Uludağ Üniversitesi Eğitim Fakültesi Dergisi / Journal of Uludag University Faculty of Education
e-ISSN: 2667-6788 https://dergipark.org.tr/tr/pub/uefad
Yıl **2023,** Cilt **36**, Sayı **1**, **100-121** | DOI: https://doi.org/10.19171/uefad.1125177 **Araştırma Makalesi | Research Article**

Fen Bilgisi Öğretmen Adaylarının Öğretimsel Karar Verme Süreçlerinin İncelenmesi[1]

Examining The Instructional Decision-Making Process Of Preservice Science Teachers

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Özet

Bu araştırma fen bilgisi öğretmen adaylarının öğretimsel karar verme süreçlerini incelemeyi amaçlamaktadır. Özel durum yöntemi ile yürütülen bu araştırmaya bir devlet üniversitesinin üçüncü sınıfında öğrenim gören 28 üçüncü sınıf fen bilgisi öğretmen adayı katılmıştır. Veri toplama aracı olarak fen bilgisi öğretmen adaylarının öğretimsel karar verme süreçlerine ilişkin bilgileri içeren öğretimsel karar verme günlükleri kullanılmıştır. Fen bilgisi öğretmen adaylarından çalışma yaprakları tasarlamaları ve tasarım süreçlerini görev olarak yazmaları istenmiştir (Görev I ve Görev II). Görev I bireysel, Görev II ise takım çalışması şeklinde yürütülmüştür. Elde edilen veriler içerik analizine tabi tutulmuştur. Elde edilen bulgular, bazı öğretmen adaylarının günlük yaşamla ilgili problem durumu oluşturabilmelerine rağmen birden fazla çözüm üretemediklerini, çözümlerin olumlu ve olumsuz yönlerini tespit edemediklerini göstermektedir. Ayrıca adayların uygun çözüme kısmen karar verebildikleri fakat en uygun çözüme ulaşma sürecini takip edemedikleri belirlenmiştir.

Anahtar Kelimeler: Karar verme, Öğretimsel karar verme, Fen bilgisi öğretmen adayı

Abstract

This study aimed to examine the instructional decision-making process of preservice science teachers. Within a case study research methodology, the study group consisted of 28 third-year preservice science teachers studying at a state university in Turkey. Instructional decision-making diaries kept by preservice science teachers containing information on their instructional decision-making processes were used to collect data. Preservice science teachers were asked to design worksheets and write down their design processes as tasks (Task I and Task II). They were asked to design worksheets individually under Task I, and as teamwork under Task II. Obtained data were analyzed by using content analysis. Findings show that some of the preservice teachers could not generate more than one solution although they could create a problem situation related to daily life; and they could not identify the positive and negative aspects of the solutions. In addition, it was determined that they could partially decide on the appropriate solution but could not follow the process of coming to the most appropriate solution.

Keywords: Decision making, Instructional decision-making skill, Preservice science teacher

1. Introduction

Decision making is a teachable skill (Mettas, 2011; Accardo & Xin, 2017). Decision making refers to collect guiding information to achieve the desired results regarding the situation

[1] Bu araştırma, "Bağlam Temelli Öğrenme Uygulamaları ile Zenginleştirilmiş Fen Bilimlerinde Yaşam Becerileri Eğitimi Kılavuzunun Tasarlanması, Uygulanması ve Değerlendirilmesi" başlıklı, 117K993 kodlu, TÜBİTAK projesinin bir bölümünü oluşturmaktadır.

Kabul Tarihi / Received: 02.06.2022 | Onay Tarihi / Accepted: 06.01.2023

encountered, creating options via systematic, scientific, and logical reasoning in the light of this information, and choosing and applying the most appropriate among these options (Khishfe, 2012). In order for the decision-making behavior to emerge; people need to recognize and feel a difficulty (problem) that causes the need to make a decision (Jime´nez Aleixandre, 2002). The person who is aware of this difficulty should have different solutions and choose one among them to overcome that difficulty (Buchanan & Henig, 1996). Teachers are the first people who encounter problems in the education process and try to solve them. How to solve a problem encountered in the teaching process is related to the teacher's ability to use instructional decision-making skills (Hora & Anderson, 2012). It takes time for preserves teachers to acquire this skill (Wise & Jung, 2019). Instructional decision-making skills are an important feature that a teacher should have to reveal the individual differences of students, design instructional process according to students' needs (Lam, 2007; Mason & Smith, 2020) and evaluate students correctly (Mitchell, 1988). Teachers have to consider the culture of the school, environmental characteristics (Lande & Mesa, 2016) and the equipment of the classroom while using his/her instructional decision-making skills (Schoenfeld, 2011). They pay attention to their career development, having fun in the lesson, and especially what students will learn while using their instructional decision-making skills (Henry, 1994). Hamilton et al. (2009) on the other hand, emphasize that it is important for teachers to consider previously measured student achievements before starting the instructional decision-making processes. The efficient functioning of pre-lesson instructional decision-making skills is a fundamental process that affects instructional decision-making skills during and after the lesson (Kohler, Henning, & Usma-Wilches, 2008). Instructional decision making can be used before, during and after the lesson (Stiggins, & Conklin, 1992). Teachers' instructional decision-making skills are affected by their professional knowledge for assentment (Mokhtari, Rosemary, & Edwards, 2007).

Carter, Stephenson & Hopper, (2015) reveal that the internships they do at schools have a positive effect on the development of instructional decision-making skills of final year preservice teachers. Kohler, Henning, & Usma-Wilches, (2008) examine preservice teachers' instructional decision-making skills during and after the lesson. The researchers found that the preservice teachers' instructional decision-making skills on formative assessment are inadequate. Preservice teachers need to develop their professional knowledge to understand students and solve their learning problems (Cooper, 2009), and gain experiences to understand what their students think (Van Driel et al., 2001). In teacher training process, preservice teachers are expected to be experienced decision makers during teaching and even to convey these decisions following the teaching context (Scales et al., 2018). Teachers do not have sufficient knowledge and experience in instructional decision-making processes in the early years of their profession (Demiraslan Çevik, 2013). Williams & Sato (2021) found that academics' prior experiences with the course affect their instructional decision-making skills. Considering that teachers' professional development has a positive effect on instructional decision making (Jenkins, 2018), it can be said that examining preservice teachers' instructional decision-making skills are important in terms of identifying and eliminating deficiencies in their professional development. It is recommended that educational politicians and academics focus on instructional decision-making skills and conduct research (Little, 2007; Greenhow, Dexter, & Hughes, 2008). Decision making is a life skill, and science teachers teach this skill in their classes (MNE, 2018). A teacher who does not develop his/her life skills and cannot use them with the right timing is also difficult to gain this skill for his/her students in learning environments designed by him/her (Jeffrey & Craft, 2004). In this respect, the concept of instructional decision making is vital in science teaching (Cooper, 2009). Moreover, a science teacher's ability to acquire and use instructional decision-making skills also means

