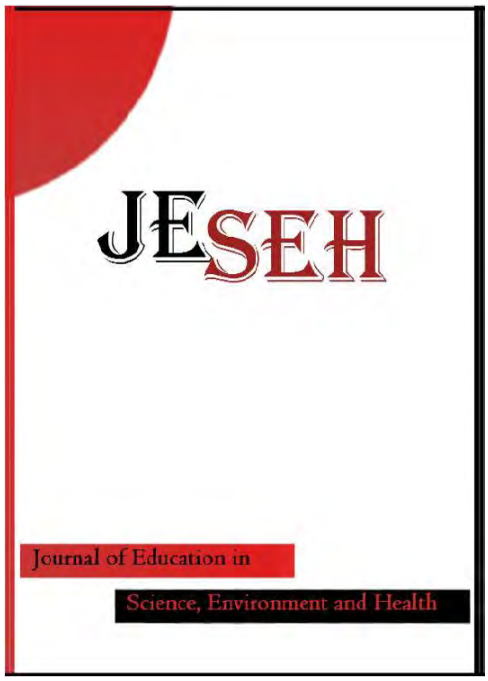

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Experiences of Science Teachers during the Pandemic-Based Distance Learning Process and Their Recommendations about the Post-Pandemic Process

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Abstract

The purpose of this study was to reveal the experiences of science teachers during the pandemic and their recommendations about the post-pandemic process. In the study, the "first period" referred to the period when the pandemic first appeared (the period between March-June 2020) and the "second period" referred to the post-summer holiday period (the period between August-November 2020). The study employed the phenomenology design, one of the qualitative research methods. For the study, one-on-one interviews were conducted with 16 science teachers working in the city of Sırnak. Interview data were analyzed using descriptive analysis and supported by direct quotations. Interview data were analyzed using descriptive analysis and supported by direct quotations. The study findings revealed that science teachers experienced problems in learning-teaching processes, assessment-evaluation, technical and structural situations due to the sudden transition to distance learning in the first period of the pandemic. In the second period of the pandemic, with the solving of technical and structural problems, teachers carried out a more systematic and planned teaching process compared to the first period. During this process, they enriched the learning environment with interactive experiments and materials, using different teaching methods and techniques. However, they stated that although they made changes in assessment and evaluation, they could not evaluate students sufficiently. In this context, teachers anticipated that students will have difficulty adapting to school after the pandemic, and they were of the opinion that the deficiencies of the pandemic process can be eliminated with make-up lessons.

Introduction

Many disasters caused by viruses were encountered in the history of humanity from past to present, and the human race was greatly damaged during the times of these disasters (Hays, 1998; Özdemir, 2005; Tunç & Aıcı, 2020; Yolun, 2012). The current Covid-19 (coronavirus) pandemic is one of these disasters. Pandemic is defined by the Turkish Language Institution (TDK) as "the common occurrence of a disease in a continent or several countries at the same time, a major epidemic" (Turkish Language Association, 2021). The disease being infectious is an important condition for a pandemic. Genetic diseases or certain cancers that are common in a certain region is not called a pandemic (Gögebakan, 2020). First detected in Wuhan, the capital of China's Hubei region, the Covid-19 virus was declared as a pandemic by the World Health Organization (WHO) on 11 March 2020 (WHO, 2020). The WHO reported 104.956.439 total cases and 2.290.488 deaths in the world (WHO, 2020) by February 6, 2021. Concerning millions, the pandemic caused a great worldwide crisis, especially in health, and led to radical changes in many areas such as social life, economy, education, arts, and sports. Furthermore, it is not known when it will end (Can, 2020). All the countries in the world are still in great competition in terms of adapting to the new situations caused by the pandemic and overcoming the process with the least damage.

Various measures were taken in many countries as a result of the increase in cases and deaths during the pandemic. Since crowded groups of people should not be together, collective activities were canceled. The information that social distance and hygiene measures should be taken to reduce the contagiousness of the virus was shared with the whole society (T.C. Sağlık Bakanlığı [Turkish Ministry of Health], 2020). With the outbreak in December 2019 and the declaration of the virus as a pandemic in March 2020, the measures that needed to be taken in the field of education were also questioned and each country set out to prepare its own action plan. First, in order to prevent the virus from spreading among students and teachers, face-to-face

learning was suspended and schools were closed (Angoletto & Queiroz, 2020). However, on the basis of the knowledge that the pandemic will not end in a short time, the search for alternative education methods started. In Turkey, due to the pandemic, face-to-face learning activities at all levels also ended, local and central exams were postponed, and online exams began to be administered. In order to alleviate the effects of the crisis caused by the pandemic in education and to prevent future problems, distance learning was considered the most effective solution (Giannini & Lewis, 2020; Karakaş, 2020).

The first case of Covid-19 was reported in March 2020 in Turkey (T.C. Sağlık Bakanlığı, 2020). After the increase in the number of cases, the educational activities at all levels of the Ministry of National Education (MEB [MoNE]) were first postponed for three weeks. Then, it was decided to continue education online until the end of the spring term of 2019-2020 (MEB, 2020). Thus, even though Turkey did not have a distance learning experience before, teachers began to have their with millions of students at the same time through distance learning. In this process, MEB planned to use three TV Channels and Education Information Network (EBA) in order to realize distance learning applications for students at the elementary, middle, and high schools (MEB, 2020). During the first distance learning process of the pandemic covering the months of April, May, and June 2020, it was announced that the grades of the last fall semester would be valid and that all students would pass. After the summer vacation, make-up classes were done (MEB, 2020). In addition, the press release given by the MEB (2020) declared that education would be carried out with distance learning tools in the 2020-2021 academic year, but the situation would be reviewed in September 2020 and the schools would be opened gradually in a controlled manner. In this process, face-to-face learning was left to the consent of the parents and it was emphasized that education in schools would be done while paying special attention to cleanliness, hygiene, and social distance. It was also announced that students who wish could continue distance learning (MEB, 2020). However, due to the recent increase in cases, education continued solely in the form of distance learning.

Unlike the previous pandemics, the Covid-19 pandemic is the first pandemic in terms of using distance learning and thus ensuring continuity in education. One of the first interventions to manage the current situation in previous pandemics was the closure of schools (Hens et al., 2009). However, in the Covid-19 pandemic, many countries suspended face-to-face learning and switched to distance learning (Sahu, 2020; Viner et al., 2020). Although open and distance learning applications drew attention especially in this period, distance learning services began to be provided in different fields (Can, 2020). The importance of quality, as well as quantity, in open and distance learning, was revealed with its increased use (Özer & Suna, 2020). With the use of various technological facilities and devices, the distance learning model can meet an important need for a large number of individuals with limited opportunities, regardless of time and place. However, currently used distance learning processes cannot be completely alternative to face-to-face applications (Tuncer & Bahadır, 2017). At this stage, interaction provided in face-to-face learning is reported as the most important deficiency for distance learning (Kaysi & Aydemir, 2017; Huss et al., 2015). In order to develop distance learning qualitatively, to eliminate its disadvantages, and, most importantly, to strengthen its interaction dimension, data-based knowledge, that is, research results that examine the model in all aspects are needed.

The widespread use of distance education during the pandemic has caused educators and education professionals to focus more on this type of teaching. There are many definitions in the national and international literature regarding this model, which is considered to be the most appropriate solution to ensure that education can continue uninterruptedly for all students during the epidemic that started suddenly (Kaya, 2002). Distance Learning is a teaching model in which individuals will continue their learning efficiently and with high quality according to their own pace and capacity (Kaya, 2002). According to Demir (2014), distance learning is a planned organization that enables the use of different technologies as well as the application of teaching methods where students and instructors are in different places at the same time. According to Moore and Kearsly (1996), distance learning is planned learning activities carried out by the student and the teacher in different environments using special techniques and applications. Emphasizing that the concept of distance learning changes according to the characteristics of the age, Kazmer and Caroline (2004) stated that the concept of distance learning was used synonymously with the word "correspondence learning" in the past, and over time it became synonymous with the word "television". However, the real recognition of the concept was realized through communication technologies including video, teleconference system, e-mail, and internet (Ergüney, 2017). Main distance learning technologies are divided into two groups, namely interactive and non-interactive. While non-interactive educational technologies are considered as "correspondence learning, printed materials, radio, television, audio, and video cassettes", interactive education technologies are evaluated in a wide range such as from multimedia, computer-aided education, electronic mail, internet, databases, satellite technologies and virtual reality to video conferencing (Demir, 2014; Midkiff & DaSilva, 2002; Taylor, 2002). Participants in distance learning are physically, educationally, and psychologically distant from other participants in terms of

time and space. In distance learning, the responsibility of learning is left to the student, in this respect, it is an education model that requires the learner to use self-management skills. Distance learning is a contemporary and effective form of learning in that it includes features such as being able to configure and update teaching methods and techniques in an electronic environment in a convenient and flexible manner, and to be used 24/7 whenever required (Gökçe, 2008; Gülbahar & Karataş, 2016; Rovai & Barnum, 2003; Ruksasuk, 1999: Simonson, 2007).

During the pandemic, with the introduction of distance learning in all countries, the problems caused by not being able to provide face-to-face learning were somewhat eliminated (Eken et al., 2020). At this point, it can be predicted that distance learning will become more prominent in the future with the contribution of new technologies and systems and become a pioneering learning model. There are studies on distance learning experiences during the pandemic in the national literature (Başaran et al., 2020; Bozkurt, 2020; Can, 2020; Genç & Gümrükçüoğlu, 2020; Sen & Kızılcalıoğlu, 2020). One of these studies was conducted by Bozkurt (2020). Bozkurt (2020), examined the experiences of elementary school students regarding the pandemic and distance learning. The study results revealed that a balanced application of theory and practice will support meaningful learning in the distance learning process during the pandemic period. In another study conducted by Başaran et al. (2020), the efficiency of distance learning during the pandemic process was examined by getting the views of teachers, students, and parents on distance learning. The participants in the study stated that distance learning has positive aspects, but the interaction is limited. In addition, the teachers emphasized that distance learning was not appropriate for individual differences, active learning did not take place and students' participation in the course was limited because of technical equipment problems. Sen and Kızılcalıoğlu (2020) explored the views of students and academicians on distance learning during the pandemic process. The study determined that distance learning negatively affected the social skills of the students and students found distance learning classes boring.

