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Research Paper

Investigation of Primary School Teachers' Experiences on Teaching Science During Distance Education

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ABSTRACT

It is seen that many opportunities are offered to both students and teachers thanks to the integration of technology into teaching environments. It can be thought that using instructional technologies in the teaching process can enable students to be active in this process, make learning enjoyable, concretize the information, and thus ensure that this information is permanent. In addition to this, distance education opportunities can be provided so that students can continue their education under extraordinary conditions. In this research, it is aimed to examine the experiences of primary teachers in teaching science during distance education. In the research, which was carried out using the case study design, which is one of the qualitative research methods, semi-structured interviews were conducted with 10 primary school teachers who were determined based on the purposive sampling method. Content analysis was used in the analysis of the data. According to the research findings, in the distance education process, most of the teachers adapted the strategy-method-techniques they used before according to the distance education process. Teachers have taken various measures to increase permanent learning, student motivation and interest. However, they also needed support during this process and had limited content development experience. It is all-important that teacher candidates are trained in terms of instructional technologies in primary school teacher training programs. In addition, if teachers need technological support, it is thought that appointing information technology teachers not only at secondary school level but also at primary school level institutions will contribute to the process in order to meet these needs.

INTRODUCTION

The rapid progress in technology brings about changes in the field of education as well as in many other fields. Thanks to the diversity in instructional technologies, it is easier for students to learn concepts, and they are enabled to be active in the teaching process. One of the implementations formed by integrating technology into education processes is distance education (Akyürek, 2020). The developments in technology and the opportunities provided by distance education have significantly developed distance education today (Fojtik, 2018; Saykılı, 2018). Distance education has traditionally been defined as instruction given to people who make planned learning in a different place or time than educators through written or electronic communication tools (Gunawardena & McIsaac, 2013). According to Thach and Murphy (1995), educational communication between teacher and student in distance education is separated by a geographical distance, communication is two-way and interactive, and technology is used to facilitate the learning process. The objectives of distance education as an alternative to face-to-face education degrees are programs, combating illiteracy in developing countries, providing educational opportunities for economic growth, and enriching curricula in non-traditional educational settings (Gunawardena & McIsaac, 2013). It has been determined that distance education has some advantages and limitations. Distance education allows the student to work in the period determined by her, to plan her work individually, flexibility, usable content, and low cost (de Oliveira et al., 2018; Fojtik, 2018). In addition, other advantages of distance education have been determined as providing education opportunities to students who cannot participate in face-to-face education, lower cost compared to face-to-face education, and the absence of time and space limitations (Kocayiğit & Uşun, 2020). On the contrary, difficulties in organizing time correctly, understanding some knowledge, being unable to find answers to questions immediately, and maintaining motivation are the difficulties faced by students in distance education (de Oliveira et al., 2018; Fojtik, 2018). It is possible to say that distance education will be disadvantageous for students who do not have enough self-discipline to perform the necessary activities without a teacher (de Oliveira et al., 2018). In addition, since communication and interaction in distance education are more limited than in face-to-face education, the development of social skills may also be negatively affected (Duman, 2020). If the limitations experienced in the distance education process can be improved, it may be possible to benefit more from its advantages. In order to make these improvements, first of all, it is necessary to define the problems experienced in distance education. It should also be considered that these problems may differ according to primary, secondary, or high school levels and lessons (e.g., mathematics, science, etc.).