that the academic success of her/his students will increase (Lee, 2007; Basye, 2012). Kohler, Henning & Usma-Wilches (2008) emphasize that it is important to examine the instructional decision-making processes of preservice teachers in different fields so that they can acquire professional knowledge. Professional knowledge and experience of teachers affect their instructional decision-making skills (Hill, Ball, & Schilling, 2008). It is important to reveal the instructional decision-making skills of preservice teachers to increase their experience and professional knowledge (Henry, 1994). Uncovering the instructional decision-making processes of teachers is very important for understanding teachers and solving their problems (Van Hover, & Yeager, 2007). This study aimed to determine the instructional decision-making process of preservice science teachers. It is thought that the end of the research will positively affect the awareness of preservice science teachers about their instructional decision-making skills. Moreover, it is expected that this study will contribute to both preservice and science teachers in terms of making self-evaluations regarding their use of instructional decision-making skills. It is thought that the results of the research will lead both science educators to update their learning environments and undergraduate program development experts to change the content of undergraduate courses. The research question of this study is as follows: How does the instructional decision-making process of preservice science teachers progress?

2. Method

The case study method is used to make an in-depth analysis of the instructional decision-making processes of preservice science teachers. This method helps the researchers to obtain in-depth information regarding a subject in a short time. As its name signifies, in other words, "case study", the results obtained via this method are limited to the cases under study, and there is no generalization concern (Meyer, 2001). In this study, the instructional decision-making processes of preservice science teachers individually and as a team will be examined.

2.1. Participants

This research was conducted in the spring semester of the 2019 - 2020 academic year. The sample of this study consists of 28 third-grade preservice science teachers studying at a state university in Turkey. Preservice science teachers conducted studies both individually and as a team. The teams were formed by the faculty members including randomly selected four preservice teachers. However, the number of preservice teachers in the teams varies from two and five due to the absence and communication problems of some students with others during the course. Preservice science teachers learn science-related conceptual knowledge and vocational knowledge courses in the first two years of their education. In the third year, Preservice science teachers learn applied science education courses. They begin to design activities for secondary school students. In the last year of their education, they apply what they have learned in their internship courses. The reason why third-year preservice science teachers are working in this study is that they will use the professional knowledge they learned in their final year internship. Therefore, identifying and eliminating the existing problems within the scope of instructional decision-making skills at this level will positively affect subsequent learning.

2.2. Data Collection Tools

Each preservice teacher was coded as P1, 2… P28 and teams were coded as T1, … T8. (T1: P25,26,8 - T2: P3,11,24,27 - T3: P9,10, 12 - T4: P15, 6, 7 - T5: P21,22,23,28 - T6: P17,19 - T7: P13,14,5,16 - T8: P1, 18, 2, 4, 20) within the scope of the study. It is emphasized that evidence-based products must be used to examine instructional decision-making skills (Little, 2007). Kohler, Henning & Usma-Wilches (2008) used reflective products to identify preservice science teachers' instructional decision-making processes. Greenhow, Dexter, & Hughes (2008) used online multimedia problem-solving scenarios to measure preservice science teachers' instructional decision-making skills on technology integration. It is important to apply a performance-based assessment to evaluate the instructional decision-making skills of the preservice science teachers (Stuart & Tatto, 2000). Therefore, in this study the instructional decision-making diaries are used as data collection tools. Open-ended questions that comply with the first four steps of the decision-making process as suggested by Bergland (1974), are prepared for preservice science teachers to write their decision-making diaries. These steps are summarized in Table 1.

Table 1. *Open-Ended Questions in the Instructional Decision-Making Diary*

Decision making processes	*Open-ended questions in the instructional decision making diary*
1-Feeling and defining the problem	1- Write down a daily life problem situation regarding the acquisition you selected. 2- Why is this situation a problem for you (as a preservice teacher)? Why this situation has to be solved? (Concerning the daily life problem that you defined regarding the acquisition you selected, what do students find difficult to understand or what may they find difficult to understand? You are a preservice science teacher. You should define the issues that students find difficult to learn effectively.)
2-Generating solutions	3-By which methods-activities would you solve the problem you defined above as a problem that is difficult to understand for students in the active involvement section of your worksheet?
3-Identifying the positive-negative aspects of solutions	4- What are the positive and negative aspects of these methods/activities that you generated for the problem solution?
4-Evaluating the most appropriate solution to meet the demands	5- From which aspects do the methods-activities you have generated for the problem solution meet your demands? 6-a- How do you generate the appropriate solution – activity? b- When are you able to generate it? c-What kind of processes do you experience?

The diaries cover the first four steps of these processes. Open-ended questions are used in the diaries to reveal these processes. The preservice science teachers write their diaries individually under Task I and as a team under Task II.

2.3. Data Collection Process

The data were collected within the scope of the Science Teaching Laboratory Practices II course taken by the participants. The preservice science teachers are expected to fill in the worksheet design processes as tasks (Task I and Task II) in their instructional decision diaries. Within the scope of the tasks, the students are asked to define a daily life problem according to the acquisitions they are responsible for and to solve this problem in their worksheets. In the first week of the semester, written documents regarding the subjects, decision making diaries, delivery, and presentation dates of the lesson plans (within the scope of the course content) are given to the preservice science teachers. After they were informed about the course requirements, they were asked to fulfill the presentations of Task I in three weeks and Task II in eight weeks. Task I presentations performed individually lasted five weeks, and Task II presentations performed as a team lasted three weeks. Each preservice science teacher has delivered his/her lesson plan and decision-making diary at the time of his/her presentation.

2.4. Data Analysis

Decision making processes of the preservice science teachers are considered as themes. The categories are created from the codes reached as a result of the content analysis. The themes and codes obtained by analyzing the findings are presented with figures and tables. The data obtained have been coded separately by two researchers at different times. The researchers have recorded the data for four weeks after the initial coding. They finalized the data analysis by comparing the codes they have reached. Then, the resulting codes were compared. Since a consensus on some codes could not be reached, the opinions of different researchers have been consulted. Finally, there have been no codes leading to disagreement in the findings. The findings that emerge in this way are included in the next section.

