8,0	2,00	7,00	9,00	0,00	7,89	92,11
E.1.8.	8,00	1,11	8,0	2,00	7,00	9,00	0,00	8,11	91,89

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,24	1,23	9,0	1,50	8,00	9,00	0,00	15,15	84,85
E.1.9.	8,05	1,06	8,0	2,00	7,00	9,00	0,00	7,89	92,11
E.1.10	8,21	1,04	9,0	2,00	7,00	9,00	0,00	5,26	94,74
E.1.11	8,26	1,06	9,0	1,00	8,00	9,00	0,00	7,89	92,11
E.1.12	7,68	1,16	8,0	2,00	7,00	9,00	0,00	15,79	84,21
E.1.13	8,34	1,10	9,0	1,00	8,00	9,00	0,00	10,53	89,47
E.1.14	8,42	1,00	9,0	1,00	8,00	9,00	0,00	7,89	92,11
E.1.15	8,37	1,00	9,0	1,00	8,00	9,00	0,00	7,89	92,11
E.1.16	8,13	1,02	8,0	2,00	7,00	9,00	0,00	5,26	94,74
E.2.	8,59	0,97	9,0	0,00	9,00	9,00	0,0	7,4	92,6
E.2.1.	8,16	1,10	9,0	1,25	8,00	9,00	0,00	10,53	89,47
E.2.2.	8,49	0,99	9,0	1,00	8,00	9,00	0,0	5,4	94,6
E.2.3.	8,38	1,16	9,0	1,00	8,00	9,00	0,0	10,8	89,2
E.2.4.	8,26	1,18	9,0	1,00	8,00	9,00	0,00	10,53	89,47
E.2.5.	8,41	1,07	9,0	1,00	8,00	9,00	0,0	8,1	91,9
E.2.6.	8,03	1,26	9,0	2,00	7,00	9,00	0,0	13,2	86,8
E.2.7.	8,03	1,15	8,0	2,00	7,00	9,00	0,00	7,89	92,11
E.3.	7,96	1,23	8,0	2,00	7,00	9,00	0,00	7,14	92,86
E.3.1.	7,94	1,04	8,0	2,00	7,00	9,00	0,00	5,56	94,44
E.3.2	7,82	1,27	8,0	2,00	7,00	9,00	0,00	13,16	86,84
E.3.3.	7,58	1,43	8,0	2,00	7,00	9,00	0,00	21,05	78,95
E.3.4	7,89	1,20	8,0	2,00	7,00	9,00	0,00	5,26	94,74
E.3.5	7,27	1,77	7,0	2,50	7,00	9,00	2,70	21,62	75,68
E.3.6	8,03	1,24	8,5	2,00	7,00	9,00	0,00	7,89	92,11
E.4.	7,44	1,34	8,0	1,00	7,00	8,00	0,00	18,52	81,48
E.4.1	7,27	1,45	7,0	1,00	7,00	8,00	2,70	18,92	78,38
E.4.2	7,76	1,51	8,0	2,00	7,00	9,00	2,63	13,16	84,21
E.4.3	8,19	1,49	9,0	1,00	8,00	9,00	2,78	5,56	91,67
E.4.4	7,89	1,43	8,0	2,00	7,00	9,00	2,70	8,11	89,19
E.5.	8,04	1,06	8,0	2,00	7,00	9,00	0,00	8,00	92,00
E.5.1.	8,03	1,19	8,0	2,00	7,00	9,00	0,0	8,1	91,9
E.5.2.	8,16	1,17	9,0	2,00	7,00	9,00	0,0	7,9	92,1
E.5.3.	8,00	1,21	8,0	2,00	7,00	9,00	0,00	10,53	89,47
E.5.4.	8,21	1,23	9,0	1,00	8,00	9,00	0,0	13,2	86,8
E.5.5.	7,68	1,16	8,0	2,00	7,00	9,00	0,00	13,16	86,84
F.1.	6,91	1,23	7,0	1,25	6,00	7,00	0,00	31,82	68,18
F.1.1.	7,40	1,31	7,0	2,00	7,00	8,50	0,00	20,00	80,00
F.1.2	7,58	1,27	7,0	2,00	7,00	9,00	0,00	16,67	83,33

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,24	1,23	9,0	1,50	8,00	9,00	0,00	15,15	84,85
F.1.3	7,56	1,40	8,0	2,00	7,00	9,00	0,00	22,22	77,78
F.1.4	7,09	1,40	7,0	3,00	6,00	8,50	0,00	40,00	60,00
F.1.5	7,46	1,54	8,0	2,00	7,00	9,00	2,86	20,00	77,14
F.1.6	7,49	1,56	8,0	2,00	7,00	9,00	2,86	17,14	80,00
F.1.7.	7,50	1,18	7,5	1,00	7,00	8,00	0,00	13,89	86,11
F.2.	7,00	1,41	7,0	2,00	6,00	8,00	4,00	24,00	72,00
F.2.1.	7,39	1,44	7,5	2,00	7,00	9,00	0,00	22,22	77,78
F.2.2.	7,11	1,41	7,0	2,00	6,00	8,00	0,00	27,03	72,97
F.2.3	6,78	1,38	7,0	2,00	6,00	8,00	0,00	38,89	61,11
F.2.4	6,97	1,40	7,0	2,00	6,00	8,00	0,00	32,43	67,57
F.2.5	7,16	1,24	7,0	1,50	7,00	8,00	0,00	24,32	75,68
F.2.6.	7,43	1,34	7,0	2,00	7,00	9,00	0,00	21,62	78,38
F.3.	7,72	0,94	7,0	2,00	7,00	9,00	0,00	4,00	96,00
F.3.1.	8,18	1,16	9,0	1,50	8,00	9,00	0,00	6,06	93,94
F.3.2.	7,86	1,23	8,0	2,00	7,00	9,00	0,00	8,11	91,89
F.3.3.	7,67	1,17	8,0	1,75	7,00	8,50	0,00	11,11	88,89
F.3.4.	7,95	1,27	8,0	2,00	7,00	9,00	0,00	10,81	89,19
F.3.5	8,08	1,26	9,0	2,00	7,00	9,00	0,00	8,11	91,89
F.3.6	7,49	1,44	7,0	2,00	7,00	9,00	0,00	20,00	80,00
F.4.	6,90	1,45	7,0	2,00	6,00	8,00	0,00	30,00	70,00
F.4.1	7,05	1,56	7,0	3,00	6,00	8,00	0,00	35,14	64,86
F.4.2	7,37	1,40	7,5	2,25	7,00	9,00	0,00	23,68	76,32
F.4.3	7,55	1,20	7,5	2,00	7,00	9,00	0,00	13,16	86,84
F.4.4	7,39	1,15	7,0	1,00	7,00	8,00	0,00	13,16	86,84

DELPHI 3. TUR ANALİZ SONUÇLARI

(Not. Boyalı hücreler ilgili kriter için belirlenen eşit değerinin altında kaldığını göstermektedir.)

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,57	0,85	9,0	1,00	8,00	9,00	0,00	5,71	94,29
A.1.1	8,28	1,16	9,0	1,00	8,00	9,00	0,00	8,33	91,67
A.1.2	8,28	0,97	9,0	1,75	7,25	9,00	0,00	5,56	94,44
A.1.3	8,69	0,63	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.1.4	8,46	0,95	9,0	1,00	8,00	9,00	0,00	5,71	94,29
A.1.5	8,51	0,82	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.1.6	7,97	1,07	8,0	2,00	7,00	9,00	0,00	5,71	94,29
A.1.7	7,19	1,45	7,0	2,75	6,00	8,75	2,78	30,56	66,67
A.2	8,31	0,95	9,0	1,00	8,00	9,00	0,00	5,56	94,44
A.2.1	8,11	1,19	9,0	2,00	7,00	9,00	0,00	11,11	88,89
A.2.2	8,06	1,12	9,0	2,00	7,00	9,00	0,00	5,56	94,44
A.2.3	8,17	1,03	9,0	2,00	7,00	9,00	0,00	5,56	94,44
A.2.4	8,19	0,98	9,0	2,00	7,00	9,00	0,00	2,78	97,22
A.2.5	8,42	0,84	9,0	1,00	8,00	9,00	0,00	2,78	97,22
A.2.6	7,56	1,23	7,0	2,00	7,00	9,00	0,00	16,67	83,33
A.3	8,40	1,63	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.3.1	8,09	1,09	8,0	1,00	8,00	9,00	0,00	11,43	88,57
A.3.2	7,78	1,29	8,0	2,00	7,00	9,00	0,00	11,11	88,89
A.3.3	7,94	1,15	8,0	2,00	7,00	9,00	0,00	5,56	94,44
A.3.4	8,14	1,13	9,0	2,00	7,00	9,00	0,00	2,78	97,22
A.3.5	8,11	1,12	9,0	2,00	7,00	9,00	0,00	5,56	94,44
A.3.6	8,28	1,03	9,0	1,00	8,00	9,00	0,00	5,56	94,44
A.3.7	8,39	0,99	9,0	1,00	8,00	9,00	0,00	8,33	91,67
A.3.8	8,22	1,07	9,0	2,00	7,00	9,00	0,00	5,56	94,44
A.4	7,83	1,27	8,0	2,00	7,00	9,00	0,00	14,29	85,71
A.4.1	8,22	0,99	8,5	1,00	8,00	9,00	0,00	5,56	94,44
A.4.2	8,03	1,16	8,0	1,75	7,25	9,00	0,00	11,11	88,89
A.4.3	8,08	1,16	8,5	2,00	7,00	9,00	0,00	8,33	91,67
A.4.4	7,11	1,53	7,0	1,00	7,00	8,00	2,78	19,44	77,78
A.4.5	8,00	1,26	8,5	2,00	7,00	9,00	0,00	13,89	86,11
A.4.6	7,47	1,30	7,5	2,00	7,00	9,00	0,00	22,22	77,78
B.1	7,97	1,14	8,5	2,00	7,00	9,00	0,00	5,88	94,12
B.1.1	7,81	1,21	8,0	2,00	7,00	9,00	0,00	11,11	88,89
B.1.2	7,44	1,25	7,0	1,75	7,00	8,75	0,00	13,89	86,11
B.1.3	8,19	1,17	9,0	1,00	8,00	9,00	0,00	5,56	94,44
B.1.4	8,11	1,26	9,0	2,00	7,00	9,00	0,00	8,33	91,67
B.1.5	7,89	1,21	8,0	2,00	7,00	9,00	0,00	11,43	88,57
B.2	8,31	1,08	9,0	1,00	8,00	9,00	0,00	5,71	94,29
B.2.1	8,39	1,05	9,0	1,00	8,00	9,00	0,00	8,33	91,67
B.2.2	8,36	1,07	9,0	1,75	7,25	9,00	0,00	5,56	94,44
B.2.3	8,44	1,11	9,0	0,00	9,00	9,00	0,00	8,33	91,67
B.2.4	8,28	1,14	9,0	1,00	8,00	9,00	0,00	5,56	94,44
B.2.5	8,33	1,04	9,0	1,00	8,00	9,00	0,00	2,78	97,22
B.2.6	8,11	1,19	9,0	2,00	7,00	9,00	0,00	5,56	94,44
B.3	8,21	0,88	8,0	1,25	7,75	9,00	0,00	2,94	97,06
B.3.1	8,28	1,21	9,0	1,00	8,00	9,00	2,78	2,78	94,44
B.3.2	8,22	1,24	9,0	2,00	7,00	9,00	2,78	0,00	97,22