In order to test the effectiveness of distance learning and make it more qualified, first of all, the experiences of teachers and students in this process should be revealed (Telli & Altun, 2020; Keskin & Özer Kaya, 2020). The positive or negative situations experienced by the teachers who are the practitioners of distance learning and the thoughts of the students who are experiencing such education can dynamically increase the quality of today's applications and contribute to future distance learning studies. The feedback given by the teachers will help determine what kind of expectations they have in distance learning and the characteristics that the learning environment should have in order for students to achieve more qualified learning.

The Study

The present study aimed to reveal the experiences of science teachers in the Covid-19 pandemic process and their recommendations regarding the post-pandemic process. In the national and international literature, there are many studies on the widespread use of distance learning in the first period of the pandemic (Almaghaslah & Alsayari, 2020; Altuntaş Yılmaz, 2020; Arslan, 2020; Balcı, 2020; Başaran et al., 2020; Bhamani et al., 2020; Bozkurt, 2020; Can, 2020; Genç & Gümrükçüoğlu, 2020; İmamoğlu & Siyimer İmamoğlu, 2020; Mahdy, 2020; Ramos-Morcillo et al., 2020; Sen & Kızılcalıoğlu, 2020; Sever & Özdemir, 2020; Ünal & Bulunuz, 2020). In these studies, the views of teachers and students on distance learning experiences in the first period of the pandemic were determined. However, in this study, the experiences of teachers working in the city of Şırnak were compared according to pandemic periods, and recommendations were made for the post-pandemic period. In order to explain teachers' experiences in more detail within the scope of the study, the pandemic process was divided into three periods: first period, second period, and post-pandemic period. The first period includes March, April, May, and June, when the Covid-19 pandemic first started, whereas the second period includes August, September, October, and November. The study is important in terms of comparing the distance learning experiences of science teachers in the first days of the pandemic and afterwards. It is believed that this study will contribute to the field in terms of determining the precautions to be taken for the post-pandemic process in which face-to-face learning is expected to start. In addition, a deeper analysis was made using the experiences and the situation was assessed. Thus, examination of the reflections of science teaching carried out with distance learning during the pandemic period will make significant contributions to the literature in terms of increasing the effectiveness of distance learning. The sub-problems identified within the scope of the study purpose are as follows:

1. What are the experiences of science teachers in the first period of the pandemic process (March-June Period)?

2. What are the experiences of science teachers in the second period of the pandemic process (August-November Period)?
3. What are the recommendations of science teachers regarding the post-pandemic process?

Method

In this study, phenomenology, one of the qualitative research methods, was employed. The research was based on teachers' views on their experiences in the lessons they taught during the pandemic. The reason why phenomenology was preferred in the study was to obtain in-depth information about the experiences, perceptions, and thoughts of teachers during and after the pandemic. In phenomenology studies, individuals' thoughts, perceptions, assessments, or the meanings they attribute to a phenomenon are investigated (Jasper, 1994; Starks & Trinidad, 2007). In order to define the phenomenon, the phenomenon is redefined by revealing the essence of individuals' experiences in phenomenology studies (Rose et al., 1995). Thus, in these studies; the connection between the examined phenomenon and the people who experienced it is emphasized (Baker et al., 1992; Kocabıyık, 2016). The phenomenon studied in the present study was "the teacher experiences during the pandemic".

Study Group

Since the criterion sampling method, one of the purposeful sampling methods, was appropriate to the study purpose, it was used to select the study group to obtain detailed information. In criterion sampling, individuals, events, facts, or situations with predetermined characteristics within the scope of the study subject are examined (Patton, 1990). The criteria determined in this study were being a science teacher in schools affiliated with the MEB in the city of Şırnak and giving science lessons during the pandemic. In this context, 16 science teachers working in Şırnak were contacted and face-to-face interviews were made with each of them on a voluntary basis. Nicknames such as Ayşe Teacher and Berna Teacher were assigned by the researcher to each of the teachers interviewed. Five of the participating teachers were male and 11 were female. Fourteen of them were working at the city center and two were working in villages. In terms of seniority, 11 teachers had been working for three years or less, whereas five teachers have a service period of 3 years or less, while 5 teachers had been working for four years and above.

Data Collection

The study data were collected by interviewing 16 science teachers who were working at two village schools and five downtown schools in the city of Şırnak in the Southeastern Anatolia Region of Turkey during the 2020-2021 academic year. Two of the teachers had been working in village schools and five in schools in the city center. In the study, the period when the pandemic first appeared (the period between March-June 2020) was named the "first period" the "first period" and the post-summer holiday period (the period between August-November 2020) was named the "second period". Face-to-face meetings were held with the teachers between October 1, 2020 and October 29, 2020. The interviews lasted an hour on average. The interviews were recorded and then turned into a written document. This written document was returned to the participants for member checking.

Data Collection Tool

In the study, the data were obtained from the structured interviews the researcher made with the teachers. In structured interviews, the researcher conducts the interviews in a planned manner with the questions he/she had prepared in the context of the study subject (Şimsek & Yıldırım, 2011). For the content validity of the questions developed by the researchers within the scope of the study, the opinions of two field education experts and one assessment and evaluation expert were taken and the interview questions were formed. During the interviews with the experts, feedback was received regarding the questions' adequacy, content validity, and comprehensibility. In the interview questions formed by the researchers, first, questions about the demographic characteristics of the teachers were asked. Then, questions about the first period of the pandemic (nine questions), the second period (eight questions), and the post-pandemic period (six questions) were asked. The interviews were conducted in an environment where the participants felt comfortable (through online interviews

or face-to-face interviews at the schools where the teachers worked at). Sample questions in the interviews were as follows:

A sample question about the first period of the pandemic: What are your experiences regarding the technical and structural situation in the first period of the pandemic?
A sample question about the second period of the pandemic: What are your experiences with the teaching methods and techniques in the second period of the pandemic? Have you made any changes in this regard compared to the first period of the pandemic? If you did, can you explain them by providing your reasons?
A sample question about the post-pandemic period: What are your recommendations about the learning environment after the pandemic?

Data Analysis

Descriptive analysis, one of the qualitative data analysis techniques, was performed to analyze the data obtained in line with the interviews. Considering the various classifications in the literature on qualitative data analysis, three basic concepts that are important for every qualitative researcher are description, analysis, and interpretation (Şimsek & Yıldırım, 2011). Description refers to the process of determining what the data collected within the scope of the study say about the research problem. Analysis refers to the process of revealing the themes that are not clearly visible in the data set with the help of conceptual classifications and explaining the relationships between these themes. Finally, interpretation is the process of revealing the meaning of what was said by the participants or what was observed in the participants (Simsek & Yıldırım, 2011). The data analysis process in the study was carried out in three stages. In the first stage, a comprehensive literature review was made and a framework (themes) was formed for the examination of the statements. The themes were determined in line with the sub-problems of the study and interview questions. The themes determined for the first and second sub-problems of the study were "learning and teaching processes", "technical and structural situation", and "assessment-evaluation". Under the first theme "learning and teaching processes" of the first and second sub-problems, five sub-themes were formed, namely "teaching methods and techniques", "teacher roles", "student roles", and "communication and materials". The themes determined for the third sub-problem of the study were "learning and teaching processes", and "assessment-evaluation". Under the first theme "learning and teaching processes" of the third sub-problem, four sub-themes were formed, namely "learning environment", "teaching methods and techniques", "teacher roles", and "student roles". In the next stage, the interviews with the teachers were transcribed into written documents. The written transcripts were analyzed within the framework of themes. Some teachers had more than one opinion for each theme. In the last stage, the consistency of the data among the raters was calculated in order to ensure reliability in the qualitative data analysis. During the data analysis, the data were examined separately by the researcher and a field expert. They discussed the "agreement" and "disagreement" issues and necessary revisions were made. The data subjected to descriptive analysis in the study were assessed by two different raters, and the Miles-Huberman reliability value (Miles & Huberman, 1994) was calculated as 91.05. Each stage used in the study and the method used is presented to the reader in detail. In this context, the data collection stage and the data analysis process were explained in detail (Marshall & Rossman, 1989). In addition, official permissions were obtained from the Şırnak/Silopi Directorate of National Education in order to conduct interviews with the teachers. The interviews were conducted with the teachers on a voluntary basis.

Findings

In this section, the findings of each sub-problem in the study and the interpretations of these findings are presented, and the data obtained are explained. The findings and interpretations were organized according to the order of the study sub-problems.

Findings and Comments Related to the First Sub-Problem

For the first sub-problem of "What are the experiences of science teachers in the first period of the pandemic process (March-June Period)?", "learning and teaching processes", "technical and structural situation", and "assessment-evaluation" themes were determined. In the study, a ranking was made considering these themes, and the findings were formed.

Findings Related to the "Learning and Teaching Processes" Theme

Under the first sub-problem, five sub-themes were determined in relation to the first theme, "learning and teaching processes". These sub-themes were "teaching methods and techniques", "teacher roles", "student roles", "communication" and "materials" respectively.

The sub-theme of "Teaching Methods and Techniques": Since there was a rapid transition to distance learning in the first period of the pandemic, teachers stated that the teaching methods and techniques they used changed, they could not use the methods and techniques that would allow interaction with the students, and therefore they could not get the efficiency they wanted from the lessons. With the transition to distance learning, some science teachers expressed that techniques other than lecture and visual techniques were insufficient. On this subject, Davut Teacher expressed his thoughts with the following words, *"Especially in the early days, the absence of eye contact and direct feedback was no different than explaining the subject to the wall, so to speak. The students didn't want to talk in front of their families and the question and answer method, which was the method I used the most, was ineffective. I had to change the whole system and switch to a more problem-solving style"*. Mehmet Teacher talked about the limitations teachers experienced in terms of teaching methods and techniques during the transition to distance learning and said, *"When I was teaching face-to-face, I could use any teaching method and technique I wanted. In distance learning, the teaching methods and techniques that I could use were limited. I generally used expository teaching"*. Another teacher stated that the teaching methods and techniques used were generally planned for face-to-face learning, so she had difficulties during distance learning. On this issue, Esra Teacher said, *"Since the methods and techniques used are arranged for face-to-face learning, their applicability in distance learning decreased. So, this caused problems in lessons' flow"*. Aylin Teacher stated that the methods she had used in face-to-face learning were effective in concretizing abstract concepts and that this changed during distance learning. She explained, *"I had a hard time explaining abstract concepts during distance learning. I mean, for example, while I was going to teach support and skeleton systems, I needed to show and move my hand while explaining the joints, but I couldn't do it. Or we would make a cell model when we were learning the cell. In this way, we would have concretized the concepts in face-to-face learning. When it was distance learning, I couldn't do these things"*. In addition, some science teachers stated that they felt inadequate about how they should teach during this process (Esra and Songül teachers) or that they could not apply the teaching methods and techniques they wanted when there were problems caused by the EBA system (İbrahim Teacher).