2.5. Ethical Procedures

Preserves Science teachers participating in the research were informed of the existence of the research. Preserves Science teachers were told that the tasks they produced would not be scored for success in the course. Preserves Science teachers who wanted to participate in this research contributed. In addition, this study was approved with the Meeting Date and Number 06.09.2017/05 by the Social and Human Sciences Ethics Committee of Kafkas University.

3. Findings

Findings obtained within the framework of the purpose of the study are presented respectively by considering the processes of instructional decision-making skills. The first question in the task logs of preservice science teachers is “Write down a daily life problem situation regarding the acquisition you selected” The answers given to this question are presented in Table 2.

Table 2. *The Preservice Science Teachers' Capability of Defining a Daily Life Problem*

Problem Situation		*The ones that cover the task acquisitions*	*The ones that do not cover the task acquisitions*
		Preservice science teachers	
Defining a problem situation	Capable of defining a problem situation regarding daily life	P2,P3,P4,P5,P7,P8,P15,P16, P17, P18, P21, P22, P23, P25, P27, T2, T3, T5, T6, T8	P12, P13, P19, P24, P28, T7
	Capable of defining a problem that is not related to daily life	P1, P11, P20, T1	P6
Not capable of defining a problem situation	Not capable of defining a problem (not able to write in problem form)	P9, P10, P26	P14, T4

Table 2 shows that most preservice science teachers individually and as teams can define a problem situation regarding daily life problem that covers task acquisitions. A few examples of preservice science teachers' expressions are presented below.

Most of the plant species in our region are unproductive and cold hardy. Therefore, within the scope of the subject I have discussed, I want the students to focus on the problem of "what should be done to adapt the strawberry plant to terrestrial climate conditions and to have two crops in summer". (P8) (Candidate's assignment: Relates genetic engineering to biotechnology).

We talk about the image created by adding olive oil to the water (T4) (Team's Assignment: We compare the densities of the solid and liquid states of water and discuss the importance of this situation for living things)

P8 coded preservice science teacher is capable of defining a problem situation regarding daily life that covers the task acquisitons. But T4 coded preservice science teacher is not capable of defining a problem that covers the task acquisitons. The second question addressed to the preservice science teachers is as follows: "Why is this situation a problem for you (as a preservice teacher)? Why does this situation have to be solved?" This question is addressed to reveal the reasons underlying the problem that they have selected. The answers given to this question are presented in Figure 1.

Figure 1. *The Preservice Science Teachers' Reasons for Selecting the Problems*

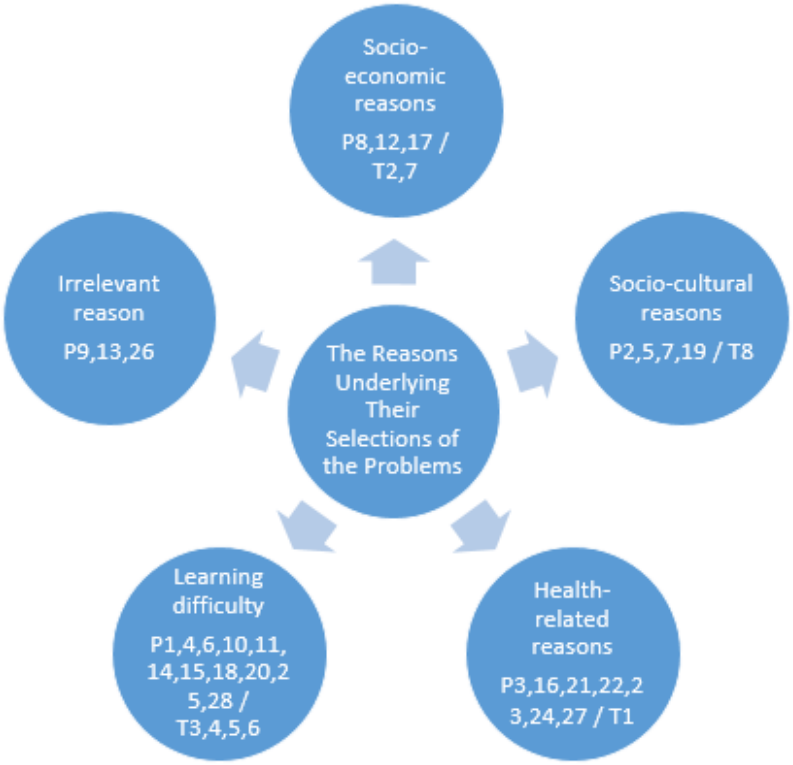


Figure 1 shows that the preservice science teachers stated socio-economic, socio-cultural, health-related, and learning difficulty reasons for the problems they have selected as an individual and as teams. One of the most important steps of the decision-making process is to be able to determine the solutions to the problem. A few examples of preservice science teachers' expressions are presented below.

Since unemployment is a big problem in our region, this problem needs to be solved (P8).

We had a hard time understanding the density issue when we were students. Since it is a difficult subject, we thought that it should be emphasized (T4)