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
B.3.3	8,25	1,25	9,0	1,00	8,00	9,00	2,78	2,78	94,44
B.3.4	8,17	1,32	9,0	2,00	7,00	9,00	2,78	5,56	91,67
B.3.5	8,11	1,26	9,0	2,00	7,00	9,00	2,78	2,78	94,44
B.4	8,56	0,70	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.4.1	7,89	1,19	8,0	2,00	7,00	9,00	0,00	8,33	91,67
B.4.2	8,25	1,13	9,0	1,00	8,00	9,00	0,00	5,56	94,44
B.4.3	8,08	1,42	9,0	2,00	7,00	9,00	2,78	5,56	91,67
B.4.4	8,17	1,34	9,0	1,00	8,00	9,00	2,78	5,56	91,67
B.4.5	8,08	1,44	9,0	2,00	7,00	9,00	2,78	5,56	91,67
B.5.	8,06	1,01	8,0	2,00	7,00	9,00	0,00	5,88	94,12
B.5.1.	7,44	1,32	7,0	1,75	7,00	8,75	2,78	8,33	88,89
B.5.2	7,47	1,59	7,5	2,00	7,00	9,00	5,56	5,56	88,89
B.5.3	7,86	1,51	8,0	2,00	7,00	9,00	5,56	2,78	91,67
B.5.4	7,86	1,38	8,0	2,00	7,00	9,00	2,78	5,56	91,67
B.5.5.	7,75	1,50	8,0	2,00	7,00	9,00	5,56	2,78	91,67
B.5.6.	7,81	1,60	8,0	2,00	7,00	9,00	5,56	2,78	91,67
B.6.	8,14	0,94	8,0	2,00	7,00	9,00	0,00	2,86	97,14
B.6.1.	8,28	1,03	9,0	1,00	8,00	9,00	0,00	5,56	94,44
B.6.2.	8,14	1,10	8,0	1,00	8,00	9,00	0,00	8,33	91,67
B.6.3.	8,39	1,10	9,0	1,00	8,00	9,00	2,78	0,00	97,22
B.7.	7,85	0,80	8,0	1,50	7,00	8,50	0,00	0,00	100,00
B.7.1	7,97	1,42	8,0	2,00	7,00	9,00	2,86	5,71	91,43
B.7.2.	8,14	1,29	9,0	1,00	8,00	9,00	2,86	2,86	94,29
B.7.3.	7,89	1,45	8,0	2,00	7,00	9,00	5,71	0,00	94,29
B.7.4.	7,60	1,48	8,0	2,00	7,00	9,00	5,71	2,86	91,43
B.7.5.	8,08	0,97	8,0	2,00	7,00	9,00	0,00	2,78	97,22
B.7.6.	7,97	1,11	8,0	2,00	7,00	9,00	0,00	5,56	94,44
B.8.	7,54	1,07	7,0	2,00	7,00	9,00	0,00	2,86	97,14
B.8.1	7,75	1,34	8,0	2,00	7,00	9,00	0,00	13,89	86,11
B.8.2	7,75	1,13	8,0	2,00	7,00	9,00	0,00	8,33	91,67
B.8.3	7,92	1,36	8,0	2,00	7,00	9,00	2,78	2,78	94,44
B.8.4	8,06	1,12	8,0	2,00	7,00	9,00	0,00	2,78	97,22
B.8.5	7,81	1,28	8,0	2,00	7,00	9,00	0,00	8,33	91,67
B.9	8,38	1,07	9,0	1,00	8,00	9,00	0,00	2,94	97,06
B.9.1	8,19	1,12	9,0	1,75	7,25	9,00	0,00	5,56	94,44
B.9.2	7,92	1,08	8,0	2,00	7,00	9,00	0,00	5,56	94,44
B.9.3	8,39	0,96	9,0	1,00	8,00	9,00	0,00	2,78	97,22
B.9.4	8,25	1,02	9,0	2,00	7,00	9,00	0,00	2,78	97,22
B.9.5	8,22	1,22	9,0	1,75	7,25	9,00	2,78	0,00	97,22
B.9.6	8,39	1,18	9,0	1,00	8,00	9,00	2,78	0,00	97,22
B.9.7	8,39	1,15	9,0	1,00	8,00	9,00	2,78	0,00	97,22
B.9.8	8,19	1,28	9,0	1,00	8,00	9,00	2,78	2,78	94,44
C.1	8,29	0,86	9,0	2,00	7,00	9,00	0,00	0,00	100,00
C.1.1	8,06	1,07	8,0	2,00	7,00	9,00	0,00	5,56	94,44
C.1.2	8,25	1,13	9,0	1,00	8,00	9,00	0,00	5,56	94,44
C.1.3.	8,25	1,16	9,0	1,75	7,25	9,00	0,00	5,56	94,44
C.2.	8,57	0,65	9,0	1,00	8,00	9,00	0,00	0,00	100,00
C.2.1	7,91	1,22	8,0	2,00	7,00	9,00	0,00	8,57	91,43
C.2.2.	8,08	1,18	8,5	2,00	7,00	9,00	0,00	8,33	91,67
C.2.3	8,28	1,14	9,0	1,00	8,00	9,00	0,00	5,56	94,44

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
C.2.4.	8,43	0,85	9,0	1,00	8,00	9,00	0,00	2,86	97,14
C.2.5	8,42	1,00	9,0	1,00	8,00	9,00	0,00	5,56	94,44
C.2.6.	8,44	1,00	9,0	1,00	8,00	9,00	0,00	5,56	94,44
C.2.7.	8,28	1,11	9,0	1,00	8,00	9,00	0,00	5,56	94,44
C.2.8	8,17	1,16	9,0	1,75	7,25	9,00	0,00	8,33	91,67
C.2.9	8,11	1,14	9,0	2,00	7,00	9,00	0,00	5,56	94,44
C.2.10	8,36	0,99	9,0	1,00	8,00	9,00	0,00	2,78	97,22
C.2.11	7,56	1,38	8,0	2,00	7,00	9,00	0,00	16,67	83,33
C.3.	8,03	1,03	8,0	2,00	7,00	9,00	0,00	5,88	94,12
C.3.1	7,89	1,04	8,0	2,00	7,00	9,00	0,00	5,56	94,44
C.3.2.	7,94	1,04	8,0	2,00	7,00	9,00	0,00	5,56	94,44
C.3.3.	8,06	0,98	8,0	2,00	7,00	9,00	0,00	2,78	97,22
D.1.	8,63	0,73	9,0	0,00	9,00	9,00	0,00	0,00	100,00
D.1.1.	8,39	1,08	9,0	1,00	8,00	9,00	0,00	5,56	94,44
D.1.2	8,42	1,13	9,0	1,00	8,00	9,00	0,00	8,33	91,67
D.1.3.	8,64	1,02	9,0	0,00	9,00	9,00	0,00	5,56	94,44
D.1.4.	8,36	1,10	9,0	1,00	8,00	9,00	0,00	5,56	94,44
D.1.5.	8,00	1,17	8,0	2,00	7,00	9,00	0,00	8,33	91,67
D.1.6.	8,08	0,97	8,0	2,00	7,00	9,00	0,00	2,78	97,22
D.1.7.	7,36	1,55	7,0	2,00	7,00	9,00	2,78	11,11	86,11
D.1.8.	8,17	1,54	9,0	1,00	8,00	9,00	2,78	2,78	94,44
D.2.	8,29	1,23	9,0	1,00	8,00	9,00	0,00	5,71	94,29
D.2.1	8,08	1,20	8,0	1,00	8,00	9,00	0,00	8,33	91,67
D.2.2.	8,39	1,05	9,0	1,00	8,00	9,00	0,00	5,56	94,44
D.2.3.	7,61	1,25	7,0	2,00	7,00	9,00	0,00	11,11	88,89
D.2.4.	8,19	1,26	9,0	1,75	7,25	9,00	0,00	8,33	91,67
D.2.5.	8,28	1,14	9,0	1,00	8,00	9,00	0,00	5,56	94,44
D.2.6.	8,28	1,11	9,0	1,00	8,00	9,00	0,00	5,56	94,44
D.2.7	8,39	1,08	9,0	1,00	8,00	9,00	0,00	5,56	94,44
D.2.8.	8,17	1,21	9,0	2,00	7,00	9,00	0,00	8,33	91,67
D.2.9.	8,06	1,17	8,0	2,00	7,00	9,00	0,00	8,33	91,67
D.3.	8,18	0,83	8,0	1,00	8,00	9,00	0,00	2,94	97,06
D.3.1.	8,14	1,13	8,0	1,00	8,00	9,00	0,00	8,33	91,67
D.3.2.	8,19	1,14	9,0	1,75	7,25	9,00	0,00	5,56	94,44
D.3.3.	7,92	1,59	8,5	2,00	7,00	9,00	2,78	8,33	88,89
D.3.4.	7,53	1,30	7,0	2,00	7,00	9,00	0,00	13,89	86,11
D.4.	7,91	0,89	8,0	2,00	7,00	9,00	0,00	2,86	97,14
D.4.1.	7,61	1,10	7,0	2,00	7,00	9,00	0,00	5,56	94,44
D.4.2.	7,89	1,06	8,0	2,00	7,00	9,00	0,00	8,33	91,67
D.4.3.	7,56	1,13	7,5	1,00	7,00	8,00	0,00	8,33	91,67
D.4.4.	7,44	1,11	7,0	1,00	7,00	8,00	0,00	11,11	88,89
E.1.	8,17	0,98	8,0	1,00	8,00	9,00	0,00	5,71	94,29
E.1.1.	7,97	1,06	8,0	2,00	7,00	9,00	0,00	8,33	91,67
E.1.2.	8,03	1,03	8,0	2,00	7,00	9,00	0,00	5,56	94,44
E.1.3.	8,14	0,99	8,0	1,00	8,00	9,00	0,00	5,56	94,44
E.1.4.	7,56	1,25	7,5	2,00	7,00	9,00	0,00	11,11	88,89
E.1.5.	8,22	1,07	9,0	2,00	7,00	9,00	0,00	5,56	94,44
E.1.6.	8,22	1,02	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.1.7.	7,89	1,14	8,0	2,00	7,00	9,00	0,00	8,33	91,67
E.1.8.	8,06	1,07	8,0	2,00	7,00	9,00	0,00	5,56	94,44