In the first period of the pandemic, some science teachers stated that they made changes to the teaching methods and techniques they used because of the transition to distance learning. Dilan teacher expressed her thoughts with these words, *"We couldn't use the methods and techniques that we could interact with the children in the transition to distance learning. I used other methods. For example, I used to make experiments on the subject and take a video of myself and send it to the children. I asked them to do similar experiments on the subject, or to do the same experiments I did on camera and send them to me"*. Furthermore, science teachers expressed that they did not have internet, or tools like computers in the first period of the pandemic and that could not use the techniques that required mutual interaction with students (Ayşe, Berna, and Melis teachers). Berna teacher expressed that she could not make adequate preparations due to the lack of technical equipment on her side and the late start of the live lessons and that she could not use techniques that required interaction. Some science teachers mentioned that they had problems with the methods and techniques they would choose due to the number and length of the live lessons (Esra and Davut teachers). Aylin Teacher explained that she could not use the discovery learning method that she frequently used in her science lessons because of the length of the live lessons. She said, *"I use the discovery learning method in my lessons very often. I ask questions, I lead my students to access information. Unfortunately, I couldn't use this method because the lessons were 30 minutes in distance learning during the pandemic process"*.

The sub-theme of "Teacher Roles": The rapid transition to distance learning in the first period of the pandemic also caused changes in the roles of teachers. Teachers stated that they had difficulties in lesson planning, achieving the learning objectives, and finishing the subjects during the transition to distance learning. They emphasized that the learning objectives determined for face-to-face learning were not finished on time and that make-up lessons should be done in a planned manner (Ayşe, Mehmet, Berna, and Melis teachers). Berna teacher explained her distress about this by saying, "To be frank, most of the learning objectives weren't finished. The Ministry was aware of this, too and make-up lessons were organized". On this issue, Melis Teacher said, *"There is a learning objective. It says the student makes inferences about the formation of the seasons. We would normally teach this learning objective in 4-5 periods. Since the children had too many connection problems and they couldn't attend every live lesson, the learning objectives were not completed. That's why I think I couldn't fully help my students gain these objectives"*. Aylin Teacher stated that other than the 8th graders, the students

could not acquire the learning objectives due to the inability of children to attend the live lessons and the insufficient three-week make-up lessons. In addition, science teachers explained that the learning objectives were not appropriate for distance learning and that the learning objectives and materials that required group work could not be used (Davut and Ayşe teachers). Ayşe Teacher expressed her opinion by saying, *"We need to conduct experiments during the teaching of certain learning objectives, we couldn't do these studies face-to-face. Yes, we did the activities and experiments remotely, but I don't think it was efficient. The children just watched, they couldn't do it themselves. For so many reasons they couldn't prepare for them, they didn't have the materials that I had. Because of these reasons, it was difficult to carry out the activities with distance learning. Therefore, I don't think that the learning objectives were acquired the students that much"*. Similarly, Ayşegül Teacher stated that the learning objectives were not appropriate for distance learning and that the learning objectives based on experiment and observation could not be taught without the necessary physical environment. Thus, she concluded that the teaching of the learning objectives was incomplete. Ahmet Teacher explained that there were subjects that they had difficulty in finishing even in face-to-face learning and said that he could not cover all the subjects and had difficulties in concretizing the concepts during distance learning and that make-up lessons could not solve this problem. Apart from these statements, some teachers stated that they did not experience any problems regarding the content of the course content in this period (Esra and İbrahim teachers). Similar to, Esra and İbrahim teachers, Mehmet Teacher said, *"Actually, I didn't have any problems regarding the content of the course. According to the feedback I had received, I don't think that the students had a problem in this regard either. The reason for this is that the 8th grade students were held responsible only for the first semester subjects for the high school entrance exam they took. I saw that this provided good motivation for their preparation for the exam. In the 5th, 6th, and 7th grades, we had to continue where we left off"*.

The sudden transition to distance learning in the first period of the pandemic caused teachers to experience certain mood changes. Teachers felt helpless because of the negativities they experienced at the beginning of the pandemic process (Aylin and Ahmet teachers). Mehmet teacher, who first had difficulties with technical problems and then with uncertainty, expressed his thoughts about helplessness with these words, *"I was communicating less with the parents. I didn't have the numbers of many of my parents. I had to look up their numbers from the e-School System. Unfortunately, some of them didn't have their number in the system or it was an old number. I tried to reach my students one by one. Frankly, neither I nor the parents knew what to do. That's why I had a hard time with this in the first period of the pandemic. I didn't know what to explain to the parents. So, I felt helpless during this process"*. Some teachers also felt stressed because of being at home all the time and the difficulties they had in planning the process (Davut and Esra teachers). Ayşegül Teacher stated that the sudden closure of schools and the uncertainty of the process dragged her into obscurity. Davut Teacher expressed the stress he experienced during this process with the following words, *"My stress level was very high because it was an unusual situation. The change in all daily work and activities and being at home all the time caused problems in time management"*. Some teachers expressed that they used distance learning materials for the first time and that they felt inadequate because they did not have experience (Aylin, Esra, and Fatma teachers). Esra Teacher explained this by saying, "*Both teachers and students had a big adaptation problem during distance learning because the curriculum and learning objectives were developed for face-to-face learning and because of my inexperience caused by not using distance education learning materials before. There were many times when I felt inadequate and fed up"*. Davut Teacher He stated that he had difficulties due to the fact that the textbooks he used were not appropriate for distance learning and that the interactive books were not adequate.

The sub-theme of "Student Roles": In the first period of the pandemic, there were also changes in student roles during the rapid transition to distance learning, especially in terms of participation in classes (Berna and Esra teachers). On this issue, Dilan Teacher said, *"The number of students enrolled in the course was 14 but the number of students connecting online to the EBA system was only three. So in general, almost eighty percent couldn't attend the classes, unfortunately"*. Aylin Teacher also stated that the participation of the students in the lessons was very low and that they could not do most of the live lessons during this period.

The science teachers stated that the students had problems adapting to the lessons in the first period of the pandemic (Dilan and İbrahim teachers). Davut Teacher expressed his thoughts on this subject with the following words: *"The suspension of schools has been a source of great uncertainty and stress, especially for 8th grade students during the exam period. Because of this, even if they attended the lessons, they had little interest in them"*. Songül Teacher explained, *"Students couldn't adapt to distance learning. They thought the school was on break. So, it was difficult for them to do something course-related and study"*. Fatma Teacher stated that the students had difficulties in adapting to the process and did not want to attend the classes because of the uncertainties they experienced. İbrahim Teacher explained the adaptation problem some students had with the following words, *"Students who encountered such a situation for the first time had difficulties in adapting to*

distance learning". Some science teachers mentioned that the students who were not interested in the face-to-face lessons had difficulties in participating in the lessons during distance learning (Ayşe, Suna, and Melis teachers). On this subject, Suna Teacher stated, *"It was really difficult to make sure the students, who were not interested in the lessons, did not participate a lot and were passive even in face-to-face lessons, attended the lessons during distance learning"*.

The sub-theme of "Communication": In the first period of the pandemic, teachers and students faced many communication problems because of the unexpected transition from face-to-face education to distance learning. Teachers stated that the suspension of face-to-face communication with students caused them to drift apart from the lessons and school (Ayşegül, Mehmet, Ayşe, and Dilan teachers). Regarding this, Ayşe Teacher expressed her thoughts using the following words, *"... I couldn't keep in touch with the children, it was difficult for me. I couldn't be very supportive of the students in my class while being away. I couldn't keep in touch with them"*. Similarly, Suna Teacher said, *"While I was able to communicate with students face-to-face very comfortably before, communication was cut off with most students when the pandemic broke out. Our students don't have phones anyway. When we called their parents, they were mostly not in the same place with the child"*. Also expressing his view on this subject, Mehmet Teacher stated that he tried to communicate with the students via Whatsapp and EBA in the first period of the pandemic, but he did not get good results because of students' opportunities and that he often directed the students to EBA TV programs. In addition, Ayşe Teacher explained that she had many students who could not log into the EBA system. Thus, she did interactive activities with only a few students and she could not get enough feedback even from them. Teachers working especially in village schools stated that they had difficulty in establishing a live lesson environment from a distance because of the region they lived in (Berna teacher). On the same subject, Dilan Teacher said, *"I work in a village school. It was very difficult for children to access the internet because only the fathers had smartphones at home. It was impossible for my students to attend the lessons online because their fathers went to work. The only time I could get in touch with my students was on WhatsApp from evening to evening"*.

Teachers stated that the lack of healthy communication with the students reduced the efficiency in the lessons (Ahmet and Sevda teachers). On this subject, Melis Teacher said, *"I mean, the child couldn't attend the lesson, how could he comprehend the learning objective. The reason for this was that since the students lived in a village environment, they had connection problems. I had difficulties in teaching the learning objectives"*. Melis Teacher explained the communication problem she experienced with her students, which led to learning losses, by saying, *"I did an experiment with children about light refraction and asked them to try it at home. It was an experiment with very simple material, but because the children did not listen to the subject from me personally or did not have full knowledge about the subject, they used statements such as 'Ma'am, how do we turn the text on the paper upside down'"*. On the same subject, Berna Teacher stated that she could not do live lessons because the EBA system did not work properly in the first months of the pandemic and that she could easily notice the moment when the students were bored in face-to-face lessons and could make changes accordingly, but could not do this in distance learning. Ayşegül teacher expressed the importance of cameras in the communication problem with the following words, *"The only way to understand whether the students were learning or not was if all the cameras were on, but most of the students refused to turn on their cameras. So, most of the learning objectives were not finished, and no feedback was received from the students on what was taught"*.