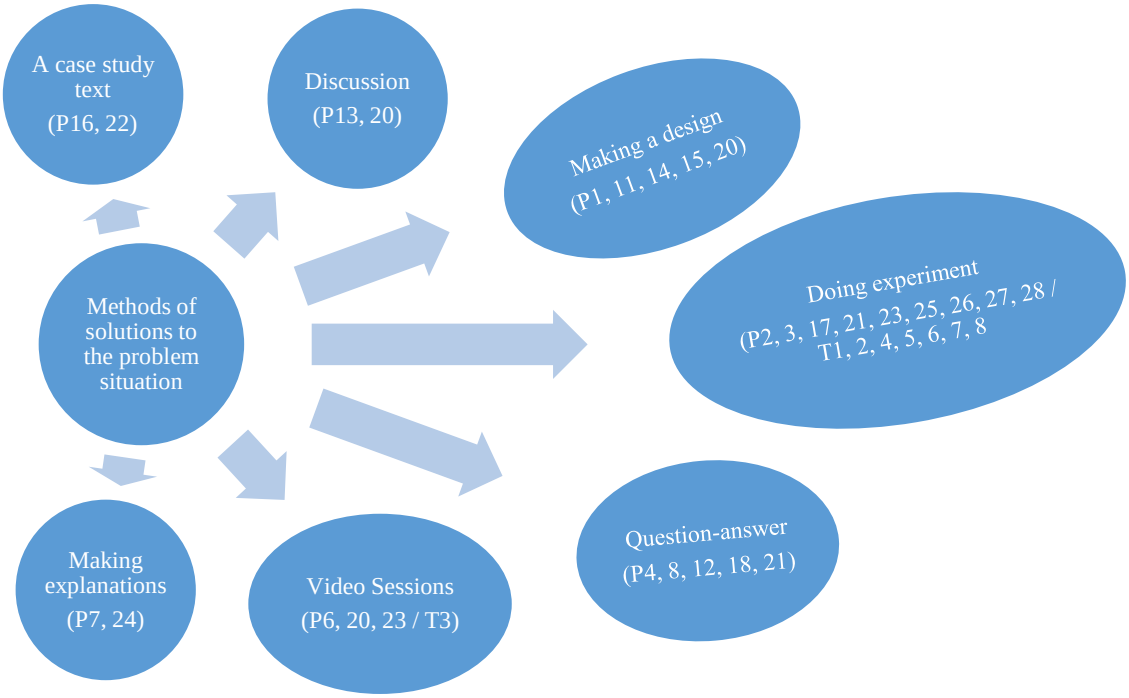
The response of P8 coded preservice science teacher is evaluated for socio-economic reasons, and the response of T4 coded preservice science teacher is evaluated within the framework of the learning difficulty code. The third question addressed to the preservice science teachers is as follows: "By which methods-activities would you solve the problem you defined above as a problem that is difficult to understand for students in the active involvement section of your worksheet?" Hence, their opinions on generating solutions are received. Table 3 shows the findings regarding the number of solutions generated by the preservice science teachers whereas Figure 2 shows the findings regarding the methods of solving the problem by the preservice science teachers who can generate solutions.

Table 3. *Number of Solutions to the Problems that the Preservice Science Teachers Selected*

Solutions	*The Preservice science teachers*
Capable of generating more than one solution	-
Capable of generating one solution	P1-4,6-8,11-18,20-28 / T1-8
Not capable of generating solution – Incoherent response	P5,9,10,19

Table 3 shows that the preservice science teachers are either not able to generate a solution or generate only one solution. It is also remarkable that the teams can generate only one solution as well. Figure 2 shows the methods of solutions proposed by the preservice teachers who can generate solutions.

Figure 2. *Methods of Solutions to the Problems*



The preservice science teachers aim to solve the problems, which they have defined by using methods or techniques such as case study, discussion, design, doing experiments, question-answer, video sessions and making explanation in the active involvement section of their worksheets. The majority of the teams prefer to solve their problems by doing experiments. The response of T4 is as follows:

The important thing is to provide students' understanding of the concept of density. We need to focus on the concept of density due to the acquisition we have discussed. We decided to do the following activity for the active involvement section of our worksheet.

Name of the experiment: Brotherhood of water and olive oil

Tools:1/2 glass of water, ½ glass of olive oil, a spoon

Steps of the experiment: Add ½ glass of water and ½ glass of olive oil to each other and mix it with a spoon.

My observations: What do you see? Let's conclude: List the densities of water and olive oil (T4)

When the answer given by the preservice science teachers coded as Team 4, for the active involvement part of the worksheet is examined, it has seen that they generate only one solution proposal as a team (Table 3) and that the solution proposal is an experimental activity. The fourth question addressed to the preservice science teachers is as follows: "What are the positive and negative aspects of these methods-activities you generated for the problem solution?" In this sense, this question is addressed to reveal the appropriateness of the generated solutions about the problems. Table 4 shows the findings regarding the fourth question.

Table 4. *Appropriateness of the Generated Solutions*

	Codes	*The Preservice science teachers*
Full determination	Content of the acquisition, usability or availability of materials, activity duration, emphasis on its role in daily life, classroom management	-
Partial determination	Content of the acquisition	P3,4,5,6,11,12,13,14,15,17,18,19,20,21,22,23,24,25,27 - T1,2,3,4,5,6,
	Availability of materials	P1- T3,5,7
	Usability of materials	P1,6,25,26 - T1
	Emphasis on its role in daily life	P22,24,27 - T6,7,8
	Activity duration	P14,28
	Classroom management	P28
Unable to determine	Not being capable of evaluating the appropriateness of the solution	P2,8,9,10,16

Table 4 shows that most of the preservice science teachers as individualy and as teams only try to decide whether the solutions are appropriate for the content of the acquisition. This shows that they do not pay attention to or put an emphasis on the availability and usability of the materials, their role, importance in daily life, activity duration, classroom management as much as the content of the acquisition. When the response of the preservice science teachers coded as T4 reflected on the decision diary is examined, it has seen that they only pay attention to the content of the acquisiton in the experimental activity they produced. The next question addressed to the preservice science teachers is as follows: "How do you generate the appropriate solution – activity? When are you able to generate it? What kind of processes do you experience?" In this sense, they are asked about their experiences during the generation of appropriate solutions, generation time, and other experiences during the generation process. Table 5 shows the findings obtained from responses to these questions below.

Table 5. *Processes of Generating Appropriate Solutions*

Processes regarding appropriate solutions	*Codes*	*Individual*	*Team*
Ways of generating appropriate solutions	Only thinking	P1,3,5,8-11,14,15,17,19,21,27,28	-
	Previous experiences	P2,4,12,13,18	-
	Internet	P6,7,20,23,24,25,29	T3
	Help from relatives	P16	-
	Textbooks	P20,22,26	T5
	Brainstorming among team members	-	T1-8
Time of generating appropriate solutions	A few days before the final submission date	P1,2,5,6,9,10,14,15,17,19-21,24-27	T1, T2, T7, T8
	A week before the final submission date	P3,4,7,8,11-13,22,23,17	T4, T5

	Two weeks before the final submission date	P16,18,28	T3, T6
Experiences during the generation of appropriate solutions	Not experiencing any unfavorable situation	P1,5-9,12,13,15,18-23,25-28	T1-8
	Not being able to make a good use of time	P2,10	-
	Feeling stressed	P3,4,24	-
	Not being able to find material	P14	-
	Not being able to find solution	P16,17	-
	Trial and error	P11	-

Table 5 shows that most preservice science teachers only think to find a solution whereas some also take advantage of the internet or use their previous experiences. It is noteworthy that most of the preservice science teachers generate an appropriate solution a few days before the final submission date, and they do not experience any unfavorable situation while generating the solution. As for the teams, they generate their solutions through brainstorming and do not experience any unfavorable situations during this process.