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
E.1.9.	8,19	1,01	8,5	1,00	8,00	9,00	0,00	5,56	94,44
E.1.10	8,33	1,01	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.1.11	8,42	1,00	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.1.12	7,78	1,07	8,0	2,00	7,00	9,00	0,00	8,33	91,67
E.1.13	8,47	1,03	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.14	8,53	0,94	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.1.15	8,44	0,94	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.1.16	8,28	0,97	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.2.	8,74	0,75	9,0	0,00	9,00	9,00	0,00	2,94	97,06
E.2.1.	8,33	0,99	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.2.2.	8,64	0,90	9,0	0,00	9,00	9,00	0,00	5,56	94,44
E.2.3.	8,58	0,81	9,0	0,75	8,25	9,00	0,00	2,78	97,22
E.2.4.	8,47	0,84	9,0	1,00	8,00	9,00	0,00	2,78	97,22
E.2.5.	8,56	0,84	9,0	0,75	8,25	9,00	0,00	2,78	97,22
E.2.6.	8,33	0,99	9,0	1,75	7,25	9,00	0,00	5,56	94,44
E.2.7.	8,31	0,98	9,0	1,00	8,00	9,00	0,00	2,78	97,22
E.3.	8,19	1,14	9,0	1,75	7,25	9,00	0,00	5,56	94,44
E.3.1.	8,00	0,94	8,0	2,00	7,00	9,00	0,00	2,86	97,14
E.3.2	8,03	1,13	8,0	2,00	7,00	9,00	0,00	5,56	94,44
E.3.3.	7,86	1,31	8,0	2,00	7,00	9,00	0,00	11,11	88,89
E.3.4	7,94	1,22	8,0	2,00	7,00	9,00	0,00	5,56	94,44
E.3.5	7,61	1,76	8,0	2,00	7,00	9,00	2,78	11,11	86,11
E.3.6	8,28	1,09	9,0	1,00	8,00	9,00	0,00	2,78	97,22
E.4.	7,92	1,05	8,0	2,00	7,00	9,00	0,00	2,78	97,22
E.4.1	7,61	1,13	8,0	1,75	7,00	8,75	0,00	11,11	88,89
E.4.2	8,03	1,16	8,0	2,00	7,00	9,00	0,00	5,56	94,44
E.4.3	8,47	1,08	9,0	1,00	8,00	9,00	0,00	5,56	94,44
E.4.4	8,19	1,09	9,0	1,75	7,25	9,00	0,00	2,78	97,22
E.5.	8,38	0,85	9,0	1,25	7,75	9,00	0,00	0,00	100,00
E.5.1.	8,22	1,15	9,0	1,75	7,25	9,00	0,00	5,56	94,44
E.5.2.	8,31	1,09	9,0	1,00	8,00	9,00	0,00	2,78	97,22
E.5.3.	8,22	1,15	9,0	1,75	7,25	9,00	0,00	5,56	94,44
E.5.4.	8,31	1,17	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.5.5.	7,92	1,16	8,0	2,00	7,00	9,00	0,00	8,33	91,67
F.1.	7,29	1,15	7,0	1,00	7,00	8,00	0,00	20,00	80,00
F.1.1.	7,58	1,11	7,0	1,75	7,00	8,75	0,00	8,33	91,67
F.1.2	7,89	1,17	8,0	2,00	7,00	9,00	0,00	5,56	94,44
F.1.3	7,81	1,24	8,0	2,00	7,00	9,00	0,00	8,33	91,67
F.1.4	7,36	1,40	7,0	3,00	6,00	9,00	0,00	27,78	72,22
F.1.5	7,64	1,55	8,0	2,00	7,00	9,00	2,78	8,33	88,89
F.1.6	7,86	1,24	8,0	2,00	7,00	9,00	0,00	8,57	91,43
F.1.7.	7,58	1,13	8,0	1,00	7,00	8,00	0,00	8,33	91,67
F.2.	7,56	0,96	7,0	1,00	7,00	8,00	0,00	5,88	94,12
F.2.1.	7,67	1,15	8,0	2,00	7,00	9,00	0,00	5,56	94,44
F.2.2.	7,17	1,42	7,0	1,75	6,25	8,00	0,00	25,00	75,00
F.2.3	6,86	1,31	7,0	2,00	6,00	8,00	0,00	33,33	66,67
F.2.4	7,19	1,31	7,0	1,00	7,00	8,00	0,00	22,22	77,78
F.2.5	7,25	1,23	7,0	1,00	7,00	8,00	0,00	19,44	80,56
F.2.6.	7,69	1,28	8,0	2,00	7,00	9,00	0,00	11,11	88,89
F.3.	7,94	0,92	8,0	2,00	7,00	9,00	0,00	2,94	97,06

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
F.3.1.	8,28	1,11	9,0	1,00	8,00	9,00	0,00	5,56	94,44
F.3.2.	8,08	1,11	8,0	2,00	7,00	9,00	0,00	2,78	97,22
F.3.3.	7,86	0,99	8,0	1,75	7,00	8,75	0,00	2,78	97,22
F.3.4.	8,11	1,14	8,5	2,00	7,00	9,00	0,00	5,56	94,44
F.3.5	8,25	1,08	9,0	1,00	8,00	9,00	0,00	2,78	97,22
F.3.6	7,75	1,20	8,0	2,00	7,00	9,00	0,00	11,11	88,89
F.4.	7,26	1,31	7,0	1,00	7,00	8,00	0,00	20,00	80,00
F.4.1	7,33	1,47	7,5	2,75	6,25	9,00	0,00	25,00	75,00
F.4.2	7,67	1,26	8,0	2,00	7,00	9,00	0,00	11,11	88,89
F.4.3	7,64	1,22	8,0	2,00	7,00	9,00	0,00	11,11	88,89
F.4.4	7,44	1,16	7,5	1,00	7,00	8,00	0,00	11,11	88,89



**DELPHI 3. TUR “ÖĞRETİM ELEMANI” GRUBUNDA FİKİR BİRLİĞİNİ İNCELEMEDE
KULLANILAN BETİMSSEL İSTATİSTİK SONUÇLARI**

(Not. Boyalı hücreler ilgili kriter için belirlenen eşit değerinin altında kaldığını ve dolayısıyla fikir birliğini varılmamış olduğuna işaret etmektedir.)