Today, it has become essential to raise individuals who can access information, associate the information with each other, question its accuracy, think critically, find solutions to the problems they encounter, be open to cooperation, and develop communication and responsibility skills, taking into account the 21st-century skills, within the education process in which students are active. Through the science course, students can explore the environment in which they live scientifically. It aims to provide students with positive attitudes, different skills, and knowledge and to raise awareness on various subjects by teaching 'the science course' in the classrooms through various methods and techniques (Ministry of National Education [MoNE], 2018). At the same time, the rapid development of technology brings some innovations in the field of education, as in every field. Especially during the pandemic period, education at the primary school level was carried out through distance education, as in all education levels, and this situation was examined in different studies (Çilek et. al., 2021; Ertan-Kantos, 2021; Kızıltaş & Çetinkaya-Özdemir, 2021; Kurt et. al., 2021; Manesis, Vlachou, Aravantinou, Barmpetaki & Kanouri, 2022). When these studies are examined, it is seen that the distance education process is mostly considered as a whole, not for teaching a particular course. Thus, a general perspective on distance education practices in primary school is obtained. In addition to these researches, it is seen that researches based on a certain course teaching are also carried out (Batmaz et al., 2021; Bulut & Susar-Kırmızı, 2021; Toptaş & Öztop, 2021; Arçay Koyuncu, 2022; López-Estrada, Elizondo-Mejías, & Pérez-Hidalgo, 2022; Štemberger, Petrić, Petrušič & Metljak, 2022). These studies allow more extensive investigations of individual courses connected to distance education implementation at the elementary school level. Another course taught in the primary school period is science. It aims to examine primary school teachers' experiences in teaching science in the distance education process with this research. Thus, it is thought that detailed information about teaching science lessons will be presented in the distance education process in the primary school period. In this way, it is thought that a detailed examination of science teaching will be made rather than a general evaluation of the teaching carried out in primary schools during distance education. Because, when the literature is examined, it is seen that it is thought that reaching the desired level of teaching in the distance education process may be affected by some features of the courses, and it is recommended to conduct research specific to the courses (Cabı & Kurt-Erhan, 2016; Karakuş, Esendemir, Ucuzsatar & Karacaoğlu, 2021). For this reason in this research, it is aimed to determine the methods and techniques they used in face-to-face and distance education, the comparison of face-to-face education and distance education in various subjects, the practices they have done to ensure a permanent education and students' interest and motivation, content development experiences in the distance education process of primary school teachers. Thus, it is thought that it will contribute to the effective use of distance education in primary school science courses when it is a choice or necessity. In this context, "What are the experiences of primary school teachers in teaching science in the distance education process?" the question constitutes the problem statement of the research. Sub-problems are given below:

1. Could the methods and techniques that the primary school teachers used in the science lesson in the face-to-face education process could be used in the distance education process?
2. Do primary school teachers think that science teaching with distance education achieves the expected goal?
3. How are the comparisons made by the primary school teachers in terms of face-to-face education and distance education within the scope of science lesson in terms of concretizing intangible information, permanent learning, students' interest and motivations for science lesson?
4. In the distance education process, what are the measures taken by the primary school teachers in order to ensure permanent learning, to attract students' interest in science lessons and to increase their motivation?
5. What are the instructional technologies experiences of the primary school teachers in the distance education process?
6. Did the primary school teachers have experience in developing content for teaching science lessons during the distance education process?

METHOD

Research Design

This research aims to examine the experiences of primary school teachers in teaching science in the distance education process. For this purpose, a case study, one of the qualitative research methods, was used. Case studies are defined as studies that examine how the factors affecting a situation affect the relevant situation and how they are affected by the relevant situation (Yıldırım & Şimşek, 2013). Case studies are also used to explore behaviors, situations, and processes that are new, different, or little understood (Hartley, 1994). In this study, the reason for the use of the case study is to examine how primary school teachers are affected by distance education process during science teaching and how they manage the distance education process. In addition, the distance education process has started to meet the educational needs of students during the pandemic period, and this process has started a new and different process for a large part of the world. Therefore, another reason for using the case study is to aim to understand better this new process that has emerged.

Participants of The Study

Since this research aims to examine the experiences of primary school teachers in teaching science in the distance education process, the participants of the research are ten primary school teachers who have conducted science courses in the distance education process. A purposive sampling method was used to determine the participants. The purposeful sampling method, considering the purpose of the research, is to carry out the research by meeting certain criteria and selecting situations that are well-equipped in terms of information (Büyüköztürk et al., 2015). In this study, primary school teachers who have taught science courses in the distance education process have been selected to be rich in knowledge and to obtain various data due to their experiences.

Information about the primary school teachers who constitute the sample of the research is presented in Table 1.