4. Discussion

Teachers constantly make decisions for teaching (eg, content, lesson pace, groupings) to meet students' learning needs. Hence, it is important to ensure preservice science teachers make correct and quick decisions in the teaching process when they start their profession (Scales et al., 2018). The decision-making process begins with the identification of the problem to be decided. When the data obtained from the study are examined it has been seen that most of the preservice science teachers are capable of defining a problem situation regarding daily life within the scope of Task I and II acquisitions. Defining the problem is one of the most difficult steps in the decision-making process (Kardaş, 2013; Jime´nez Aleixandre, 2002). Preservice science teachers sometimes can explain the reason for a mistake made in the decision-making process and sometimes not being able to generate a solution to a problem situation, with their current experience (Sancar & Deryakulu, 2020). The teacher training process, which starts with studentship and continues with novice teaching, is expressed as the transition process to becoming experienced teachers and also experienced decision makers (Scales et al., 2018). It is seen that the preservice science teachers who can define a problem are able to do so when they work as a team. How much of the decisions to be taken during the instructional decision-making process is shared with other individuals is an important aspect. This is because fulfilling a task and making important decisions on one's own sometimes forces the person and obliges him/her to conduct teamwork (Adair, 2017). Teamwork skills refer to the skills that enable students to participate in research processes with others to achieve a common goal (Robinson & Zajicek, 2005). The concept of team learning refers to the acquisition of competencies such as knowledge, skills and performance through the interaction and experience of interconnected people. The research supports a positive relationship between team cohesion and performance (Kozlowski & Ilgen, 2006). Therefore, individuals in the team have to adapt to changing needs and demands (Kozlowski et al., 1999; Kozlowski, et al., 1996). Furthermore, accurate and timely decision making

depends on continuing scientific discussions within the team. (Engle, 2003; Aymen-Peker et al., 2012; Nutt, 2008; Steele et al., 2007). The fact that some of the preservice science teachers cannot define problem situations within the scope of their task acquisitions. It may stem from their incapability of associating daily life with science subjects (Kirman Bilgin & Kala, 2018). It will be difficult to solve a problem that is not well defined. Hence, preservice science teachers must first create problem situations effectively to solve a problem. Because a well-defined problem will also reveal the criteria and limitations of the product that is introduced for the solution of that problem (Kolodner et al., 2003; Brunsell, 2012). The preservice science teachers define problem situations regarding learning difficulties, health-related causes, socio-cultural and socio-economic reasons, respectively. Besides, some of them stated irrelevant reasons. It is also observed that the preservice science teachers stated irrelevant reasons also are not able to define a problem situation within the scope of Task I while working individually. As these preservice science teachers experience difficulty in defining a daily life problem, it leads them to fail in expressing the reasons underlying the problem they have selected. New information should be added to the existing information to solve a problem (Wineburg & Fournier, 1994). It is seen that the most common reason stated for selecting the problems is learning difficulty. As the learning difficulty is the leading problem situation determined by the preservice science teachers, it shows that they have the competence of considering problems professionally.

When the data obtained from the decision making diaries regarding the number of the solutions of the problems determined by the preservice science teachers are examined (Table 3), it has seen that both individually and as a team, they are either not capable of generating more than one solution, they are capable of generating one solution or not capable of generating solutions. However, as a requirement of decision-making skills, individuals are expected to decide on the solution that is the most appropriate for the desired features from more than one solution. Bozkurt Altan et al. (2018) stated that preservice science teachers have problems in generating alternatives to the problem situations. If the problem given to preservice science teachers involves more than one situation, it can be offered to divide each situation into pieces to allow small groups to brainstorm and generate alternative solutions. It is thought that this result stems from preservice science teachers' writing down the first solution that comes to their mind, without brainstorming or doing research about the solution and not working together to generate a shared solution. As known appropriate solutions can only be revealed through the participation of the whole team, consensus, research, and detailed problem solving (Mentzer, 2011). Individuals should gather information before making a decision and search for possible alternatives (Kardaş, 2013). Therefore, they will be able to generate alternative ideas. When the findings regarding the preservice science teachers' ways of solving problems (Figure 2) are examined, it is seen that they mostly prefer doing experiments to solve the problems, whereas they rarely use making a design, question-answer, video sessions. It is observed that they do not mention the brainstorming method, which is one of the methods used in identifying possible solutions and creating new ideas. Mentzer (2011) argues that the most effective ways to identify possible solutions are found by brainstorming and researching the existing solutions. Hora (2014) revealed that the majority of science and mathematics teacher candidates believe that it is easier for students to learn through repetition. In this study, however, the candidates did not put any emphasis on repetition.

When the appropriateness of the solution ways of the problems determined by the preservice science teachers are examined, it is seen that they can be mostly categorized in the partial determination category both for individuals and teams. While designing the lesson plans, it has been seen that the majority of the preservice science teachers paid attention to the content of acquisition in decision making process. The 3rd-year preservice science teachers have taken the core courses

related to their professional skills such as "Teaching Principles and Methods, Science Program and Planning, Science Teaching Laboratory Practices I, Instructional Technologies and Material Design" within the curriculum. However, it was revealed that (Table 4) when deciding on the suitability of the solution way they have determined, preservice science teachers do not pay attention to the coexistence of features such as availability and usability of materials, emphasis on its role in daily life, activity duration, classroom management. This shows that the preservice science teachers do not think holistically while generating the solutions. Bachor and Baer (1999) find out that preservice science teachers benefit from their intuition while using their instructional decision-making skills. It can be concluded that preservice science teachers generally make their instructional decisions in a limited and general way (Demiraslan-Çevik, 2013). They make superficial decisions because of their insufficient experience and practice, and their poor professional knowledge (Meshede et al., 2017). In a study conducted by Kapucu (2019), it is seen that even though 44 students are instructed about the whole product design process, only five of them manage to design in compliance with all the steps of the process. This shows that although the whole process about decision making process is explained in detail, learning is not fully realized by the vast majority of students. In all lessons the preservice science teachers are asked to pay particular attention to the content of acquisition while preparing lesson plans and worksheets, this leads them to attach importance to this category. Moreover, though these students have not taken a classroom management course yet, it can be expected not to one take this aspect into account in their lesson plan. It is seen that the preservice science teachers do not have a full understanding of preparing a lesson plan, yet as they do not consider aspects such as the availability and usability of the materials, emphasis on its role in daily life, activity duration, and classroom management in their lesson plans and worksheets. It is observed that preservice science teachers mostly determine the appropriate solution to their problems mostly by only thinking and previous experiences, through the internet and a few of them uses textbooks (Table 5), without researching and questioning and before considering their previous experiences. This situation is also an indication that they do not acquire the decision-making skills covering the problem-solving steps at the desired level. It is also seen that the preservice science teachers do not understand that there are too many aspects to consider when solving a problem and they try to reach a solution with the first idea that comes to their mind without having good knowledge to the solution. After the problem is defined, it is necessary to do some research instead of solving the problem with the first idea that comes to mind (Scales et al., 2018). When the time take off for generating appropriate solution to the problems that preservice science teachers spared (Table 5) is examined, it has seen that most of the preservice teachers use the last few days before the final submission date both as individuals and as teams. Correct timing and effective use of time play an important role in decision making processes (Jime´nez-Aleixandre, 2002). But this situation shows that preservice teachers try to determine the appropriate solution in a short time. When the experience of preservice science teachers in the process of generation of the appropriate solution (Table 5) is examined, it has seen that those who experience unfavorable situations while working individually do not experience any unfavorable situation while working as a team. This situation can be seen as an indicator of the positive contribution of teamwork to academic achievement.