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,58	0,90	9,0	0,75	8,50	9,00	0,00	8,33	91,67
A.1.1	8,00	1,41	9,0	2,00	7,00	9,00	0,00	16,67	83,33
A.1.2	8,50	0,90	9,0	1,50	8,00	9,00	0,00	0,00	100,00
A.1.3	8,64	0,67	9,0	1,00	8,50	9,00	0,00	0,00	100,00
A.1.4	8,73	0,65	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.1.5	8,82	0,60	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.1.6	8,73	0,47	9,0	1,00	8,50	9,00	0,00	0,00	100,00
A.1.7	7,42	1,16	7,0	2,50	6,50	8,50	0,00	25,00	75,00
A.2	8,42	1,00	9,0	1,00	8,00	9,00	0,00	8,33	91,67
A.2.1	8,00	1,41	9,0	2,00	7,00	9,00	0,00	16,67	83,33
A.2.2	8,00	1,13	8,5	2,00	7,00	9,00	0,00	8,33	91,67
A.2.3	8,33	1,07	9,0	1,75	7,50	9,00	0,00	8,33	91,67
A.2.4	8,50	0,80	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.2.5	8,67	0,89	9,0	0,00	9,00	9,00	0,00	8,33	91,67
A.2.6	7,83	1,27	8,0	2,00	7,00	9,00	0,00	16,67	83,33
A.3	9,00	0,00	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.3.1	8,55	0,52	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.3.2	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
A.3.3	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
A.3.4	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
A.3.5	8,25	1,29	9,0	1,75	7,50	9,00	0,00	8,33	91,67
A.3.6	8,42	1,24	9,0	0,75	8,50	9,00	0,00	8,33	91,67
A.3.7	8,50	1,00	9,0	0,75	8,50	9,00	0,00	8,33	91,67
A.3.8	8,08	1,31	9,0	2,00	7,00	9,00	0,00	8,33	91,67
A.4	8,25	1,54	9,0	1,50	8,00	9,00	0,00	8,33	91,67
A.4.1	8,08	1,31	9,0	2,00	7,00	9,00	0,00	8,33	91,67
A.4.2	8,00	1,35	8,5	1,75	7,50	9,00	0,00	16,67	83,33
A.4.3	8,17	1,27	9,0	1,75	7,50	9,00	0,00	8,33	91,67
A.4.4	7,08	1,93	7,0	2,50	6,50	8,50	8,33	16,67	75,00
A.4.5	8,00	1,48	8,5	1,75	7,50	9,00	0,00	8,33	91,67
A.4.6	7,83	1,53	8,0	1,75	7,50	9,00	0,00	16,67	83,33
B.1	8,27	1,01	9,0	2,00	7,00	9,00	0,00	0,00	100,00
B.1.1	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
B.1.2	7,50	1,38	7,5	1,75	7,00	8,50	0,00	8,33	91,67
B.1.3	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
B.1.4	8,33	1,44	9,0	1,00	8,00	9,00	0,00	8,33	91,67
B.1.5	8,00	1,48	8,0	1,00	8,00	9,00	0,00	9,09	90,91
B.2	8,42	1,51	9,0	0,00	9,00	9,00	0,00	8,33	91,67
B.2.1	8,50	1,17	9,0	0,75	8,50	9,00	0,00	8,33	91,67
B.2.2	8,58	1,16	9,0	0,00	9,00	9,00	0,00	8,33	91,67
B.2.3	8,67	1,15	9,0	0,00	9,00	9,00	0,00	8,33	91,67
B.2.4	8,33	1,44	9,0	1,00	8,00	9,00	0,00	8,33	91,67
B.2.5	8,33	1,44	9,0	1,00	8,00	9,00	0,00	8,33	91,67
B.2.6	8,17	1,53	9,0	1,75	7,50	9,00	0,00	8,33	91,67
B.3	8,91	0,30	9,0	0,00	9,00	9,00	0,00	0,00	100,00
B.3.1	8,00	1,71	8,5	1,00	8,00	9,00	8,33	0,00	91,67

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
B.3.2	8,17	1,75	9,0	1,00	8,00	9,00	8,33	0,00	91,67
B.3.3	8,08	1,73	9,0	1,00	8,00	9,00	8,33	0,00	91,67
B.3.4	8,17	1,75	9,0	1,00	8,00	9,00	8,33	0,00	91,67
B.3.5	8,00	1,76	9,0	1,75	7,50	9,00	8,33	0,00	91,67
B.4	8,73	0,47	9,0	1,00	8,50	9,00	0,00	0,00	100,00
B.4.1	7,92	1,62	9,0	2,00	7,00	9,00	0,00	16,67	83,33
B.4.2	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
B.4.3	8,33	1,72	9,0	0,75	8,50	9,00	8,33	0,00	91,67
B.4.4	8,25	1,71	9,0	1,00	8,00	9,00	8,33	0,00	91,67
B.4.5	8,33	1,78	9,0	0,00	9,00	9,00	8,33	0,00	91,67
B.5.	8,27	0,90	9,0	2,00	7,50	9,00	0,00	0,00	100,00
B.5.1.	7,75	1,71	8,0	2,00	7,00	9,00	8,33	0,00	91,67
B.5.2	7,67	1,72	8,0	2,00	7,00	9,00	8,33	0,00	91,67
B.5.3	7,92	1,73	8,5	1,75	7,50	9,00	8,33	0,00	91,67
B.5.4	7,83	1,75	8,5	2,00	7,00	9,00	8,33	0,00	91,67
B.5.5.	7,75	1,71	8,0	2,00	7,00	9,00	8,33	0,00	91,67
B.5.6.	7,75	1,76	8,5	2,00	7,00	9,00	8,33	0,00	91,67
B.6.	8,33	0,89	8,5	1,00	8,00	9,00	0,00	8,33	91,67
B.6.1.	8,50	1,17	9,0	0,75	8,50	9,00	0,00	8,33	91,67
B.6.2.	8,08	1,51	9,0	1,00	8,00	9,00	0,00	16,67	83,33
B.6.3.	8,17	1,70	9,0	1,00	8,00	9,00	8,33	0,00	91,67
B.7.	8,27	0,65	8,0	1,00	8,00	9,00	0,00	0,00	100,00
B.7.1	8,00	1,76	9,0	1,75	7,50	9,00	8,33	0,00	91,67
B.7.2.	8,08	1,73	9,0	1,00	8,00	9,00	8,33	0,00	91,67
B.7.3.	7,75	1,71	8,0	2,00	7,00	9,00	8,33	0,00	91,67
B.7.4.	7,67	1,67	8,0	2,00	7,00	9,00	8,33	0,00	91,67
B.7.5.	8,25	1,06	9,0	1,75	7,50	9,00	0,00	8,33	91,67
B.7.6.	8,08	1,24	8,5	1,75	7,50	9,00	0,00	8,33	91,67
B.8.	7,67	1,44	8,0	2,00	7,00	9,00	0,00	8,33	91,67
B.8.1	7,58	1,62	8,0	2,00	7,00	9,00	0,00	16,67	83,33
B.8.2	7,50	1,45	8,0	1,75	7,00	8,50	0,00	16,67	83,33
B.8.3	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
B.8.4	7,75	1,48	8,0	2,00	7,00	9,00	0,00	8,33	91,67
B.8.5	8,00	1,48	8,5	1,75	7,50	9,00	0,00	8,33	91,67
B.9	8,18	1,54	9,0	1,00	8,00	9,00	0,00	9,09	90,91
B.9.1	8,08	1,24	8,5	1,75	7,50	9,00	0,00	8,33	91,67
B.9.2	8,00	1,41	9,0	2,00	7,00	9,00	0,00	16,67	83,33
B.9.3	8,42	1,24	9,0	0,75	8,50	9,00	0,00	8,33	91,67
B.9.4	8,33	1,30	9,0	1,50	8,00	9,00	0,00	8,33	91,67
B.9.5	8,33	1,78	9,0	0,00	9,00	9,00	8,33	0,00	91,67
B.9.6	8,33	1,72	9,0	0,75	8,50	9,00	8,33	0,00	91,67
B.9.7	8,25	1,76	9,0	0,75	8,50	9,00	8,33	0,00	91,67
B.9.8	8,08	1,73	9,0	1,00	8,00	9,00	8,33	0,00	91,67
C.1	8,91	0,30	9,0	0,00	9,00	9,00	0,00	0,00	100,00
C.1.1	8,25	1,29	9,0	1,75	7,50	9,00	0,00	8,33	91,67
C.1.2	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
C.1.3.	8,33	1,50	9,0	0,75	8,50	9,00	0,00	8,33	91,67
C.2.	8,73	0,47	9,0	1,00	8,50	9,00	0,00	0,00	100,00
C.2.1	8,00	1,60	9,0	2,00	7,00	9,00	0,00	16,67	83,33
C.2.2.	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
C.2.3	8,50	1,45	9,0	0,00	9,00	9,00	0,00	8,33	91,67
C.2.4.	8,91	0,30	9,0	0,00	9,00	9,00	0,00	0,00	100,00
C.2.5	8,58	1,16	9,0	0,00	9,00	9,00	0,00	8,33	91,67
C.2.6.	8,58	1,16	9,0	0,00	9,00	9,00	0,00	8,33	91,67
C.2.7.	8,50	1,17	9,0	0,75	8,50	9,00	0,00	8,33	91,67
C.2.8	8,42	1,16	9,0	1,00	8,00	9,00	0,00	8,33	91,67
C.2.9	8,25	1,22	9,0	1,00	8,00	9,00	0,00	8,33	91,67
C.2.10	8,58	1,16	9,0	0,00	9,00	9,00	0,00	8,33	91,67
C.2.11	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
C.3.	8,64	0,67	9,0	1,00	8,50	9,00	0,00	0,00	100,00
C.3.1	8,25	1,22	9,0	1,00	8,00	9,00	0,00	8,33	91,67
C.3.2.	8,33	1,23	9,0	1,00	8,00	9,00	0,00	8,33	91,67
C.3.3.	8,58	1,16	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.1.	8,91	0,30	9,0	0,00	9,00	9,00	0,00	0,00	100,00
D.1.1.	8,58	1,16	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.1.2	8,67	1,15	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.1.3.	8,67	1,15	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.1.4.	8,08	1,31	9,0	2,00	7,00	9,00	0,00	8,33	91,67
D.1.5.	8,00	1,35	9,0	2,00	7,00	9,00	0,00	8,33	91,67
D.1.6.	8,25	1,22	9,0	1,00	8,00	9,00	0,00	8,33	91,67
D.1.7.	7,08	2,19	7,0	3,50	6,00	9,00	8,33	16,67	75,00
D.1.8.	7,75	2,45	9,0	1,75	7,50	9,00	8,33	8,33	83,33
D.2.	8,58	1,44	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.2.1	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
D.2.2.	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
D.2.3.	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
D.2.4.	8,42	1,51	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.2.5.	8,42	1,51	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.2.6.	8,08	1,44	8,5	1,00	8,00	9,00	0,00	8,33	91,67
D.2.7	8,50	1,45	9,0	0,00	9,00	9,00	0,00	8,33	91,67
D.2.8.	7,92	1,62	9,0	2,00	7,00	9,00	0,00	16,67	83,33
D.2.9.	8,08	1,44	8,5	1,00	8,00	9,00	0,00	8,33	91,67
D.3.	8,09	0,70	8,0	1,00	8,00	8,50	0,00	0,00	100,00
D.3.1.	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
D.3.2.	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
D.3.3.	7,67	2,31	9,0	1,75	7,50	9,00	8,33	8,33	83,33
D.3.4.	7,25	1,54	7,0	1,75	7,00	8,50	0,00	16,67	83,33
D.4.	8,36	0,67	8,0	1,00	8,00	9,00	0,00	0,00	100,00
D.4.1.	7,58	1,44	7,5	2,00	7,00	9,00	0,00	8,33	91,67
D.4.2.	7,83	1,27	8,0	2,00	7,00	9,00	0,00	8,33	91,67
D.4.3.	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
D.4.4.	7,83	1,27	8,0	2,00	7,00	9,00	0,00	8,33	91,67
E.1.	8,00	1,21	8,0	1,75	7,50	9,00	0,00	8,33	91,67
E.1.1.	8,08	1,16	8,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.2.	8,17	1,19	8,5	1,00	8,00	9,00	0,00	8,33	91,67
E.1.3.	8,25	1,14	8,5	1,00	8,00	9,00	0,00	8,33	91,67
E.1.4.	7,75	1,22	8,0	2,00	7,00	9,00	0,00	8,33	91,67
E.1.5.	8,25	1,22	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.6.	8,17	1,19	8,5	1,00	8,00	9,00	0,00	8,33	91,67
E.1.7.	8,17	1,19	8,5	1,00	8,00	9,00	0,00	8,33	91,67