The Sub-Theme of "Material": In the first period of the pandemic, science teachers stated that they had problems in using teaching materials, making them appropriate for distance learning, delivering them to students, and getting feedback (Songül and Davut teachers). Some teachers expressed that they could not use the materials they used in face-to-face education, but only pdf files, z books, or videos (Fatma and Dilan teachers). In addition, some science teachers mentioned the difficulties in using materials appropriate for face-to-face education in distance learning (İbrahim and Esra teachers). Expressing how she could not effectively use the experiment technique, which is suitable for face-to-face education, Melis Teacher said, *"Since I couldn't show the experiment live to the students in the experiment videos I sent, the students couldn't understand it clearly from the video. It wasn't a problem in the classroom environment because I showed it to them, but unfortunately, I had a problem like this"*. Furthermore, Aylin Teacher stated she had difficulty in being able to find material for the show and tell and said, *"When I was teaching the lesson, for example, I have to do experiments in the laboratory. If I had the materials at home, I did the experiments one way or another. If I didn't have the materials, I couldn't do that experiment, I just talked about the subject and had them watch videos"*. Similarly, Mehmet Teacher stated that the materials generally used in science lessons were materials that students physically touched and observed, and that these materials could not be used when face-to-face education was suspended. As a reason, he cited the fact that he did not have a chance to get those materials because he was away from the school and that these materials could not be used in distance learning.

Some science teachers stated that they did not have too many problems with the materials they used in the first period of the pandemic during distance learning. Thus, they brought a different perspective to the situation (Suna and Mehmet teachers). On this matter, Suna Teacher expressed her thoughts with the following words, *"Since I did not have the chance to use physical materials, I used interactive materials. Actually, I didn't have much trouble with this and I had the chance to turn a disadvantage into an advantage and used a lot of experiment videos, interactive experiments, and other online materials"*. Parallel to Suna Teacher, Fatma Teacher said, "I tried to realize the learning objectives with homework assignments I gave via Whatsapp, and activities and lecture videos sent via EBA as much as possible. During this process, I used the EBA TV and kept up with the subjects simultaneously with the curriculum there". In addition, Mehmet Teacher stated that he made short videos about the subjects that the students could not understand so that when the students could not connect to the internet or experienced disconnections, they could follow the lesson with these videos. Expressing that the materials sent electronically could not be adequately reviewed by the students, Ayşe Teacher explained, *"I was giving homework to children, I was sending practices from EBA. Wherever I was on the subjects in March, I sent a pdf file on that subject. I sent practices but there were parents and students who could not open the pdf file. I had such difficulties"*.

Findings Related to the "Technical and Structural Situation" Theme

In the context of the first sub-problem, the findings related to the second theme, "technical and structural situation", are presented below.

About the technical equipment problems, science teachers mainly mentioned students not having the necessary equipment in their homes in the first period of the pandemic (Davut, Songül, and Sevda teachers). In this regard, Dilan Teacher said, *"I did not have any problems myself, but my students did not have technological devices. I mean, yeah, the TRT EBA Channel has been established but as their teacher, I couldn't see them when I wanted to because there was no tablet at home, there was no computer, there was a limited number of smartphones, those who had smartphones had internet problems and connection problems"*. Similarly, Ayşegül Teacher stated that there was no internet infrastructure in the places where many of the students' houses were located, and those who had infrastructure could not afford to get internet subscriptions or did not have enough devices. Berna Teacher explained in more detail what kind of technical problems occurred due to the region students lived in and said, *"Because of the region we lived in, the number of children at home was high but the number of phones they could use was limited. If the mother also had a phone, this number was maybe two, and our students didn't know how to use a smartphone. Compared to students in the West, students here didn't have phones. So, they also didn't know the applications on the phone. Therefore, students couldn't gain much access to the course. Unfortunately, my students are a bit far from technology"*. Some science teachers also stated that students living in a village could not use the internet packages provided by the Ministry of National Education for free of charge (Aylin and Berna teachers).

In addition, related to internet connection during the live lessons, some science teachers stated that they experienced audio and video problems (Berna and Aylin teachers). Songül teacher expressed her thoughts on this subject with the following words, *"During my live lessons, I had audio and visual problems in many lessons. The reason for this was the disconnections that occurred on the internet, and although these problems were experienced from time to time, they prevented learning at a significant level"*. It was also stated by the teachers that there were students who could only follow the lessons from EBA due to internet interruptions (Ayşegül and Sevda teachers).

Teachers expressed the problems caused by the lack of technical knowledge of many students during distance learning. On this subject, Ayşe Teacher expressed her thoughts with the following words, *"My children couldn't use phones, they didn't even know how to log into EBA. Unfortunately, I had students who couldn't log in to EBA with the password we gave to them. Also, technical problems such as the crash of EBA were among the problems I had*". Furthermore, Davut Teacher expressed that the students did not know how to use online education materials, so the participation in the lessons was low.

In addition, in the first period of the pandemic, some teachers experienced problems due to their lack of technical knowledge. Teacher Melis said, *"I had great difficulty in teaching, drawing, and writing on the computer because it wasn't a usual situation"*. Also, Esra, Mehmet, and Ali teachers expressed that they did not have a good command of the Zoom program and that the language of the program was English. Thus, they had difficulties in their first use. Furthermore, Ali Teacher stated that at the very beginning of the distance learning

process, he had a lack of knowledge about using technical equipment in the lessons, which created an adaptation problem. Sharing his thoughts on this subject, İbrahim Teacher said, *"I went to my hometown when the pandemic first started. Since I don't have a computer, I started using my phone for live lessons for a while but unfortunately, I wasn't very familiar with the programs"*. Some science teachers, on the other hand, stated that they did not experience any problems with technical equipment since they had previously had sufficient computer education (Berna, Esra, and Mehmet teachers). Regarding this, Berna teacher expressed her thoughts with the following words, *"Due to my computer-related training, I didn't have any problems with technical equipment. I also didn't have any problems with the Zoom or the EBA programs"*.

Findings Related to the "Assessment-Evaluation" Theme

In the context of the first sub-problem, the findings and comments related to the third theme, "Assessment-Evaluation" are presented below.

While talking about the problems they encountered in the context of assessment and evaluation in the first period of the pandemic, science teachers stated that they did not go through an efficient measurement and evaluation process (Davut and Ayşe teachers). Sharing her experience in the context of assessment and evaluation due to the low participation, Ayşegül Teacher said, *"I tried to observe how much the subject was learned by asking for the answers to the work reports I sent over EBA and the tests I sent via Whatsapp during the assessment-evaluation phase and then sending the answer key but students' low participation prevented me from making a full conclusion in terms of assessment and evaluation"*. In this regard, İbrahim Teacher also supported what Ayşegül teacher said and mentioned that he could not fully identify students' learning deficiencies in terms of assessment and evaluation due to their low participation in the lessons. Similarly, Ali Teacher stated that he could not ensure sufficient student participation in the works he sent via the internet and that the students did not show enough interest in the videos and worksheets he sent in addition. Thus, he expressed that he did not have a healthy assessment and evaluation process.

Some science teachers attributed the difficulties they had in assessment and evaluation in the first period of the pandemic to not establishing healthy communication with the parents (Ayşe, Aylin, and Berna teachers). Regarding this, Berna teacher expressed her opinion with these words, *"I had to be able to communicate very well with the parents so that I could assess and evaluate. Most of the fathers were working. Mothers' phones were not smartphones. So, I couldn't communicate clearly and effectively with them. There were deficiencies in assessment and evaluation"*. Some of the teachers stated that the students behaved too relaxed in the context of assessment and evaluation since they were informed that everyone would pass (Berna and Ayşe teachers). On this subject, Ayşe Teacher said, *"During distance learning, I generally had students who were too relaxed and not attending the live lessons. The students thought, 'I can listen to the repetition lessons in the evening anyway' and displayed a very relaxed attitude. Besides, after a while, the Ministry announced that there would be no exams and that all students would pass. I can't say that I made a healthy assessment and evaluation"*.

Some of the science teachers mentioned obstacles caused by the students, such as not turning on their cameras and microphones, and stated that this created a problem in not getting answers to the questions asked for assessment (Aylin and Mehmet teachers). Fatma teacher mentioned that since it was the first period of the pandemic, there were no standardized written exams or exams developed by the teachers themselves and that the assessment and evaluation tools were also limited. She explained this with the following words, *"I used the tests in z-books and the question-answer method as measurement tools but the main tools w were the tests. Normally, in all my exams, I use short-answer, true-false, fill-in-the-blank, and multiple-choice questions together, which it should be. Therefore, I was concerned that the assessment was insufficient"*. Esra teacher also stated that not holding written exams created a big problem in the context of assessment and evaluation. There were also teachers like Songül Teacher who said that they could not do assessment and evaluation in any way.

Findings and Comments Related to the Second Sub-Problem

For the second sub-problem of "What are the experiences of science teachers in the second period of the pandemic process (August-November Period)?", "learning and teaching processes", "technical and structural situation", and "assessment-evaluation" themes were determined. In the study, a ranking was made considering these themes, and the findings were formed.

Findings Related to the "Learning and Teaching Processes" Theme

Under the second sub-problem, five sub-themes were determined in relation to the first theme, "learning and teaching processes". These sub-themes were "teaching methods and techniques", "teacher roles", "student roles", "communication" and "materials" respectively. In the study, a ranking was made considering these themes, and the findings were formed.