5. Conclusion

It is concluded that preservice science teachers are not capable to use the steps of decision-making skills; as defining a daily life problem related to acquisition, generating solutions more than

one for the problem, selecting the most appropriate solution for the problem, applying the solution, and making a decision, at the desired level in the current study.

6. Implications

Some implications can be made according to the results of the study. First, the course content can be developed by science educators who aim at acquiring life skills and this content should be taught as a selective course to develop preservice teachers' decision-making skills at the desired level. Second, teaching practices can be devoted to improving preservice teachers' decision-making skills within the scope of "Teaching Technologies", "Material Design in Science Teaching", "Science Education Laboratory Practices I-II", and "Science Teaching" courses. Third, it was seen that some preservice science teachers were negatively influenced by teamwork. Therefore, it may also be suggested to conduct studies to improve the teamwork skills of the preservice science teacher. Researchers who are interested in the subject may be advised to examine the third and final year instructional decision-making processes of pre-service science teachers as a longitudinal study. In this way, the problems that arise in the instructional decision-making skills of preservice science teachers can be revealed more clearly.

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Geniş Özet

Giriş

Eğitim sürecinde sorunlarla karşılaşan ve bunları çözmeye çalışan ilk kişiler öğretmenlerdir. Öğretim sürecinde karşılaşılan bir problemin nasıl çözüleceği, öğretmenin öğretimsel karar verme becerilerini kullanabilmesiyle ilgilidir (Hora ve Anderson, 2012). Öğretmen adaylarının bu beceriyi kazanması zaman almaktadır (Wise & Jung, 2019). Öğretimsel karar verme becerileri, öğrencilerin bireysel farklılıklarını ortaya çıkarmak, öğretim sürecini öğrencilerin ihtiyaçlarına göre tasarlamak (Lam, 2007; Mason ve Smith, 2020) ve öğrencileri doğru değerlendirmek (Mitchell, 1988) için bir öğretmenin sahip olması gereken önemli bir özelliktir. Öğretmenler, öğretimsel karar verme becerilerini kullanırken (Schoenfeld, 2011), okulun kültürünü, çevre özelliklerini (Lande ve Mesa, 2016) ve sınıfın donanımını göz önünde bulundurmak zorundadır. Kariyer gelişimlerine, derste eğlenmelerine ve özellikle öğrencilerin öğretimsel karar verme becerilerini kullanırken ne öğreneceklerine dikkat ederler (Henry,

1994). Hamilton ve ark. (2009) ise öğretmenlerin öğretimsel karar verme süreçlerine başlamadan önce önceden ölçülen öğrenci başarılarını dikkate almalarının önemli olduğunu vurgulamaktadır. Ders öncesi öğretimsel karar verme becerilerinin verimli bir şekilde işlemesi, öğretimsel karar verme becerilerini ders sırasında ve sonrasında etkileyen temel bir süreçtir (Kohler, Henning ve Usma-Wilches, 2008).

Öğretimsel karar verme, dersten önce, ders sırasında ve sonrasında kullanılabilir (Stiggins ve Conklin, 1992). Fen öğretiminde öğretimsel karar verme kavramı oldukça önemlidir (Cooper, 2009). Bir fen bilgisi öğretmeninin öğretimsel karar verme becerisini kazanabilmesi ve kullanabilmesi, öğrencilerinin akademik başarılarının artacağı anlamına da gelmektedir (Lee, 2007; Basye, 2012). Kohler, Henning & Usma-Wilches, (2008) farklı alanlardaki öğretmen adaylarının öğretimsel karar verme süreçlerinin incelenmesinin adayların meslek bilgisi edinebilmeleri için önemli olduğunu vurgulamaktadır. Öğretmenlerin sahip oldukları mesleki bilgi ve deneyimlerde onların öğretimsel karar verme becerilerini etkiler (Hill, Ball, & Schilling, 2008). Öğretmen adaylarının öğretimsel karar verme becerilerinin ortaya çıkarılması onların deneyimlerini ve mesleki bilgilerini artırmak için önemlidir (Henry, 1994). Öğretmenlerin mesleki gelişimlerinin öğretimsel karar verme üzerinde olumlu bir etkiye sahip olduğu (Jenkins, 2018) göz önüne alındığında, öğretmen adaylarının öğretimsel karar verme becerilerinin incelenmesi, mesleki gelişimlerindeki eksikliklerinin belirlenmesi ve giderilmesi açısından önemli olduğu söylenebilir. Eğitim politikacılarının ve akademisyenlerin öğretimsel karar verme becerisine odaklanmaları ve araştırma yapmaları önerilmektedir (Little, 2007; Greenhow, Dexter, & Hughes, 2008).

Bu araştırma, fen bilgisi öğretmen adaylarının öğretimsel karar verme süreçlerini belirlemeyi amaçlamıştır. Araştırmanın sonuçlanmasının fen bilgisi öğretmen adaylarının öğretimsel karar verme becerilerine ilişkin farkındalıklarını olumlu yönde etkileyeceği düşünülmektedir. Ayrıca bu çalışmanın hem öğretmen adaylarına hem de fen bilgisi öğretmen adaylarına öğretimsel karar verme becerilerini kullanmalarına ilişkin öz değerlendirme yapmaları açısından katkı sağlayacağı düşünülmektedir. Araştırma sonuçlarının hem fen eğitimcilerini öğrenme ortamlarını güncellemeye hem de lisans program geliştirme uzmanlarını lisans derslerinin içeriğini değiştirmeye yönlendireceği planlanmaktadır. Bu çalışmanın araştırma sorusu şu şekildedir: Fen bilgisi öğretmen adaylarının öğretimsel karar verme süreçleri nasıl ilerlemektedir?