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
E.1.8.	8,25	1,22	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.9.	8,25	1,14	8,5	1,00	8,00	9,00	0,00	8,33	91,67
E.1.10	8,33	1,23	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.11	8,42	1,16	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.12	8,00	1,21	8,0	1,75	7,50	9,00	0,00	8,33	91,67
E.1.13	8,42	1,16	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.14	8,42	1,16	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.15	8,33	1,15	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.1.16	8,25	1,14	8,5	1,00	8,00	9,00	0,00	8,33	91,67
E.2.	8,91	0,30	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.2.1.	8,33	0,98	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.2.2.	8,75	0,87	9,0	0,00	9,00	9,00	0,00	8,33	91,67
E.2.3.	8,58	0,90	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.2.4.	8,33	0,98	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.2.5.	8,75	0,87	9,0	0,00	9,00	9,00	0,00	8,33	91,67
E.2.6.	8,58	0,90	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.2.7.	8,50	1,17	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.3.	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.3.1.	8,55	0,69	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.3.2	8,00	1,48	8,5	1,75	7,50	9,00	0,00	8,33	91,67
E.3.3.	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
E.3.4	7,92	1,51	8,5	2,00	7,00	9,00	0,00	8,33	91,67
E.3.5	8,00	1,60	9,0	1,75	7,50	9,00	0,00	16,67	83,33
E.3.6	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.4.	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.4.1	7,83	1,53	8,0	1,75	7,50	9,00	0,00	16,67	83,33
E.4.2	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.4.3	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.4.4	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.5.	8,45	0,82	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.5.1.	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
E.5.2.	8,33	1,50	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.5.3.	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.5.4.	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
E.5.5.	8,17	1,47	9,0	1,00	8,00	9,00	0,00	8,33	91,67
F.1.	7,25	1,48	7,0	2,50	6,50	8,50	0,00	25,00	75,00
F.1.1.	7,58	1,38	8,0	1,75	7,00	8,50	0,00	8,33	91,67
F.1.2	7,50	1,38	7,5	1,75	7,00	8,50	0,00	8,33	91,67
F.1.3	7,67	1,44	8,0	2,00	7,00	9,00	0,00	8,33	91,67
F.1.4	7,83	1,47	8,0	2,00	7,00	9,00	0,00	8,33	91,67
F.1.5	7,25	2,14	8,0	1,75	7,00	8,50	8,33	8,33	83,33
F.1.6	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
F.1.7.	7,75	1,36	8,0	1,50	7,50	8,50	0,00	8,33	91,67
F.2.	7,82	0,87	8,0	2,00	7,00	8,50	0,00	0,00	100,00
F.2.1.	7,58	1,38	8,0	1,75	7,00	8,50	0,00	8,33	91,67
F.2.2.	7,58	1,44	7,5	2,00	7,00	9,00	0,00	8,33	91,67
F.2.3	7,08	1,44	7,0	2,00	6,00	8,00	0,00	33,33	66,67
F.2.4	7,42	1,62	8,0	2,50	6,50	8,50	0,00	25,00	75,00
F.2.5	7,42	1,51	8,0	2,50	6,50	8,50	0,00	25,00	75,00
F.2.6.	7,33	1,50	8,0	1,00	7,00	8,00	0,00	16,67	83,33

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
F.3.	7,91	0,83	8,0	2,00	7,00	8,50	0,00	0,00	100,00
F.3.1.	8,42	1,44	9,0	0,75	8,50	9,00	0,00	8,33	91,67
F.3.2.	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
F.3.3.	7,75	1,36	8,0	1,50	7,50	8,50	0,00	8,33	91,67
F.3.4.	7,92	1,44	8,0	1,75	7,50	9,00	0,00	8,33	91,67
F.3.5	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
F.3.6	8,25	1,48	9,0	1,00	8,00	9,00	0,00	8,33	91,67
F.4.	7,42	1,38	7,0	1,75	7,00	8,50	0,00	8,33	91,67
F.4.1	6,42	1,62	6,0	2,75	5,00	7,50	0,00	58,33	41,67
F.4.2	7,75	1,42	8,0	2,00	7,00	9,00	0,00	8,33	91,67
F.4.3	7,83	1,59	8,5	2,00	7,00	9,00	0,00	16,67	83,33
F.4.4	7,42	1,44	7,5	1,75	7,00	8,50	0,00	16,67	83,33



**DELPHI 3. TUR “LİSANS ÜSTÜ ÖĞRENCİ” GRUBUNDA FİKİR BİRLİĞİNİ
İNCELEMEDE KULLANILAN BETİMSSEL İSTATİSTİK SONUÇLARI**

(Not. Boyalı hücreler ilgili kriter için belirlenen eşit değerinin altında kaldığını ve dolayısıyla fikir birliğini varılmamış olduğuna işaret etmektedir.)

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,20	1,14	9,0	2,00	7,00	9,00	0,00	10,00	90,00
A.1.1	8,36	0,81	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.1.2	7,73	1,10	8,0	2,00	7,00	9,00	0,00	18,18	81,82
A.1.3	8,91	0,30	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.1.4	8,00	1,26	9,0	2,00	7,00	9,00	0,00	18,18	81,82
A.1.5	8,09	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
A.1.6	7,64	1,36	8,0	2,00	7,00	9,00	0,00	18,18	81,82
A.1.7	8,00	1,18	8,0	2,00	7,00	9,00	0,00	18,18	81,82
A.2	8,00	1,10	8,0	2,00	7,00	9,00	0,00	9,09	90,91
A.2.1	8,00	1,10	8,0	2,00	7,00	9,00	0,00	9,09	90,91
A.2.2	7,45	1,21	7,0	2,00	7,00	9,00	0,00	9,09	90,91
A.2.3	7,64	1,03	7,0	2,00	7,00	9,00	0,00	9,09	90,91
A.2.4	7,82	1,17	7,0	2,00	7,00	9,00	0,00	9,09	90,91
A.2.5	8,18	0,87	8,0	2,00	7,00	9,00	0,00	0,00	100,00
A.2.6	8,36	0,81	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.3	7,36	2,62	8,0	2,00	7,00	9,00	0,00	0,00	100,00
A.3.1	7,55	1,04	8,0	1,00	7,00	8,00	0,00	18,18	81,82
A.3.2	7,73	1,19	8,0	2,00	7,00	9,00	0,00	18,18	81,82
A.3.3	7,55	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
A.3.4	7,91	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
A.3.5	7,45	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
A.3.6	7,73	0,90	8,0	1,00	7,00	8,00	0,00	9,09	90,91
A.3.7	7,82	1,17	8,0	2,00	7,00	9,00	0,00	18,18	81,82
A.3.8	8,18	1,08	9,0	2,00	7,00	9,00	0,00	9,09	90,91
A.4	7,30	1,16	7,0	2,25	6,00	8,25	0,00	30,00	70,00
A.4.1	8,18	1,08	9,0	2,00	7,00	9,00	0,00	9,09	90,91
A.4.2	7,73	1,42	8,0	2,00	7,00	9,00	0,00	18,18	81,82
A.4.3	7,82	1,40	8,0	2,00	7,00	9,00	0,00	18,18	81,82
A.4.4	6,91	1,51	7,0	2,00	6,00	8,00	0,00	27,27	72,73
A.4.5	7,55	1,29	7,0	3,00	6,00	9,00	0,00	27,27	72,73
A.4.6	7,09	1,30	7,0	2,00	6,00	8,00	0,00	36,36	63,64
B.1	8,20	1,14	9,0	2,00	7,00	9,00	0,00	10,00	90,00
B.1.1	8,00	1,10	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.1.2	7,36	1,43	7,0	2,00	7,00	9,00	0,00	18,18	81,82
B.1.3	7,64	1,12	8,0	1,00	7,00	8,00	0,00	9,09	90,91
B.1.4	7,36	1,29	7,0	2,00	7,00	9,00	0,00	18,18	81,82
B.1.5	7,27	0,90	7,0	1,00	7,00	8,00	0,00	18,18	81,82
B.2	8,20	0,92	8,0	1,00	8,00	9,00	0,00	10,00	90,00
B.2.1	7,82	1,17	8,0	2,00	7,00	9,00	0,00	18,18	81,82
B.2.2	7,91	1,14	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.2.3	7,73	1,27	7,0	2,00	7,00	9,00	0,00	18,18	81,82
B.2.4	7,82	1,08	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.2.5	8,27	0,79	8,0	1,00	8,00	9,00	0,00	0,00	100,00
B.2.6	7,73	1,10	7,0	2,00	7,00	9,00	0,00	9,09	90,91
B.3	7,60	0,84	8,0	1,00	7,00	8,00	0,00	10,00	90,00
B.3.1	8,18	1,08	9,0	2,00	7,00	9,00	0,00	9,09	90,91