The sub-theme of "Teaching Methods and Techniques": Since the teaching methods and techniques teachers used changed in the second period of the pandemic, teachers stated that they could not use the methods and techniques that would allow interaction with the students, and therefore they could not get the efficiency they wanted from the lessons. Science teachers emphasized that they mostly used lecture and question-answer methods among the teaching methods and techniques in the second period of the pandemic, (Melis and Davut teachers). Expressing her thoughts on this issue, Ayşe Teacher said the following words, *"I often use the lecture and question-answer method. I'm constantly using the brainstorming technique so that the lessons don't get monotonous. Every now and then there is a commotion, I make them turn off their microphones to eliminate the confusion. I only have the student to whom I have the right to speak turn on the microphone. I make them watch videos. I ask the students to put the books in front of them, and I make them follow the book"*. Stating that she made some changes in her practices in the second period of the pandemic compared to the first period, Ayşe Teacher explained, *"In the first period of the pandemic, I didn't have an active live lesson, I could only deliver the worksheets work and lecture notes online to the students. I was able to communicate through the Whatsapp group. Now, I want students to take screenshots while I'm doing live lessons from EBA. Then I ask them to write the answers to the questions and send them to me privately. I contact their classroom teachers. I teach the same PDF file in the lesson"*. Some of the science teachers stated that they were more planned and prepared in the second period of the pandemic (Ayşe, Aylin, Esra, and Davut teachers). Aylin teacher stated that she only lectured in the first period of the pandemic but since she knew that the pandemic would continue, she was more prepared and planned in the second semester and that she tried different teaching methods and techniques in this context.

In addition, some of the science teachers expressed that they mostly used digital education platforms as teaching methods and techniques, especially in the second period of the pandemic (Esra, Davut, and Ahmet teachers). Regarding this, Davut Teacher explained his thoughts with the following words, *"My methods and techniques completely adapted to online education in the second period. I was able to concretize the subjects with interactive experiments and provide education similar to real life with the necessary video materials"*. Parallel to Davut Teacher, Suna Teacher mentioned that she tried to use every method and technique she can use on the internet.

The sub-theme of "Teacher Roles": Teachers stated that they overcame the difficulties in the second period of the pandemic more easily compared to the first period since they were prepared and that their anxiety about finishing the subjects and realizing the learning objectives decreased (Dilan and Ahmet teachers). On this issue, Ayşe Teacher Ayşe said, *"I can realize most of the learning objectives. I explain the subject to the children even from a distance, and when I ask questions, I can get the right answers"*. In addition, science teachers stated that although a new academic year started in the second period of the distance learning, there was no change in the scope of the course contents, this did not pose a problem for them, and that they did their best to provide learning even from a distance (Ayşe, Suna, and Dilan teachers). On the contrary, some of the science teachers stated that they still had difficulties in finishing all the subjects according to the annual plan due to the decrease in lesson hours and length compared to face-to-face teaching, and therefore they taught the subjects faster (Ayşegül and Sevda teachers). On the subject of teaching faster, Dilan Teacher stated that she was only able to realize the learning objectives at the remember and understand levels and that she had problems with the learning objectives at the application level, where the student should be active. Ayşe Teacher expressed her thoughts on the difficulty of realizing learning objectives requiring practice with distance learning and said, *"I have difficulties with the learning objectives where the child should be active. For example, one of the learning objectives is "the student deigns the model". All I can do is ask the students to send a photo of their model. Frankly, it is very difficult to realize such learning objections with distance learning. In this sense, I can't realize the learning objectives where the student needs to be active"*.

The stress and anxiety experienced by the teachers in the first period of the pandemic decreased in the second period of the pandemic. On this issue, teachers stated that their self-confidence increased in some subjects (Berna, Melis, and Aylin teachers). On this subject, Ayşe Teacher said, *"I see now that we can achieve some things even from a distance in the second period"* and explained what she could do in detail. She stated, *"I can start the live lessons two minutes before. Now I can make my preparations. I upload the files I need to upload to*

the system. So, I reduce the time I waste". Similarly, Melis Teacher expressed that compared to the first period of the pandemic, she started to have more command of the programs she could use in distance learning and that she could use the EBA system and the Zom program better. Mentioning the new experience she had, Melis Tacher said, *"For example, I didn't know about screen sharing in the first period of the pandemic, now I learned it"*.

The sub-theme of "Student Roles": Science teachers stated that due to the fact that schools were suspended for a while in the first period of the pandemic and the transition to distance learning was sudden, students perceived that process as a break and that this affected student participation even if there were live lessons (Berna and Ayşe teachers). They added that the students got used to the pandemic process in the second period of the pandemic and that the participation in the lessons increased as a result (Berna, Aylin, and Ayşe teachers). Expressing her thoughts on this subject, Ayşe Teacher said, *"Class participation increased in the second semester. When I started giving live lessons, I started with three people, now 17 people attend the lessons"*. On this issue, Berna Teacher, who had been working in a village school, stated, *"In the second period, the children had the excitement of starting a new grade. When their longing for school increased, they wanted to attend the lessons. I can even say that they understood the value of face-to-face education"*. Melis Teacher asserted that there was an increase in student participation and attendance in the live lessons since it was announced that the schools would be opened after 21 September, the exams would be held and absenteeism would also be taken into account.

The sub-theme of "Communication": The science teachers maintained that they had fewer technical communication problems as they got used to the distance learning process and that they were able to communicate in a healthy way with the increase in the student participation rate in the live lessons (Davut and Songül teachers). Melis Teacher said, *"I can say that our communication increased since children's participation in the lesson also increased compared to the first period of the pandemic. We all got used to this process.*" In addition, since all the teachers were bound to have live lessons in this process, it was revealed that teachers were more conscious and prepared about distance communication tools compared to the first period of the pandemic. The students and parents were also more prepared in this regard. On being experienced and conscious about distance learning, Dilan Teacher said, *"In the second period of the pandemic, we taught our lessons online again, but this time we, the teachers and the children were more conscious. Now everyone was aware of online education because they were used to this situation, be it during the summer or because of the first pandemic process. Parents became aware of this issue, too"*. Dilan Teacher explained that parents with good financial status tried to buy new communication tools, but still, students did not attend the lessons on a whole class basis. Ayşe Teacher expressed that in the second period of the pandemic, some improvements were made in the EBA system compared to the first period, that she could see which student attended the lessons and that she talked to students using the Zoom program.

In the second period of the pandemic, the schools were open for teachers and the teachers had to stay in the same city or town where they normally work. Thus, it was revealed that communication with students increased in this period because of these (Aylin and Berna teachers). Furthermore, teachers were informed that the ones who did not have the means would use the computers, smart boards, and internet (Melis Teacher). In this regard, Ali Teacher said, *"We were in the same cities where our schools were in the second period of the pandemic. In other words, even if it was distance learning, teachers should have to be at schools. So, I didn't have much difficulty in communicating with the students"*. Ali Teacher also mentioned that he frequently communicated with his students on Whatsapp using audio or video recording, and since he worked in a village school, he was able to conduct more detailed works in terms of meeting with the students. He expressed, *"Since we are a village school, the school size is small and every teacher had a live class to keep track of. Apart from this, we had 8th grade students that we had to follow closely. Each 8th grade student was assigned to a teacher. First, we had one-on-one interviews with the 8th graders, then we kept going with the other grades. We took a special interest in the students. Because of this, students attended live lessons more frequently and used EBA for repetition"*. In addition, the low class size in village schools facilitated student follow-up. Some teachers also stated that they were in constant communication with the students and their participation in the lessons increased since they had to be in the city where they worked during this period.

The sub-theme of "Materials": Science teachers stated that they used materials appropriate for distance learning in the second period of the pandemic (Davut and Esra teachers). They mentioned that they mostly used slides, videos, PDF files, and interactive books among these materials (Ayşe and Melis teachers). However, some of the science teachers stated that they had problems because they could not use the materials in the subject content where 3D materials should be used. Expressing his problem, Ali Teacher said, "We need 3D representations because of our subject area. For example, while explaining the solar and lunar eclipses, I open a photo file and

draw arrows on it, but the students may not understand the movement of the Moon and its position change relative to the Earth and the Sun". Similarly, Berna Teacher maintained that using experiment videos in distance education did not work well, and students could not make inferences from online experiment videos compared to experiments conducted in the classroom environment in face-to-face education. On the other hand, Aylin Teacher expressed that she was able to conduct experiments with the students in the second period of the pandemic and said, *"I was trying to do the experiments in the textbooks in the first period of the pandemic but the kids didn't have the materials. I was the only one doing the experiment. They were watching. I began to do the experiments with materials that the students had in the second period of the pandemic. I was sharing these before on Whatsapp and they prepared them by themselves. In a way, the lab became our kitchen"*.

Findings Related to the "Technical and Structural Situation" Theme

In the context of the second sub-problem, the findings related to the second theme, "technical and structural situation", are presented below.

Science teachers mentioned that there were problems in the EBA system due to its volume (Melis, Aylin, Davut, and Berna teachers), but the problems experienced decreased compared to the first period because of the updates done in the system (Ayşe, Ayşegül, and Berna teachers). Songül Teacher expressed that she was able to start the lesson in the last 10 minutes of the 30-minute lesson due to the volume in EBA. On this issue, Ayşe Teacher said, *"When we started on August 31, we were having trouble logging in the EBA system, the system was kicking us out and EBA was very slow. Now (November) I can log in to the system more easily because EBA is updated."* Parallel to Ayşe Teacher, Berna teacher stated that there were times when she could not log in to EBA due to its volume therefore she could not give her lessons. She added that the students also experienced the same problem but this problem disappeared over time as EBA was updated.

The participating science teachers also mentioned that they experienced difficulties due to the problems with the internet infrastructure (Songül, Berna, Aylin, and Dilan teachers). Berna Teacher stated that since the place where she worked was a village school, they experienced internet interruptions, and especially students could not attend the lessons. Aylin Teacher added that they had a lot of power cuts because of the region. Thus, they could not do some of the lessons even if there was internet. In addition, Dilan teacher stated that she had difficulty in reaching all her students through live lessons since most of the students did not have internet and phones, tablets, or computers to connect to the internet. Some science teachers, on the other hand, mentioned that they were able to solve their problems related to technical equipment in the second period of the pandemic. On this issue, Davut Teacher said, *"I have made all my technical infrastructure serviceable. I myself hadn't had a problem with my technical equipment"*.

Findings Related to the "Assessment-Evaluation" Theme

In the context of the second sub-problem, the findings and comments related to the third theme, "Assessment-Evaluation" are presented below.