Yöntem

Bu araştırmada, fen bilgisi öğretmen adaylarının öğretimsel karar verme süreçlerinin özelliklerinin derinlemesine incelenmesi amaçlandığı için özel durum yöntemi kullanılmıştır. Bu araştırmada iki farklı durum üzerinde odaklanılmaktadır. Birincisi adayların bireysel yürüttükleri öğretimsel karar verme süreçleri, ikincisi takım olarak yürüttükleri öğretimsel karar verme süreçleridir.

Bu araştırmanın örneklemini bir devlet üniversitesinde öğrenim gören üçüncü Sınıf fen bilgisi öğretmen adayları (28 öğretmen adayı) oluşturmuştur. Bu araştırmada üçüncü sınıf öğretmen adayları ile çalışılmasının sebebi, adayların öğrendikleri mesleki bilgileri son sınıfta stajda kullanacak olmalıdır. Dolayısıyla bu kademede öğretimsel karar verme becerileri kapsamında var olan problemlerin tespit edilmesi ve giderilmesi sonraki öğrenmeleri olumlu yönde etkileyecektir. Fen bilgisi öğretmen adayları veri toplama araçları kapsamında hem bireysel hem de takım olarak çalışmalar yürütmüşlerdir. Takımlar, öğretim üyesi tarafından dört öğretmen adayından oluşacak şekilde rastgele olarak oluşturulmuştur. Fakat ders süresince devamsızlık yapmaları ve iletişim problemi yaşamalarından kaynaklanan sorunlardan ötürü takımlarda öğretmen adayı sayıları iki ile beş arasında değişmektedir. Öğretimsel karar verme becerilerinin incelenebilmesi için mutlaka kanıta dayalı ürünlerin kullanılması

gerektiği vurgulanmaktadır (Little, 2007). Araştırmada veri toplama aracı olarak öğretmen adaylarının karar verme süreçlerini içeren karar verme günlükleri kullanılmıştır. Bu yönü ile mevcut araştırmanın öğretimsel karar verme becerilerine yönelik yapılan diğer çalışmalardan ayrıldığı söylenebilir. Karar verme günlüklerinin yazılmasında Bergland (1974) tarafından ortaya atılan karar verme sürecinin ilk dört basamağına uygun açık uçlu sorular hazırlanmıştır. Bu süreçler şu şekilde özetlenebilir: 1- Problemin hissedilmesi ve belirlenmesi, 2- Çözüm yollarının oluşturulması, 3- Çözüm yollarının olumlu-olumsuz yönlerinin belirlenmesi, 4- İstekleri karşılama açısından en uygun çözüm yolunun belirlenmesi, 5- Belirlenen çözüm yolunun uygulanması ve sonucun değerlendirilmesi. Günlükler bu süreçlerin ilk dördünü içermektedir. Bu süreçlerin ortaya çıkarılabilmesi için günlük içerisinde açık uçlu sorulardan yararlanılmıştır. Öğretmen adayları Görev I kapsamında bireysel, Görev II kapsamında ise takım olarak günlüklerini yazmışlardır. Dersi yürüten fen eğitimcisi (Dr. Öğretim Üyesi) tarafından öğretmen adaylarından Bağlam temelli öğrenme yaklaşımının bir uygulaması olan REACT [ilişkilendirme (**R**elating) - tecrübe etme (**E**xperiencing) - uygulama (**A**pplying) - iş birliği (**C**ooperating) - transfer etme (**T**ransferring)] stratejisi kapsamında ders planları oluşturmaları ve REACT stratejisinin ikinci basamağı olan tecrübe etme basamağı için dikkat çekme - etkin uğraşı - değerlendirme bölümlerinden oluşan özgün çalışma yaprağı tasarlamaları istenmiştir. Ders planları için REACT stratejisinin seçilmesinin nedeni bu stratejinin bağlam temelli öğrenme yaklaşımının bir uygulaması olmasından kaynaklanmaktadır. Bağlam temelli öğrenme yaklaşımının temel felsefesi günlük hayat problemlerinin fen bilgisi dersleriyle ilişkilendirilmesini, öğrenme ortamlarında çözüm yollarının tartışılmasını ve çözülmesini gerektirmektedir. Dolayısıyla günlük hayat problemlerinin çözümü yaşam becerilerini kullanarak gerçekleşebilir. Karar verme becerisinin de bir yaşam becerisi olduğu düşünüldüğünde bir bireyin bu beceriyi nasıl kullandığı da ancak fen bilgisi dersi ile ilgili bir günlük yaşam problemiyle baş başa bırakıldığında tespit edilebileceği söylenebilir. Fen bilgisi öğretmen adaylarından çalışma yapraklarını tasarlama süreçlerini karar verme günlüklerine görev (Görev I ve Görev II) olarak yazmaları beklenmektedir. Görev I için çalışma yapraklarını bireysel, Görev II için ise takım çalışması şeklinde tasarlanmaları istenmiştir. Karar verme becerisinin yaşam becerilerinden biri olmasından ötürü görevler kapsamında sorumlu oldukları kazanımlara yönelik bir günlük hayat problemi belirlemeleri ve bu problemi çalışma yaprağı içerisinde özgün olarak çözmeleri belirtilmiştir. Dönemin ilk haftası öğretmen adaylarına, sorumlu oldukları konular, karar verme günlükleri, ders planlarının teslim ve sunum tarihleri (ders içeriği kapsamında) yazılı doküman olarak verilmiştir. Öğretmen adayları bu bilgilendirmeden 3 hafta sonra Görev I, 8 hafta sonrada Görev II sunumlarını yerine getirmişlerdir. Bireysel olarak yerine getirilen Görev I sunumları 5 hafta, takım olarak yerine getirilen Görev II sunumları 3 hafta sürmüştür. Her öğretmen adayı(ları) sunum anında ders planlarını ve karar verme günlüklerini ilgili öğretim üyesine teslim etmiştir.