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
B.3.2	7,73	0,90	7,0	2,00	7,00	9,00	0,00	0,00	100,00
B.3.3	7,91	1,14	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.3.4	7,27	1,01	7,0	1,00	7,00	8,00	0,00	18,18	81,82
B.3.5	7,45	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
B.4	8,10	0,99	8,5	2,00	7,00	9,00	0,00	0,00	100,00
B.4.1	7,82	0,98	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.4.2	8,09	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.4.3	7,18	1,33	7,0	1,00	7,00	8,00	0,00	18,18	81,82
B.4.4	7,55	1,29	8,0	2,00	7,00	9,00	0,00	18,18	81,82
B.4.5	7,18	1,33	7,0	1,00	7,00	8,00	0,00	18,18	81,82
B.5.	7,00	0,67	7,0	0,50	6,75	7,25	0,00	20,00	80,00
B.5.1.	6,91	1,14	7,0	0,00	7,00	7,00	0,00	18,18	81,82
B.5.2	6,45	1,69	7,0	1,00	6,00	7,00	9,09	18,18	72,73
B.5.3	6,91	1,51	7,0	1,00	7,00	8,00	9,09	9,09	81,82
B.5.4	7,00	1,00	7,0	0,00	7,00	7,00	0,00	18,18	81,82
B.5.5.	6,82	1,47	7,0	0,00	7,00	7,00	9,09	9,09	81,82
B.5.6.	6,91	1,87	7,0	1,00	7,00	8,00	9,09	9,09	81,82
B.6.	8,10	0,99	8,5	2,00	7,00	9,00	0,00	0,00	100,00
B.6.1.	7,82	1,08	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.6.2.	7,91	0,94	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.6.3.	8,27	0,79	8,0	1,00	8,00	9,00	0,00	0,00	100,00
B.7.	7,44	0,53	7,0	1,00	7,00	8,00	0,00	0,00	100,00
B.7.1	7,40	1,51	8,0	1,50	6,75	8,25	0,00	20,00	80,00
B.7.2.	7,50	1,08	8,0	1,00	7,00	8,00	0,00	10,00	90,00
B.7.3.	7,20	1,62	7,5	1,00	7,00	8,00	10,00	0,00	90,00
B.7.4.	7,10	1,79	8,0	1,50	6,50	8,00	10,00	10,00	80,00
B.7.5.	7,64	0,81	7,0	1,00	7,00	8,00	0,00	0,00	100,00
B.7.6.	7,64	1,21	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.8.	7,50	0,85	7,0	1,25	7,00	8,25	0,00	0,00	100,00
B.8.1	7,45	1,13	7,0	1,00	7,00	8,00	0,00	9,09	90,91
B.8.2	7,64	0,81	7,0	1,00	7,00	8,00	0,00	0,00	100,00
B.8.3	7,27	1,62	7,0	1,00	7,00	8,00	9,09	0,00	90,91
B.8.4	8,00	0,89	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.8.5	7,18	1,25	7,0	1,00	7,00	8,00	0,00	18,18	81,82
B.9	8,10	0,88	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.9.1	7,91	1,30	8,0	2,00	7,00	9,00	0,00	9,09	90,91
B.9.2	8,09	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.9.3	8,09	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.9.4	7,73	0,90	7,0	2,00	7,00	9,00	0,00	0,00	100,00
B.9.5	7,82	0,87	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.9.6	8,00	1,00	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.9.7	8,36	0,67	8,0	1,00	8,00	9,00	0,00	0,00	100,00
B.9.8	7,91	1,22	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.1	8,00	0,89	8,0	2,00	7,00	9,00	0,00	0,00	100,00
C.1.1	7,55	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
C.1.2	7,91	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.1.3.	7,82	1,08	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.2.	8,09	0,83	8,0	2,00	7,00	9,00	0,00	0,00	100,00
C.2.1	8,20	1,03	8,5	1,25	7,75	9,00	0,00	10,00	90,00
C.2.2.	7,82	1,17	8,0	2,00	7,00	9,00	0,00	18,18	81,82

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
C.2.3	7,91	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.2.4.	8,00	1,00	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.2.5	8,27	1,01	9,0	1,00	8,00	9,00	0,00	9,09	90,91
C.2.6.	8,36	1,03	9,0	1,00	8,00	9,00	0,00	9,09	90,91
C.2.7.	7,82	1,25	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.2.8	7,64	1,36	8,0	2,00	7,00	9,00	0,00	18,18	81,82
C.2.9	7,82	1,33	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.2.10	8,27	0,90	9,0	2,00	7,00	9,00	0,00	0,00	100,00
C.2.11	7,09	1,38	7,0	2,00	6,00	8,00	0,00	27,27	72,73
C.3.	7,70	1,25	7,5	2,25	6,75	9,00	0,00	20,00	80,00
C.3.1	7,82	0,98	8,0	2,00	7,00	9,00	0,00	9,09	90,91
C.3.2.	7,64	0,92	8,0	1,00	7,00	8,00	0,00	9,09	90,91
C.3.3.	7,82	0,75	8,0	1,00	7,00	8,00	0,00	0,00	100,00
D.1.	8,18	0,98	9,0	2,00	7,00	9,00	0,00	0,00	100,00
D.1.1.	8,00	1,26	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.1.2	7,55	1,29	8,0	2,00	7,00	9,00	0,00	18,18	81,82
D.1.3.	8,27	1,35	9,0	2,00	7,00	9,00	0,00	9,09	90,91
D.1.4.	8,27	1,27	9,0	1,00	8,00	9,00	0,00	9,09	90,91
D.1.5.	7,91	1,22	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.1.6.	7,91	0,83	8,0	2,00	7,00	9,00	0,00	0,00	100,00
D.1.7.	7,45	1,44	8,0	2,00	7,00	9,00	0,00	18,18	81,82
D.1.8.	8,36	0,67	8,0	1,00	8,00	9,00	0,00	0,00	100,00
D.2.	8,20	1,32	9,0	1,25	7,75	9,00	0,00	10,00	90,00
D.2.1	7,73	1,19	8,0	0,00	8,00	8,00	0,00	18,18	81,82
D.2.2.	8,09	0,94	8,0	1,00	8,00	9,00	0,00	9,09	90,91
D.2.3.	6,82	0,98	7,0	1,00	6,00	7,00	0,00	27,27	72,73
D.2.4.	7,64	1,36	8,0	2,00	7,00	9,00	0,00	18,18	81,82
D.2.5.	7,91	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.2.6.	8,00	1,10	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.2.7	8,18	0,98	8,0	1,00	8,00	9,00	0,00	9,09	90,91
D.2.8.	8,00	1,10	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.2.9.	7,27	0,90	7,0	1,00	7,00	8,00	0,00	18,18	81,82
D.3.	7,60	0,97	7,5	1,25	7,00	8,25	0,00	10,00	90,00
D.3.1.	7,82	1,08	8,0	2,00	7,00	9,00	0,00	18,18	81,82
D.3.2.	7,73	1,01	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.3.3.	7,91	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.3.4.	7,91	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
D.4.	7,45	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
D.4.1.	7,45	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
D.4.2.	7,55	1,04	8,0	1,00	7,00	8,00	0,00	18,18	81,82
D.4.3.	7,36	1,21	7,0	1,00	7,00	8,00	0,00	18,18	81,82
D.4.4.	7,18	1,08	7,0	1,00	7,00	8,00	0,00	18,18	81,82
E.1.	8,30	1,06	9,0	1,25	7,75	9,00	0,00	10,00	90,00
E.1.1.	8,27	1,01	9,0	1,00	8,00	9,00	0,00	9,09	90,91
E.1.2.	8,18	0,98	8,0	1,00	8,00	9,00	0,00	9,09	90,91
E.1.3.	7,91	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.1.4.	7,27	1,62	7,0	2,00	7,00	9,00	0,00	18,18	81,82
E.1.5.	7,73	1,10	7,0	2,00	7,00	9,00	0,00	9,09	90,91
E.1.6.	7,82	0,98	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.1.7.	7,82	1,08	8,0	2,00	7,00	9,00	0,00	9,09	90,91