Science teachers stated that there was more awareness among students in terms of assessment and evaluation and that the students started to experience anxiety about their grades in the second period of the pandemic compared to the first period, (Dilan and Aylin teachers). Berna Teacher commented, *"In the first period of the pandemic, there was no anxiety about grades among the students. I told them the exams would be face-to-face in the second period. I told them they need to the lessons in the second period of the pandemic and I even told them I would do oral exams"*. Similarly, Melis Teacher stated that since the exams would be held face-to-face in the second period of the pandemic, students had grade anxiety. Thus, she did not encounter any problems in terms of assessment and evaluation in the second period of the pandemic compared to the first period. However, she emphasized that she could not do much about the process assessment since the 30-minute lessons were very limited. Regarding the same issue, Sevda Teacher said, *"As in the first period of the pandemic, I had to teach the subjects more quickly and reduce the assessment works taking into consideration the short periods"*. Ayşe Teacher explained that she made some changes regarding assessment and evaluation compared to the first period of the pandemic and said, *"Now I can meet with my students one-on-one and teach my lessons. I can give homework from the z book I use in the lesson and I can follow up. I meet with the classroom teachers of my students"*. In addition, Ayşe Teacher maintained that being at her place of work during the second period of the pandemic made it easier for her to meet with her colleagues. Therefore, she could follow her students better. Songül Teacher expressed that they did not have a chance to assess what the students knew or did not know

about the first period, and when she got in contact with the students face-to-face with the opening of the schools in the second period, she saw that the students learned very little about the subjects. Furthermore, Esra Teacher stated that the exams were not held and that she tried to make various inferences about the students participating in the live lessons using observation and that she would use these inferences in terms of assessment and evaluation. Similarly, Davut Teacher mentioned that they had an incomplete assessment and evaluation process because a central examination was not held.

Findings and Comments Related to the Third Sub-Problem

For the third sub-problem of "What are the recommendations of science teachers regarding the post-pandemic process?", "learning and teaching processes", and "assessment-evaluation" themes were determined. In the study, a ranking was made considering these themes, and the findings were formed.

Findings Related to the "Learning and Teaching Processes" Theme

In the context of the third sub-problem, four sub-themes were determined in relation to the "learning and teaching processes" theme, which was determined as the first theme. These sub-themes were "teaching environment", "teaching methods and techniques", "teacher roles", and "student roles", respectively.

The sub-theme of "Learning Environment": For the post-pandemic period, science teachers believed that students would have difficulties in adapting to the face-to-face learning environment (Esra and Songül teachers). In this regard, Melis teacher said, *"It will be difficult for children to adapt to school. At the moment (pandemic period), the classes are divided into two in face-to-face education. I think there will be difficulties in adapting to this situation when the classes are reunited later on"*. Melis added that it would not possible to return to the pre-pandemic learning environments, but this situation would be overcome more easily in village schools. Dilan Teacher stated that the crowding in learning environments and virus anxiety would cause adaptation problems to the lessons and said, *"Since the classes will go back to the old crowded selves and the seatings will be without distance again, the students will be in contact with each other more and it will take more time for them to focus on the lesson"*. In addition, Suna Teacher expressed that even if the effects of the pandemic subside, the students in the classroom with masks would have breathing difficulties during the lesson and as a result, there would be distractions in the learning environments. Songul Teacher regarded the problem of adaptation to the face-to-face learning environment from another perspective and said, *"Students currently (in the pandemic period) experience more self-learning because they do everything using computers and the internet. After the pandemic, leaving this environment and entering a crowded classroom environment may surprise them"*. Furthermore, Berna Teacher believed that there would be no negativities in terms of the learning environment after the pandemic and that she would continue face-to-face education with the students from where they left off. However, she added that it may be easier for some students to follow the lessons from home and that coming back to school at this point may create an adaptation problem.

Some science teachers associated their thoughts about what kind of situations may arise in the learning environment for the post-pandemic period with the problems originating from the region. On this subject, Ayşe Teacher said, *"There are problems because of the region. This is Şırnak, after all, a terror zone. At one time, they suspended education for a long time. I think we are already one step behind, compared to the western regions of our country. There are also too many children at home, the mothers are mostly illiterate, fathers are usually not at home because they are truck drivers. So, there is no concerned parent profile here"*. Ayşe Teacher added that the regional reasons would create a negative learning environment for the post-pandemic period and that learning environments should be reorganized, especially in the terms of reading and writing, which was the main problem. Mehmet Teacher also made the following statements about the problems arising from the region: *"Children in this region change teachers a lot. Because of this, they are not good academically when they graduate elementary school and start middle school. Although I am a science teacher, I pay attention to spelling and punctuation rules while I make them write in the class. So, I want children to improve their Turkish. I think many of my students will have difficulties with their reading and writing skills because they don't read books, and the feedback I get from parents is in this direction"*. Dilan Teacher also associated the problems arising from the region with the insufficient number of schools and crowded classrooms and commented that this situation would affect the social distancing that will be on the agenda after the pandemic. She also stated that the insufficient technological and physical infrastructure (such as the laboratories) in schools would adversely affect the learning environments in science classes. She added that if distance learning is followed by face-to-face education throughout the country in the post-pandemic period, the inadequacy of the

financial opportunities of the people in this region will reduce student participation in classes and this will negatively affect the learning environment.

The sub-theme of "Teaching Methods and Techniques": The participating science teachers had concerns about social distancing in the post-pandemic period in terms of teaching methods and techniques to be used in learning environments. Regarding this, Ayşe Teacher said, *"After the pandemic, I don't think that this disease will end soon. I feel like we'll have to maintain social distancing for a few more years even if schools are open. Because of this, we may not be able to do group work. I think we can't do activities that will affect social distancing the most. For example, drama. We won't be able to use these techniques"*. Similarly, Melis Teacher stated that they were already uncomfortable with the crowded classrooms before the pandemic, that they would experience this same problem after the pandemic, and that they would not be able to apply the methods and techniques that require group work if there would be no change in the class sizes. Suna Teacher, like Melis Teacher, stated that they could not use various methods because of the crowded classrooms before the pandemic, and if this situation continued after the pandemic, they would not be able to use different methods again. Therefore, they would not be able to compensate for the learning losses caused by the pandemic. Parallel to the aforementioned teachers, Fatma Teacher also expressed that the inadequacy of the technical (smartboard) and physical (laboratory) facilities in the school she worked in in the pre-pandemic period created problems in using various teaching methods and techniques and that this situation would not improve in the post-pandemic period, which would also cause problems in using the methods and techniques related to these facilities.

Some of the science teachers, on the other hand, stated that there would be no problem in the smooth implementation of many teaching methods and techniques after the pandemic (Songül, Ayşegül, Ahmet, and Dilan teachers). However, although Berna Teacher is of the opinion that there would not be much trouble in this regard, she mentioned that methods and techniques that require repetition of the subjects should be used after the pandemic due to the fact that the students were deprived of face-to-face education and some of the learning objectives in distance learning were not completed and suggested that make-up lessons be held in order to avoid problems in terms of time. In addition, Aylin Teacher signaled that when face-to-face education would start in the post-pandemic period, she would diversify the teaching methods and techniques she could use and said, *"I realized the value of the teaching methods and techniques I used during the pandemic process while doing face-to-face education because the methods you could use in online education were limited, I could only lecture"*. Dilan Teacher suggested that orientation training should be given to students and that using engaging activities for repetition for past subjects such as games, and experiments could prevent the student from having difficulty in making connections between the topics.

The sub-theme of "Teacher Roles": Science teachers stated that they should work on eliminating students' learning losses that happened during distance learning since the learning objectives were not completed and not all students attended the live lessons. On this subject, Ayşe Teacher said, *"For example, while learning the solar and lunar eclipses, the student may not have been able to attend the live lessons on the phases of the moon, which was the subject of the previous year. At this point, I think that I may have trouble teaching the learning objectives of the new grade after the pandemic. So, we will always be trying to fill a gap"*. Ayşe Teacher also suggested that distance learning should be used together with face-to-face education after the pandemic. She also emphasized that with the opening of schools at all levels, teachers can make up for this gap by working overtime. In parallel with Ayşe Teacher's first view, Berna teacher said, *"I think that I could not fully teach my students the learning objectives in distance learning. This will lead students to incompletely attain the learning objectives one year later"*. Berna Teacher, who recommended that the old subjects be briefly repeated in each lesson in the period after the pandemic, added that the class hours and period length the teachers should be increased. Davut Teacher also made a statement on the period hours and said, *"I think that in an environment where the period length are not reduced, the adaptation to the school will be faster and we will return to the normal order in a short time but in a situation where the duration gets shorter, I believe that the process should be supported with live lessons, otherwise the learning objectives will be incomplete"*. Furthermore, Melis Teacher expressed that in the live lessons during distance learning, students could not comprehend abstract concepts because she could not use some teaching methods and techniques, and therefore they had information gaps in these concepts. Related to this, Melis Teacher stated that she would work to concretize the subjects that students could not understand and to eliminate these gaps after the pandemic.

Some of the science teachers believed that everything would return to normal in the post-pandemic period and there would not be much change in their roles (Ayşegül, Sevda,r and Suna teachers). Regarding this, Aylin Teacher said, *"Despite the reduced period hours during the pandemic process, I think that I won't have any problems because since the period hours will return to normal after the pandemic, it will be better for us"*. Similarly, Songül Teacher also believed that there would not have a problem with finishing up all the subjects.

However, she also believed that there might be problems with children's psychology and that it would be necessary to understand them and support them like a psychological counselor.

The sub-theme of "Student Roles": Expressing that students' desire to attend classes would increase compared to distance learning since face-to-face education will start after the pandemic period, Ayşe Teacher said, *"I don't think we will have problems in class participation because the children have been away from school enough and in this process they missed school and understood the value of school. That's what I think"*.Contrary to Ayşe Teacher, Berna and Ahmet teachers stated that students would not show much interest in face-to-face lessons. Due to the anxiety of the parents about the pandemic, Berna teacher said, *"There may be those among parents and students who are nervous. After this process, I think there will be parents who won't want to send their children to school. Class sizes may decrease"*. In addition, some of the science teachers emphasized that there would be difficulties in group works as students would have socialization problems in this process and that there would be an increase in students' contact and chattering tendencies during the lesson (Ayşe, Melis, and Dilan teachers). Dilan teacher believed that students' asking for permission to speak would decrease during the lesson and said, *"I think that the habit of raising fingers will decrease at the very least. Already in the distance learning process, this behavior has decreased and I think that this behavior will not be return when we start school again"*. Furthermore, Davut Teacher maintained that the students would not want to come to the classes with an understanding that they were away from school and lessons and did not care much about the teachers. Ali and Songül teachers expressed that distractions can be seen among students and even introversion among them can be encountered.