Bulgular

Öğretmen adaylarının çoğunluğunun problem durumu oluşturabildikleri göze çarpmaktadır. Ancak problem durumu oluşturabilen öğretmen adaylarının bir kısmının, verilen görev kazanımı çerçevesinde günlük hayattan problem durumu oluşturmadığı görülmektedir. Takımların çoğunluğunun ise görev kazanımlarını kapsayan günlük hayatla ilişkili problem durumlarını oluşturabildikleri görülmektedir. Fen bilgisi öğretmen adaylarının bireysel ve takım olarak oluşturdukları problemleri, sosyo-ekonomik, sosyo-kültürel, sağlık, öğrenme zorluğu gibi nedenlere bağlı olarak belirledikleri görülmektedir. Karar verme sürecinin en önemli basamaklarından bir tanesi de probleme yönelik çözüm yolları belirleyebilmektir. Öğretmen adaylarının ya çözüm üretemedikleri ya da sadece bir çözüm yolu belirledikleri görülmektedir. Takımların ise sadece bir adet çözüm yolu

belirledikleri dikkat çekmektedir. Öğretmen adayları belirledikleri problem durumlarını, çalışma yaprağının etkin uğraşı bölümünde, örnek olay metni, tartışma, tasarım yaptırma, deney yaptırma, soru-cevap, video gösterisi ve açıklama yapma gibi yöntem veya teknikler kullanarak çözmek istemişlerdir. Takımların çoğunluğu ise deney etkinliği yaptırmayı tercih etmişlerdir. Öğretmen adaylarının ve takımların çoğunluğunun belirledikleri çözüm yollarını bir değişken açısından değerlendirdikleri dikkat çekmektedir. Adayların genellikle çözüm yollarını, kazanımın içeriğine uygun olup olmadığını belirlemeye çalıştıkları görülmektedir. Ürettikleri çözüm yolunda kullandıkları materyallerin bulunabilirliğine, kullanılabilirliğine, günlük hayattaki yeri ve önemine, etkinliği uygulama süresine, etkinliği uygulama sürecinde oluşabilecek kontrolsüzlüğe, kazanımın içeriği kadar dikkat edilmediği ve vurgulanmadığı görülmektedir. Adayların çoğunluğunun uygun çözüm yolunu belirlerken sadece düşündükleri, internetten yardım aldıkları ve ön yaşantılarından elde ettikleri deneyimleri kullandıkları görülmektedir. Öğretmen adaylarının çoğunluğunun uygun çözüm yolunu görevlerini teslim etmeden birkaç gün önce belirledikleri ve çözüm yolunu belirleme sürecinde herhangi bir olumsuzlukla karşılaşmadıkları dikkat çekmektedir. Takımların ise uygun çözüm yolunu, üyeler arasında beyin fırtınası yaparak belirledikleri ve uygun çözüm yolunu belirleme sürecinde olumsuzluk yaşamadıkları görülmektedir.

Sonuç ve Öneriler

Fen bilgisi öğretmen adaylarının karar verme süreçlerinin incelendiği mevcut araştırmadan elde edilen en önemli sonuç adayları öğretimsel karar verme becerisinin süreçlerini kullanmıyor olmalarıdır. Öğretmen adaylarının bir kısmı günlük hayatla ilişkili problem durumu oluşturabilseler de birden fazla çözüm yolu belirleyememektedirler. Birden fazla çözüm yolu belirleyememeleri oluşturulan çözüm yollarının olumlu - olumsuz yönlerini tespit etme ve çözüm yolları arasından en uygun olanı seçmelerinin de önüne geçmiştir. Belirledikleri çözüm yolu ise verilen görevin özelliklerini kısmen karşılamaktadır. Buna rağmen görevi yerine getirme sürecinde herhangi bir olumsuzluk yaşamamaları karar verme becerilerinin henüz gelişmediğini göstermektedir. Aynı zamanda fen bilgisi öğretmen adayları verilen görevi yerine getirme sürecinde ise araştırma-sorgulama faaliyetlerini yapmadıkları ve en uygun çözüm yoluna ulaşma sürecini takip etmedikleri tespit edilmiştir. Çünkü adayların çoğu gerek bireysel gerekse takım çalışmalarında sadece düşünerek veya beyin fırtınası yaparak istedikleri uygun çözüm yoluna karar vermişlerdir. Bachor ve Baer (1999), öğretmen adaylarının öğretimsel karar verme becerilerini kullanırken sezgilerinden yararlandıklarını tespit etmiştir. Demiraslan-Çevik (2013) öğretmen adayları genellikle öğretimsel kararlarını sınırlı ve genel bir şekilde verdiklerini tespit etmiştir. Meshede et al. (2017), öğretmen adaylarının yüzeysel kararlar verdiklerini; bunun nedeninin deneyimlerinin ve uygulamalarının yetersiz olmasıyla ve meslek bilgilerinin zayıf olmasıyla ilişkilendirmişlerdir. Bahsi geçen araştırmaların sonuçlarının mevcut araştırmanın sonuçlarıyla benzerlik gösterdiği dikkat çekmektedir. Bunun yanı sıra adayların karar verme süreçleri takım çalışmalarından olumlu ve olumsuz yönde etkilendikleri de tespit edilmiştir.

Fen bilgisi öğretmen adaylarının öğretimsel karar verme becerisini istenilen düzeyde geliştirebilmek adına fen eğitimcilerine yaşam becerilerini kazandırmaya yönelik bir ders içeriği geliştirmeleri ve seçmeli bir ders olarak okutulması önerilebilir. Aynı zamanda "Öğretim Teknolojileri ve Materyal Tasarımı - Fen Öğretimi Laboratuar Uygulamaları I-II ve Özel Öğretim Yöntemleri" dersleri kapsamında adayların öğretimsel karar verme becerilerinin gelişimine yönelik öğretim süreci yürütülmesi önerilebilir.

Ethical Procedures

Ethical approval and written permission were obtained from Kafkas University Social and Human Sciences Ethics Committee with the decision dated 06.09.2017 and numbered 05/01. The research was carried out following ethical rules at every stage. Participation of the candidates in the research took place on a voluntary basis.

Acknowledgments

This research paper is part of TUBITAK (The Scientific and Technological Research Council of Turkey) Project coded 117K993 “Design, Implementation, and Evaluation of Life Skills Training Guide in Enriched Science with Context-Based Learning Practices.”

Statement of Responsibility

The authors contributed equally to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Conflicts of Interest

The authors declare that there is no conflict of interest.