Table 1. Information on Primary School Teachers Who is Participants of the Study

Participants	Gender	Service time	Educational status
T1	Female	18 Years	Bachelor's degree
T2	Male	25 Years	Bachelor's degree
T3	Male	20 Years	Bachelor's degree
T4	Male	18 Years	Bachelor's degree
T5	Female	25 Years	Bachelor's degree
T6	Female	25 Years	Master
T7	Male	26 Years	Bachelor's degree
T8	Female	10 Years	Bachelor's degree
T9	Female	8 Years	Bachelor's degree
T10	Female	14 Years	Bachelor's degree

As it can be seen in Table 1, the participants of the research consist of a total of ten primary school teachers, six female (60%) and four male (40%). The service period of these teachers varies, with a minimum of eight years and a maximum of twenty six years. It is also seen that only one teacher has a master's degree.

Data Collection Tools

In order to collect data in line with the purpose of the research, semi-structured interviews were conducted with the primary school teachers who teach science courses in the distance education process. Semi-structured interviews provide detailed information on the subject based on the statements of the interviewee (Büyüköztürk et al., 2015).

The researcher prepared the semi-structured interview form developed for the research by taking the opinions of an information technologies teacher conducting a doctoral study on distance education. Initially, 24 questions were included in this semi-structured interview form, and expert opinions were received. These experts consist of academicians who carry out studies on science teaching (n=6) and who carry out studies on distance education in the Department of Computer Education and Instructional Technologies (n=1). Experts' opinions on the questions in the semi-structured interview form were tested for reliability, and this process is explained in detail under the title "Validity and Reliability Measures". Thus, the semi-structured interview form was given its final form.

In order to prevent data loss in the semi-structured interviews, notes were kept for the answers given by the primary school teachers, and the interviews were audio recorded with the approval of the primary school teachers interviewed.

Data Analysis

Content analysis was used to analyze the data obtained in this research, which was carried out within the scope of qualitative research methods. Content analysis is defined as a technique in which the coding carried out based on some rules is summarized with smaller categories (Büyüköztürk et al., 2015). This process progressed as suggested by Yıldırım and Şimşek (2013) as coding the data, finding the themes, organizing the codes and themes, defining and interpreting the findings.

First, the audio recordings recorded during the interviews were turned into written documents. The data, which were turned into written documents, were examined, the researcher made coding, and then themes were created. In addition, in some cases, where necessary, the codes are divided into sub-codes. The themes created are presented in Figure 1 as a whole. In addition, to enable the reader to see the generated themes, codes, and sub-codes schematically, these are presented visually under the related sub-problem title, and the frequency values of the code/sub-codes are included in these visuals.

Validity and Reliability Measures

In order to ensure the validity and reliability of the research, expert opinions on the semi-structured interview form were taken. The opinions of the experts regarding the questions in the semi-structured interview form were tested for reliability by using the formula "[Consensus/[Agreement + Disagreement]]X100" developed by Miles and Huberman (1994). If the reliability calculations are over 70%, it is accepted that the research questions are reliable (Miles & Huberman, 1994). Accordingly, it was decided to exclude interview questions with a value below 70% from the semi-structured interview form. As the reliability percentages of the remaining questions were more than 70%, it was determined that the questions within the scope of the research were appropriate.

For the reliability of the research, detailed information was given about the participants who formed the data source. In addition, the reliability of the research was tried to be increased by explaining the preparation stage of the semi-structured interview form, which is the data collection tool, and the data collection and analysis process in detail. Bilgin (2014) emphasized that the same data set can be recorded by the same encoder at different times for the reliability of content analysis. In this study, after the data were organized according to codes and themes, the researcher recoded the data set four weeks later. Thus, the percentage of reliability

was calculated by comparing the coding similarities and differences of the same data set. In order to ensure the reliability of the research, this percentage should be at least 70% (Yıldırım & Şimşek, 2013). In this study, it was determined that there was 95% agreement between the coding made by the researcher in different time periods. In addition, opinions were received from two experts, one of whom is an academician and one a teacher, who are Ph.D. students in the field of computer and instructional technologies regarding coding, and it was determined that there was 96% agreement.

In addition, the validity was increased by explaining the reason for choosing the research method, specifying the participant selection method, and using purposive sampling. Interviews, to increase the validity of the research, were conducted face-to-face during the data collection process. In addition, during the research process, the data obtained from the participants were confirmed by the participants. Finally, including direct quotations from the individuals interviewed within the scope of the research is another measure taken for the validity of the research (Başkale, 2016; Baltacı, 2019 Tutar, 2022).