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
E.1.8.	7,36	0,92	7,0	1,00	7,00	8,00	0,00	9,09	90,91
E.1.9.	7,73	1,01	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.1.10	7,91	0,94	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.1.11	8,09	1,04	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.1.12	7,64	1,21	7,0	2,00	7,00	9,00	0,00	18,18	81,82
E.1.13	8,27	1,27	9,0	2,00	7,00	9,00	0,00	18,18	81,82
E.1.14	8,36	1,03	9,0	1,00	8,00	9,00	0,00	9,09	90,91
E.1.15	8,45	0,93	9,0	1,00	8,00	9,00	0,00	9,09	90,91
E.1.16	7,82	0,98	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.2.	8,20	1,23	8,5	1,00	8,00	9,00	0,00	10,00	90,00
E.2.1.	7,73	1,19	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.2.2.	8,18	1,25	9,0	1,00	8,00	9,00	0,00	9,09	90,91
E.2.3.	8,09	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.2.4.	8,09	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.2.5.	8,00	1,00	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.2.6.	7,82	0,98	7,0	2,00	7,00	9,00	0,00	0,00	100,00
E.2.7.	7,82	0,87	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.3.	8,36	1,03	9,0	1,00	8,00	9,00	0,00	9,09	90,91
E.3.1.	7,73	1,01	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.3.2	7,73	1,01	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.3.3.	7,18	1,47	7,0	3,00	6,00	9,00	0,00	27,27	72,73
E.3.4	7,64	1,21	8,0	2,00	7,00	9,00	0,00	9,09	90,91
E.3.5	7,64	1,29	7,0	2,00	7,00	9,00	0,00	9,09	90,91
E.3.6	8,09	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.4.	7,82	0,75	8,0	1,00	7,00	8,00	0,00	0,00	100,00
E.4.1	7,45	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
E.4.2	7,55	1,04	7,0	2,00	7,00	9,00	0,00	9,09	90,91
E.4.3	8,36	1,03	9,0	1,00	8,00	9,00	0,00	9,09	90,91
E.4.4	7,91	0,94	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.5.	7,70	0,95	7,0	2,00	7,00	9,00	0,00	0,00	100,00
E.5.1.	7,64	1,03	7,0	2,00	7,00	9,00	0,00	9,09	90,91
E.5.2.	7,82	0,87	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.5.3.	7,64	1,03	7,0	2,00	7,00	9,00	0,00	9,09	90,91
E.5.4.	7,45	1,04	7,0	1,00	7,00	8,00	0,00	18,18	81,82
E.5.5.	7,09	0,83	7,0	0,00	7,00	7,00	0,00	18,18	81,82
F.1.	7,00	0,94	7,0	1,25	6,00	7,25	0,00	30,00	70,00
F.1.1.	7,36	1,03	7,0	1,00	7,00	8,00	0,00	18,18	81,82
F.1.2	7,55	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
F.1.3	7,55	0,93	7,0	1,00	7,00	8,00	0,00	9,09	90,91
F.1.4	7,73	1,10	7,0	2,00	7,00	9,00	0,00	9,09	90,91
F.1.5	7,27	1,19	7,0	1,00	7,00	8,00	0,00	18,18	81,82
F.1.6	7,60	0,97	7,5	1,25	7,00	8,25	0,00	10,00	90,00
F.1.7.	7,09	1,04	7,0	1,00	7,00	8,00	0,00	18,18	81,82
F.2.	7,27	1,19	7,0	1,00	7,00	8,00	0,00	18,18	81,82
F.2.1.	7,64	1,21	8,0	2,00	7,00	9,00	0,00	9,09	90,91
F.2.2.	6,09	1,45	6,0	2,00	5,00	7,00	0,00	72,73	27,27
F.2.3	6,09	1,30	6,0	2,00	5,00	7,00	0,00	63,64	36,36
F.2.4	6,45	1,13	7,0	2,00	5,00	7,00	0,00	45,45	54,55
F.2.5	6,73	1,19	7,0	1,00	6,00	7,00	0,00	36,36	63,64
F.2.6.	7,36	1,21	7,0	1,00	7,00	8,00	0,00	18,18	81,82

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
F.3.	7,90	0,99	8,0	2,00	7,00	9,00	0,00	10,00	90,00
F.3.1.	8,00	1,00	8,0	2,00	7,00	9,00	0,00	9,09	90,91
F.3.2.	7,73	0,90	7,0	2,00	7,00	9,00	0,00	0,00	100,00
F.3.3.	7,73	0,79	8,0	1,00	7,00	8,00	0,00	0,00	100,00
F.3.4.	7,64	1,03	7,0	2,00	7,00	9,00	0,00	9,09	90,91
F.3.5.	8,18	0,87	8,0	2,00	7,00	9,00	0,00	0,00	100,00
F.3.6.	7,82	1,08	8,0	2,00	7,00	9,00	0,00	9,09	90,91
F.4.	7,00	0,67	7,0	0,50	6,75	7,25	0,00	20,00	80,00
F.4.1.	7,45	1,04	8,0	1,00	7,00	8,00	0,00	9,09	90,91
F.4.2.	7,18	1,08	7,0	1,00	7,00	8,00	0,00	18,18	81,82
F.4.3.	7,45	1,21	8,0	1,00	7,00	8,00	0,00	18,18	81,82
F.4.4.	7,27	1,27	8,0	1,00	7,00	8,00	0,00	18,18	81,82



**DELPHI 3. TUR “ÖĞRETMEN” GRUBUNDA FİKİR BİRLİĞİNİ İNCELEMEDE
KULLANILAN BETİMSSEL İSTATİSTİK SONUÇLARI (SAMPLE)**

(Not. Boyalı hücreler ilgili kriter için belirlenen eşit değerinin altında kaldığını ve dolayısıyla fikir birliğini varılmamış olduğuna işaret etmektedir.)

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
A.1	8,85	0,38	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.1.1	8,46	1,20	9,0	0,50	8,50	9,00	0,00	7,69	92,31
A.1.2	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.1.3	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.1.4	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
A.1.5	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
A.1.6	7,62	0,87	7,0	1,50	7,00	8,50	0,00	0,00	100,00
A.1.7	6,31	1,49	6,0	1,50	5,50	7,00	7,69	46,15	46,15
A.2	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.2.1	8,31	1,11	9,0	2,00	7,00	9,00	0,00	7,69	92,31
A.2.2	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
A.2.3	8,46	0,88	9,0	1,50	7,50	9,00	0,00	0,00	100,00
A.2.4	8,23	0,93	9,0	2,00	7,00	9,00	0,00	0,00	100,00
A.2.5	8,38	0,77	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.2.6	6,62	0,87	7,0	1,00	6,00	7,00	0,00	30,77	69,23
A.3	8,77	0,60	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.3.1	8,15	1,34	9,0	1,50	7,50	9,00	0,00	15,38	84,62
A.3.2	7,38	1,12	7,0	1,50	7,00	8,50	0,00	7,69	92,31
A.3.3	7,85	0,90	8,0	2,00	7,00	9,00	0,00	0,00	100,00
A.3.4	8,31	0,95	9,0	2,00	7,00	9,00	0,00	0,00	100,00
A.3.5	8,54	0,88	9,0	1,00	8,00	9,00	0,00	0,00	100,00
A.3.6	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
A.3.7	8,77	0,60	9,0	0,00	9,00	9,00	0,00	0,00	100,00
A.3.8	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
A.4	7,85	0,99	8,0	2,00	7,00	9,00	0,00	7,69	92,31
A.4.1	8,38	0,51	8,0	1,00	8,00	9,00	0,00	0,00	100,00
A.4.2	8,31	0,63	8,0	1,00	8,00	9,00	0,00	0,00	100,00
A.4.3	8,23	0,83	8,0	1,50	7,50	9,00	0,00	0,00	100,00
A.4.4	7,31	1,18	7,0	1,50	7,00	8,50	0,00	15,38	84,62
A.4.5	8,38	0,96	9,0	1,00	8,00	9,00	0,00	7,69	92,31
A.4.6	7,46	1,05	7,0	1,50	7,00	8,50	0,00	15,38	84,62
B.1	7,54	1,20	7,0	2,00	7,00	9,00	0,00	7,69	92,31
B.1.1	7,54	1,13	7,0	2,00	7,00	9,00	0,00	15,38	84,62
B.1.2	7,46	1,05	7,0	1,50	7,00	8,50	0,00	15,38	84,62
B.1.3	8,62	0,65	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.1.4	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.1.5	8,31	1,03	9,0	1,50	7,50	9,00	0,00	7,69	92,31
B.2	8,31	0,75	8,0	1,00	8,00	9,00	0,00	0,00	100,00
B.2.1	8,77	0,60	9,0	0,00	9,00	9,00	0,00	0,00	100,00
B.2.2	8,54	0,88	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.2.3	8,85	0,55	9,0	0,00	9,00	9,00	0,00	0,00	100,00
B.2.4	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.2.5	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
B.2.6	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
B.3	8,08	0,86	8,0	2,00	7,00	9,00	0,00	0,00	100,00

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
B.3.1	8,62	0,65	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.3.2	8,69	0,75	9,0	0,00	9,00	9,00	0,00	0,00	100,00
B.3.3	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.3.4	8,92	0,28	9,0	0,00	9,00	9,00	0,00	0,00	100,00
B.3.5	8,77	0,44	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.4	8,77	0,44	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.4.1	7,92	0,95	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.4.2	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
B.4.3	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.4.4	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.4.5	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.5.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.5.1.	7,62	0,96	7,0	1,50	7,00	8,50	0,00	7,69	92,31
B.5.2	8,15	0,90	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.5.3	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.5.4	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.5.5.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.5.6.	8,62	0,51	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.6.	8,00	1,00	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.6.1.	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.6.2.	8,38	0,77	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.6.3.	8,69	0,48	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.7.	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00
B.7.1	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
B.7.2.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.7.3.	8,54	0,66	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.7.4.	7,92	0,95	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.7.5.	8,31	0,95	9,0	2,00	7,00	9,00	0,00	0,00	100,00
B.7.6.	8,15	0,90	8,0	2,00	7,00	9,00	0,00	0,00	100,00
B.8.	7,46	0,88	7,0	1,00	7,00	8,00	0,00	0,00	100,00
B.8.1	8,15	1,21	9,0	2,00	7,00	9,00	0,00	15,38	84,62
B.8.2	8,08	1,04	8,0	2,00	7,00	9,00	0,00	7,69	92,31
B.8.3	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.8.4	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
B.8.5	8,15	0,99	9,0	2,00	7,00	9,00	0,00	0,00	100,00
B.9	8,77	0,60	9,0	0,00	9,00	9,00	0,00	0,00	100,00
B.9.1	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.9.2	7,69	0,85	7,0	1,50	7,00	8,50	0,00	0,00	100,00
B.9.3	8,62	0,65	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.9.4	8,62	0,65	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.9.5	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.9.6	8,77	0,44	9,0	0,50	8,50	9,00	0,00	0,00	100,00
B.9.7	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
B.9.8	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
C.1	8,00	0,91	8,0	2,00	7,00	9,00	0,00	0,00	100,00
C.1.1	8,31	0,85	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.1.2	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.1.3.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
C.2.	8,85	0,38	9,0	0,00	9,00	9,00	0,00	0,00	100,00
C.2.1	7,62	0,96	7,0	2,00	7,00	9,00	0,00	0,00	100,00