I addition, some of the science teachers stated that the students who could not attend the live lessons during the distance learning process would have difficulty in understanding the new subjects and that there would be differences between the students in the post-pandemic period due to their insufficient prior knowledge about the subjects (Ayşe, Berna, and Suna teachers). Regarding this, Suna Teacher said, *"I think that after the pandemic period, there will be differences between students who attended the live lessons and those who did not, and this will lead to differences in their levels"*. Teacher Esra, similar to the Suna Teacher's beliefs, expressed that successful students usually attended the live lessons during the pandemic period and that there will be a lack of knowledge after the pandemic among the students who did not attend the lessons. In addition to academic shortcomings in science subjects, Dilan and Mehmet teachers feared that there would be problems regarding students' reading and writing skills, which they believed to be more fundamental problems. In this regard, Dilan Teacher said, *"I think we will have difficulties in children's reading and writing skills. Even now, we are experiencing difficulties during the course period. I think we will definitely have problems about this after the pandemic"*.

Findings Related to the "Assessment-Evaluation" Theme

In the context of the third sub-problem, the findings related to the second theme, "Assessment-Evaluation" are presented below.

The participating science teachers stated that student competencies in terms of assessment and evaluation would be understood in the classroom after the pandemic, and therefore all students should be present in the classroom (Ayşe and Davut teachers). Regarding this, Ayşe Teacher said: *"I think we will understand what the students know and don't know when they enter the classroom. At the moment (pandemic period), I think that if all students attend live lessons, there will be no learning deficiencies"* and stated that necessary conditions should be provided for all students to participate in the live lessons during the distance learning process. İbrahim and Ahmet teachers emphasized that students would have difficulties while teaching the new subject as they could not attain most of the learning objectives during the pandemic process, and instead, the missing learning objectives should be compensated by using appropriate measurement tools. Melis Teacher suggested that a placement test should be held after the pandemic to determine the subjects and concepts that could not be learned by the students, and said, *"Students will have low levels because they did not experience a productive learning environment during the distance learning process. At this point, we will experience an imbalance. Very few students will be competent. As a solution, a separate class can be formed for those who constantly attended the live lessons. Then, the teacher can teach and assess accordingly"*.

Some of the participating science teachers suggested that makeup lessons should be given to students at the weekends and the number of fundamental courses should be increased after the pandemic process so that the financial impossibilities of the students do not affect their efficacy levels and no group among students such as those who attended the online lessons and those who did not would be formed (Melis and Ali teachers). On this

subject, Melis Teacher stated, *"The child will not be able to fully master the learning objectives of the previous year. Since the spiral programming approach is used in Science, students will be incomplete. Since the new topic is related to the old topic, I think that students will have problems understanding the topics. They may even experience feelings of inadequacy"*. Like many of her fellow teachers, Songül Teacher recommended that the deficiencies should be determined with placement tests, and the transition to the new topic should undergo in that way, and she explained her opinion with the following words: *"I think we will have problems with the subjects of the previous period. After the deficiencies are determined with the placement tests, the repetition of the past topics and the processing of the new topics by taking consideration of the old topics will be a solution to this problem"*. In addition, Songül teacher stated that assessment and evaluation works must be done in the school environment in order to keep children away from the computer screen.

Results and Discussion

In the study, science teachers' experiences during the pandemic process and their recommendations for the post-pandemic process were explored. Employing the qualitative method, the study discusses the findings regarding teachers' instructional experiences and suggestions below.

Regarding the first period of the pandemic, teachers stated that they experienced problems in learning and teaching processes, assessment and evaluation, and technical and structural situations. Among the reasons for this situation, the sudden transition to distance learning in this process, the change in teaching methods and techniques used by the teachers, and not using methods and techniques that enable the interaction with students can be presented. Therefore, it was revealed that the teachers could not get the desired efficiency from their lessons. Some teachers emphasized that the teaching methods and techniques they used in the live lessons were limited due to the lack of equipment. In addition, science teachers stated that students did not have tools such as the internet and computers in the first period of the pandemic and that techniques requiring mutual interaction with students could not be realized. With the transition to distance learning, some science teachers expressed that they could not use anything other than lecture and visual techniques. In particular, the teachers maintained that they had difficulty in concretizing the subjects, referring to the limited materials they used in the lessons. Also, the teachers emphasized that the students had problems in understanding and interpreting the activities and materials sent from the internet and that the technical knowledge of the parents was insufficient in helping their children. However, some of the teachers stated that with the transition to distance learning, they had the chance to use web-based activities and materials more actively, thus turning a problem into an opportunity. Although teachers had problems with the transition to distance learning in this process, it can be stated that they could integrate web-based applications into their learning environments.

In the study, the most important problem was revealed to be the loss of communication between teachers and students due to the sudden interruption to face-to-face education in the first period of the pandemic. This sudden development brought with it uncertainties, causing teachers to feel helpless and inadequate in many subjects. Some teachers stated that they tried to communicate with their students in the first period of the pandemic, but they could not achieve this since students lacked equipment and had physical problems related to the Internet. In other words, the reason for this was teachers being caught unprepared for this process and the problems experienced due to physical inadequacies. In this case, the suspension of teachers' face-to-face communication with students and students' distancing themselves from the classes and school can be given as reasons for the decline in students' productivity in classes. In their study, Başaran et al. (2020) aimed to collect information about the efficiency of the distance learning process by examining the views of teachers, students, and parents on distance learning during the pandemic process. In the aforementioned study, the participants stated that distance learning had positive aspects, but the interaction was limited, active learning did not occur, it was not appropriate for individual differences, and there were negative situations such as only a few students attending the lessons because of technical equipment problems. In particular, the inadequacy of physical conditions causes students to exhibit negative attitudes towards distance learning (Serçemeli & Kurnaz, 2020). In another study conducted by Mishra, Gupta, and Shree (2020), although the participating students agreed that distance learning was the appropriate method for the pandemic process, they also stated that distance learning was inadequate due to its characteristics such as ease of learning, student participation and effectiveness, and lack of adequate planning. Along with this lack of planning, they complained about the high cost of the internet. In their study, Keskin and Özer-Kaya (2020) determined that web-based education allowed students to learn in distance learning applications, but what was learned was not permanent and there were technical problems during the education.

The rapid transition to distance learning during the pandemic process also caused changes in the terms of

teacher roles. Teachers stated that they had difficulties in the transition to distance education, especially in the context of planning the teaching of the subject, realizing the learning objectives, and finishing the subjects. Similarly, Koç (2020) stated that even though the vast majority of the learning objectives in the curriculum are adaptable to distance learning during the pandemic process, some of the learning objectives should be revised and organized. In addition, although some elements and learning objectives pointing to distance learning were included in the curriculum, the lack of sample experiences and assessment activities that can be used for these learning objectives made it difficult to implement the curriculum.

The participating teachers expressed that the make-up lessons could not be carried out in a planned way because the participation in the lessons was low. Thus, the learning objectives were not completely realized. In addition, they stated that they found the make-up lessons insufficient, that the learning objectives were not appropriate for online education, and that the learning objectives and materials requiring group work could not be used. Furthermore, some teachers mentioned that the time given within the scope of distance learning for the course contents was insufficient, and therefore their teaching was not effective. The teachers' views revealed that some learning objectives based on experiment and observation were not completed due to the lack of the necessary physical environment, and therefore teaching the learning objectives requiring application and practice lacked. Supporting the results of the present study, Pınar and Dönel Akgül (2020) revealed that middle school students found the use of distance learning in science lessons useful in terms of repetition and reinforcement of the subjects but they also found that not being able to use the experiment method created problems.

In the present study, the participating science teachers stated that they had problems in using teaching materials, making them appropriate for distance learning, delivering them to students, and getting feedback in the learning and teaching process in the first period of the pandemic. In addition, some science teachers stated that they had difficulties because the textbooks used in the courses were not suitable for distance learning and that the interactive books were inadequate. They also emphasized that teachers had problems with their students' participation in the lessons. The reason for this was that the students did not want to talk in live lessons because they were with their families, and this caused the teachers to not use the question and answer technique, which is the method often used in face-to-face lessons. Similarly, a study by Iwai (2020) revealed that the sudden transition to the use of digital platforms such as "Zoom" posed difficulties for educators who were less experienced in the internet and computers in the implementation of curricula. In addition, it was stated that the discipline of a classroom, which is controlled only through the screen and microphone, created problems for educators. Keskin and Özer-Kaya (2020) determined that students could not communicate comfortably with teachers in distance learning applications.

The performance of teachers is one of the factors that ensure the success of distance learning (Bıyıklı & Özgür, 2021). The results of this study put forth that teachers continued teaching in the first period of the pandemic, even though they had instructional problems and technical equipment deficiencies in the distance learning process. Similarly, in the study conducted by Serçemeli and Kurnaz (2020), it was determined that teachers experienced problems in distance learning during the pandemic process due to lack of technical equipment. In another study by Fidan (2020), it was concluded that the main problems of teachers who were teaching through distance learning were hardware and communication with students. When the problems experienced at the national level are compared with different countries, similar results are encountered. In their study, Niemi and Kousa (2020) aimed to reveal the views and practices of teachers and students in a local middle school in Finland about the process during the pandemic period. The study results revealed that the main difficulties for teachers were that the same naturalness provided by face-to-face teaching could not be achieved, thus a quality learning process could not be realized with distance learning. Although teachers had quickly learned to use technological platforms, their opinions about the quality of interaction were negative. In addition, students stated that they worked hard, got tired, and lost their motivation during the process.