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
C.2.2.	8,00	0,91	8,0	2,00	7,00	9,00	0,00	0,00	100,00
C.2.3	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.2.4.	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.2.5	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.2.6.	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.2.7.	8,46	0,88	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.2.8	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
C.2.9	8,23	0,93	9,0	2,00	7,00	9,00	0,00	0,00	100,00
C.2.10	8,23	0,93	9,0	2,00	7,00	9,00	0,00	0,00	100,00
C.2.11	7,38	1,19	7,0	1,50	7,00	8,50	0,00	15,38	84,62
C.3.	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00
C.3.1	7,62	0,87	7,0	1,50	7,00	8,50	0,00	0,00	100,00
C.3.2.	7,85	0,90	8,0	2,00	7,00	9,00	0,00	0,00	100,00
C.3.3.	7,77	0,83	8,0	1,50	7,00	8,50	0,00	0,00	100,00
D.1.	8,77	0,60	9,0	0,00	9,00	9,00	0,00	0,00	100,00
D.1.1.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.1.2	8,92	0,28	9,0	0,00	9,00	9,00	0,00	0,00	100,00
D.1.3.	8,92	0,28	9,0	0,00	9,00	9,00	0,00	0,00	100,00
D.1.4.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
D.1.5.	8,08	1,04	8,0	2,00	7,00	9,00	0,00	7,69	92,31
D.1.6.	8,08	0,86	8,0	2,00	7,00	9,00	0,00	0,00	100,00
D.1.7.	7,54	0,88	7,0	1,50	7,00	8,50	0,00	0,00	100,00
D.1.8.	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
D.2.	8,08	0,95	8,0	2,00	7,00	9,00	0,00	0,00	100,00
D.2.1	8,31	0,95	9,0	2,00	7,00	9,00	0,00	0,00	100,00
D.2.2.	8,62	0,65	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.2.3.	7,69	0,85	7,0	1,50	7,00	8,50	0,00	0,00	100,00
D.2.4.	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.2.5.	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.2.6.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
D.2.7	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.2.8.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.2.9.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
D.3.	8,69	0,48	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.3.1.	8,38	0,77	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.3.2.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
D.3.3.	8,15	1,21	9,0	1,50	7,50	9,00	0,00	7,69	92,31
D.3.4.	7,46	1,27	7,0	2,00	7,00	9,00	0,00	15,38	84,62
D.4.	7,92	0,86	8,0	2,00	7,00	9,00	0,00	0,00	100,00
D.4.1.	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00
D.4.2.	8,23	0,83	8,0	1,50	7,50	9,00	0,00	0,00	100,00
D.4.3.	7,38	0,65	7,0	1,00	7,00	8,00	0,00	0,00	100,00
D.4.4.	7,31	0,95	7,0	1,00	7,00	8,00	0,00	7,69	92,31
E.1.	8,23	0,73	8,0	1,00	8,00	9,00	0,00	0,00	100,00
E.1.1.	7,62	0,96	7,0	1,50	7,00	8,50	0,00	7,69	92,31
E.1.2.	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00
E.1.3.	8,23	0,83	8,0	1,50	7,50	9,00	0,00	0,00	100,00
E.1.4.	7,62	0,96	7,0	1,50	7,00	8,50	0,00	7,69	92,31
E.1.5.	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
E.1.6.	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
E.1.7.	7,69	1,18	8,0	2,00	7,00	9,00	0,00	7,69	92,31
E.1.8.	8,46	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.1.9.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.1.10	8,69	0,75	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.1.11	8,69	0,75	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.1.12	7,69	0,85	7,0	1,50	7,00	8,50	0,00	0,00	100,00
E.1.13	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
E.1.14	8,77	0,60	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.1.15	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.1.16	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
E.2.	9,00	0,00	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.2.1.	8,85	0,38	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.2.2.	8,92	0,28	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.2.3.	9,00	0,00	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.2.4.	8,92	0,28	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.2.5.	8,85	0,38	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.2.6.	8,54	0,97	9,0	0,50	8,50	9,00	0,00	7,69	92,31
E.2.7.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.3.	7,85	0,90	8,0	2,00	7,00	9,00	0,00	0,00	100,00
E.3.1.	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00
E.3.2	8,31	0,85	9,0	1,50	7,50	9,00	0,00	0,00	100,00
E.3.3.	8,38	0,77	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.3.4	8,23	0,93	9,0	2,00	7,00	9,00	0,00	0,00	100,00
E.3.5	7,23	2,24	7,0	2,00	7,00	9,00	7,69	7,69	84,62
E.3.6	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.4.	7,77	0,83	8,0	1,50	7,00	8,50	0,00	0,00	100,00
E.4.1	7,54	0,88	7,0	1,00	7,00	8,00	0,00	7,69	92,31
E.4.2	8,31	0,85	9,0	1,50	7,50	9,00	0,00	0,00	100,00
E.4.3	8,62	0,77	9,0	0,50	8,50	9,00	0,00	0,00	100,00
E.4.4	8,38	0,77	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.5.	8,85	0,38	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.5.1.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
E.5.2.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
E.5.3.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
E.5.4.	8,92	0,28	9,0	0,00	9,00	9,00	0,00	0,00	100,00
E.5.5.	8,38	0,65	8,0	1,00	8,00	9,00	0,00	0,00	100,00
F.1.	7,54	0,97	7,0	1,50	7,00	8,50	0,00	7,69	92,31
F.1.1.	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00
F.1.2	8,54	0,88	9,0	1,00	8,00	9,00	0,00	0,00	100,00
F.1.3	8,15	1,28	9,0	2,00	7,00	9,00	0,00	7,69	92,31
F.1.4	6,62	1,33	6,0	1,50	6,00	7,50	0,00	61,54	38,46
F.1.5	8,31	0,95	9,0	2,00	7,00	9,00	0,00	0,00	100,00
F.1.6	8,00	1,29	9,0	2,00	7,00	9,00	0,00	7,69	92,31
F.1.7.	7,85	0,90	8,0	2,00	7,00	9,00	0,00	0,00	100,00
F.2.	7,58	0,79	7,0	1,00	7,00	8,00	0,00	0,00	100,00
F.2.1.	7,77	0,93	7,0	2,00	7,00	9,00	0,00	0,00	100,00
F.2.2.	7,69	0,85	7,0	1,50	7,00	8,50	0,00	0,00	100,00
F.2.3	7,31	0,95	7,0	1,00	7,00	8,00	0,00	7,69	92,31
F.2.4	7,62	0,87	7,0	1,50	7,00	8,50	0,00	0,00	100,00
F.2.5	7,54	0,88	7,0	1,50	7,00	8,50	0,00	0,00	100,00

MADDE	M	SD	MDN	IGR	Q1	Q3	%(1-3)	%(4-6)	%(7-9)
F.2.6.	8,31	0,95	9,0	2,00	7,00	9,00	0,00	0,00	100,00
F.3.	8,00	1,00	8,0	2,00	7,00	9,00	0,00	0,00	100,00
F.3.1.	8,38	0,87	9,0	1,50	7,50	9,00	0,00	0,00	100,00
F.3.2.	8,54	0,78	9,0	1,00	8,00	9,00	0,00	0,00	100,00
F.3.3.	8,08	0,76	8,0	1,50	7,50	9,00	0,00	0,00	100,00
F.3.4.	8,69	0,63	9,0	0,50	8,50	9,00	0,00	0,00	100,00
F.3.5	8,31	0,85	9,0	1,50	7,50	9,00	0,00	0,00	100,00
F.3.6	7,23	0,83	7,0	1,00	7,00	8,00	0,00	15,38	84,62
F.4.	7,31	1,65	7,0	3,50	5,50	9,00	0,00	30,77	69,23
F.4.1	8,08	1,26	9,0	2,00	7,00	9,00	0,00	7,69	92,31
F.4.2	8,00	1,22	8,0	2,00	7,00	9,00	0,00	7,69	92,31
F.4.3	7,62	0,87	7,0	1,50	7,00	8,50	0,00	0,00	100,00
F.4.4	7,62	0,77	7,0	1,00	7,00	8,00	0,00	0,00	100,00





CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Koyuncu, Fulya
Nationality: Turkish (TC)
Date and Place of Birth: 15 March 1985, Ankara
Marital Status: Single
Phone: +90 312 210 22 92
Fax: +90 312 210 22 91
email: e168657@metu.edu.tr

EDUCATION

Degree	Institution	Year of Graduation
MS	METU Secondary Science and Mathematics Education	2011
BS	Marmara University Biology Education	2008
High School	TED High School, Ankara	2003

WORK EXPERIENCE

Year	Place	Enrollment
2020	Eğlenceli Bilim	Business Development Coordinator
2019-2020	TEMA Vakfı	Deputy Head of Education Department
2018-2019	TEDMEM	Policy Analyst
2015-2018	MAYA Schools	Measurement and Evaluation Specialist
2013-2015	TEDMEM	Policy Analyst
2011-2013	TEGV	Measurement and Evaluation Specialist
2010-2011	CITO Turkey	Education Specialist

FOREIGN LANGUAGES

Advanced English, Fluent German

PUBLICATIONS

1. Cetinkaya, B., Erbas, A. K., Celikdemir, K., Koyuncu, F., Kol, M. & Alacaci, C., Professional Competencies That Mathematics Teacher Educators Should Have: Reflections from A Workshop. *“Proceedings of the Thirty-Ninth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education”* (2018). p.491-494.

2. Erbař, A. K., etinkaya, B., Alacacı, C., Koyuncu, F., elikdemir, K., Kol, M., Yılmaz, N., Kurt, . C. (2017, Mayıs). Matematik ğretmen, yetiřtirmek iin gerekli matematik bilgisi: Ne bilmeli? Ne dzeyde bilmeli? Ne řekilde bilmeli? 3. *Trk Bilgisayar ve Matematik Eėitimi Sempozyumu* [3rd Turkish Computer and Mathematics Education Symposium] Bildiri zetleri Kitabı (s. 60-61). Afyon, Trkiye.