In the present study, the teachers expressed that the teaching process in the second period of the pandemic was carried out in a more systematic and planned manner compared to the first period of the pandemic. Teachers and students had fewer problems in this period because they were more experienced than in the first period. In addition, the teachers were more technologically prepared in the second period of the pandemic compared to the first period. It was revealed that students attended more lessons in the second period since they were informed that their absences will be taken into account the exams would be held face-to-face. The teachers working in the village schools had the opportunity to follow their students closely due to the small class sizes. The participating teachers stated that they taught the learning objectives more in the second period. However, they were only able to realize the learning objectives at the remember and understand levels due to the insufficient course hours and period length. Thus, they expressed that the learning objectives at the application level were lacking. Despite these negativities, it can be said that teachers and students improved themselves from different perspectives in

this process, showing more interest and participation in the lessons. Similarly, Cakın and Külekçi Akyavuz (2020) put forth in their study that teachers had problems with communication, and parents and students' learning during the pandemic process. In addition, teachers stated that they also did supportive activities to motivate students, encourage them to continue school, and warn them to protect their health.

The present study determined that science teachers used lecture and question and answer a lot among the teaching methods and techniques in the second period of distance learning and that they benefited more from digital education platforms. The study also revealed that some teachers, who were better adapted to the pandemic process than the first period, made their own plans, used different teaching methods and techniques in this direction, concretized the concepts with interactive experiments, and provided permanent learning with video materials in the second period. Although the teachers had problems with internet connection in this period, they mostly used slides, videos, PDF files, and interactive books as materials. In addition, teacher views also revealed that three-dimensional materials not being used in the learning environment caused some teachers to have problems in concretizing the concepts.

Science teachers mostly mentioned the lack of necessary equipment in students' homes in terms of technical equipment problems experienced in the first period of the pandemic. Many students did not have internet infrastructure in their homes, and those with infrastructure did not have the financial status for the internet subscription. Some science teachers also stated that students living in villages could not use the internet packages provided by the Ministry of National Education for free of charge. Furthermore, teachers expressed that students could not log in to EBA because they did not know how to use it and that students could not use EBA efficiently because of the crashes in the EBA system. According to these views, in addition to not having equipment, students' inadequacies in using technology effected negatively the teaching process. Furthermore, some of the science teachers teaching online for the first time and not being able to use the Zoom program effectively also negatively affected the learning process. However, the problems experienced by teachers regarding technical equipment decreased in the second period of the pandemic compared to the first period of the pandemic.in EBA were solved and the system was updated, the teachers were able to log in for the lessons before students and they used time more effectively by completing their preparations.

The present study put forth that the stress and anxiety experienced by the teachers in terms of technique and equipment in the first period decreased in the second period of the pandemic. At this point, teachers stated that they started to have more command of the programs they could use in distance education, and they were able to use the EBA system and the Zoom program better compared to the first period of the pandemic. In this period, the teachers had fewer technical communication problems as they got used to the distance learning process, and that they were able to establish healthy communication with the increase in the participation rate of the students in the live lessons. It can be said that in the second period of the pandemic, students and teachers got used to the process and as a result, students' participation in the lessons increased. Furthermore, some of the science teachers had difficulties in finishing up the subjects according to the annual plan due to the decrease in lesson hours and length compared to face-to-face teaching, and therefore they stated that they taught the subjects faster. Burke and Dempsey (2020) expressed that the educational process entered with the pandemic had advantages and disadvantages for teachers. As an advantage, they emphasized that teachers had an important opportunity to get to know digital education platforms and that this would save time and practicality in terms of accessing some resources and materials. As a disadvantage, they stated that online learning puts teachers under pressure and when schools are opened and face-to-face education start, they are worried about not being able to finish the curriculum.

The results of the studies in the literature on technical equipment problems during the pandemic process support the results of the present study (Bakioğlu & Çevik, 2020; Bıyıklı & Özgür, 2021; Fidan, 2020; Pınar & Dönel Akgül, 2020; Serçemeli & Kurnaz, 2020; Ünal & Bulunuz, 2020). The study conducted by Ünal and Bulunuz (2020) aimed to determine the views of science teachers on "distance learning" during the pandemic process. The study revealed that teachers had technical problems originating from the system at the beginning of the pandemic process and then the problems were partially reduced. Another of these studies is the study of Bakioğlu and Çevik (2020) conducted with teachers. Bakioğlu and Çevik (2020), in their study also aiming to determine the views of science teachers on distance learning during the pandemic process, put forth that science teachers did not know what a pandemic was and that they had technical hardware problems. In addition, it was determined in the present study that the participation of the students in the lessons was low and the teachers had problems in the distance learning process in teaching the practical learning objectives to students. Similarly, Pınar and Dönel Akgül (2020) emphasized that the EBA platform had an important role in distance learning and that the addition of live lessons to this platform was positively received by the students. However, some students experienced software problems in this platform and could not use the platform efficiently. In particular, they

expressed the negativities such as the inadequacy of the time given for the live lessons, the site giving error, the slow operation of the platform due to being busy, limited log in, and the insufficient internet quotas.

While talking about the assessment and evaluation in the first period of the pandemic, science teachers stated that they did not have an efficient assessment and evaluation process. In terms of assessment and evaluation, teachers mentioned that they had difficulty in controlling students due to the lack of a strong control mechanism and that they did not have grade anxiety because they had the perception that all students would pass no matter what. As a result, there was no efficient assessment and evaluation process in the first period of the pandemic. Also, in this process, the teachers had difficulties in making assessments and evaluations because they did not receive sufficient support from the parents. Unlike the first period of the pandemic, in the second period of the pandemic, science teachers made changes in terms of assessment and evaluation and made general inferences in the evaluation of students by communicating with the classroom teachers. It was determined that the teachers had one-on-one interviews with the students they could reach or that they reached a conclusion as a result of their observations. Some of the teachers stated that students' assessments and evaluations were incomplete because the students were not subjected to standardized exams. It was concluded that the teachers were inadequate in assessment and evaluation in the second period of the pandemic like the first period and t could not evaluate the students at an adequate level.

The participating science teachers in the present study stated that students would have difficulties in adapting to the face-to-face learning environment. Some science teachers believed that the problems originating from the region would create a negative learning environment for the post-pandemic period. They stated that learning environments should be reorganized, especially in terms of reading and writing, which is the fundamental problem. In addition, some science teachers expressed that after the pandemic, there would be a difference in academic achievement between students who attended the live lessons and those who could not and that the theoretical knowledge that students should have would be lacking when they move to the next grade. As a result, it can be said that after the pandemic, the course hours and length should be increased in order to briefly repeat the old topics, to concretize the incomprehensible topics, and to complete the deficiencies.

Some of the teachers stated that after the pandemic process, students would show behaviors such as introversion, distraction, or excessive socialization, and therefore, time would be needed to adapt students to the learning process. In terms of realizing the learning objectives, science teachers maintained that not all of the learning objectives could be given in normal time and incomplete learnings may occur that may lead to a difference in achievement among students. As a solution to this situation, works can be made to eliminate the learning deficiencies in students that happened due to the fact that the learning objectives could not be finished in distance learning and not all students could attend the live lessons.

Some teachers expressed that the pandemic would continue for a long time and that social distancing rules would be in our lives. Therefore, they believed that there would be difficulties in teaching learning objectives requiring group work and that activities preventing social distancing could not be done in schools. At this point, the number of class sizes may need to be reduced and classrooms may need to be technologically improved after the pandemic. Some teachers suggested that students should be oriented in this process and that engaging in interesting activities such as repetition, games, and experiments on past topics would make it easier for students to make connections between subjects.

In addition, they also suggested that refreshers should be offered for the incomplete learning objectives. Science teachers believed that the proficiency level of the students would be understood in the classroom after the pandemic period, and emphasized that all students should be in the classroom environment. At this point, a placement test can be held after the pandemic to determine the subjects and concepts that have not been learned by the students. However, some teachers believed that there would be no negative situation in terms of the learning environment in the post-pandemic period, everything would return to normal and face-to-face education would continue with the students from where they had left off. It can be predicted that students' willingness to attend classes will increase when face-to-face education will begin compared to distance learning.

Sarı and Nayır (2020) examined the pandemic period in international reports in terms of education and identified the emerging problems and the opportunities created by this process. This study emphasized that methods to make communication with the family stronger should be found, and teacher-parent communication should be provided in a very good way in terms of both the curriculum and the practices to be made. The present study also underlined that assessment and evaluation methods should be diversified and that necessary regulations should be made by reviewing the functions of schools. Similarly, Sever and Özdemir (2020) aimed to concretize the events in the distance learning process through photographs and interpret them from a

participant-centered perspective. According to the study results, students living in rural areas experienced inequality of opportunity, and the pandemic process was an experience that was highly stressful and required self-control skills. In the present study, it was determined that there was pessimism and hopelessness in the students and that this would create adaptation problems. In another study, it was also revealed that although teachers had positive thoughts about distance learning, they also believed that high-level interaction and social communication cannot be easily achieved as in face-to-face education (Hebebci, Bertiz, & Alan, 2020). Figueroa et al. (2020) stated that although students who were getting orthopedics specialization education made positive assessments about distance learning activities, they still considered these activities as a necessary complement to face-to-face teaching activities.

Recommendations

In line with the study results, the following recommendations can be made:

Action plans should be developed and updated during and after the pandemic with the participation of all stakeholders such as teachers, parents, and school management in order to eliminate the learning deficiencies and increase students' motivation to school. In order to finish the incomplete learning objectives during and after the pandemic process, make-up education in which applied teaching methods and techniques will be used should be planned so that students can establish strong connections between concepts and subjects. Orientation programs can be carried out during and after the pandemic process to eliminate the problems of adaptation to face-to-face education, especially for students, teachers, and parents. Support should be obtained from the state institutions in order to eliminate the problems related to technical equipment, which were partially resolved in the second period of the pandemic, and to provide the necessary infrastructure. In this regard, it is important to solve the problems, especially in rural areas. In addition, trainings should be organized to inform teachers and parents about technical infrastructure. Distance learning and face-to-face in-service trainings should be organized for teachers, distance education should be introduced with all its aspects, and the teaching methods, techniques, and materials that can be used in this process should be taught. Teachers' competencies in using digital platforms should be increased. In this study, the problems experienced during the pandemic process were discussed in terms of science teachers' views. Future studies using different sample groups and different research methods can be conducted to determine the other aspects of the subject and present solutions.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in JESEH journal belongs to the authors.

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