Research Ethics

In order to carry out the research, necessary permissions were obtained from the Social and Human Sciences Scientific Research and Publication Ethics Committee of Kafkas University. Following the approval of the ethics committee, the necessary official permissions were obtained.

FINDINGS

In this section, the answers given by the primary school teachers to the questions asked to examine the experiences of the primary school teachers regarding the teaching of science in the distance education process are presented by dividing them into themes, codes and sub-codes. The view of the themes created as a whole is presented in Figure 1.

Figure 1. Themes created through teacher expressions

As seen in Figure 1, during distance education, expressions of teachers about science teaching consist of "strategy-method-technical", "comparison", "need for repetition", "measures for distance education", "experiences on instructional technology in distance education" and "content development experiences" themes.

Findings on "Strategies Methods and Techniques"

In order to obtain detailed information about the strategies-methods and techniques used by the teachers in the teaching of science in the distance education process, the answers given by the teachers to the questions asked were examined and coded as presented in Figure 2.

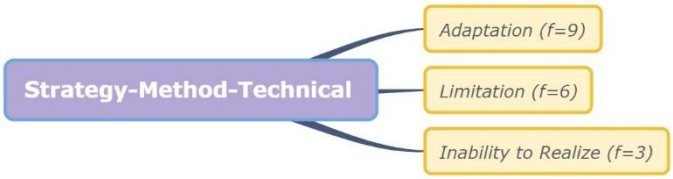

Figure 2 Coding distributions of strategy-method-technical

As seen in Figure 2, the strategy-method-technical theme consists of "adaptation" (*f*=9), "limitation" (*f*=6) and "inability to realize" (*f*=3) codes. The teacher statements of the codes are given below:

> "*In face-to-face education, I make use of the experimental method, question-answer and lecture method. I applied these methods as homework in distance education. The students made the experiments themselves and sent them by taking videos. .... The experiments were carried out at home in the form of homework. I used to give students assignments to experiment. At this point, I was collaborating with the parents. The experiments done by the students were videotaped and sent to me*" (T1) (Adaptation).
> "*Experiments could also be done. .... But we did the experiments that we could do. We didn't do the experiments that we had to use fire, stove. But in the home environment, we prepared and did the experiments that they could do. .... But what we can do. Like a magnet, for example*" (T5) (Limitation).

> "*In face-to-face education, I use the experiment method and demonstration methods in teaching science lessons. I mostly benefit from observational learning through smart boards and textbooks. .... We could not use most of them in distance education. For example, we could not use methods such as experimentation and demonstration. We had to include studies that were mostly done by watching over the internet. .... I couldn't use the experiment method. The students did not experiment, they watched the experiments done on the internet*" (T9) (Inability to realize).

Considering the teacher statements examined under the strategy-method-technical theme, it can be deduced that the majority of the teachers benefited from the strategy-methods and techniques they used in face-to-face education by making some adaptations in the distance education process. When T1's statement is examined, it is seen that parent support is important in this process. The statements made by T3 also support this. This statement is as follows:

> "*I use experiment and question-answer methods in face-to-face education. We were able to use these method techniques in distance education as well. The children were doing experiments with their families or we were giving them as homework, they were doing it as homework*" (T3).

In the distance education process, it was stated by some teachers that the strategy methods and techniques used in the face-to-face education process for science lesson teaching could not be used. One of them is experiments, which are essential in science teaching. When the teacher's statement presented (T9) is examined, it is seen that the students themselves cannot do experiments in distance education; instead, experiment videos in online environments are used. This situation was also emphasized by T2. This statement is as follows "*We couldn't do the experiments, but we tried to animate them with video and other kinds of visual materials*" (T2).
It is also seen that there are some limitations in the use of the strategy methods and techniques used in addition to the adaptation and inability to realize cases.

Findings on "Comparison"

The answers given by teachers were examined and coded in order to determine the comparisons between distance education and face-to-face education in terms of concretizing soft information and associating subjects with daily life, permanent learning, students' interest and motivation towards the lesson. Information about this coding is presented in Figure 3.

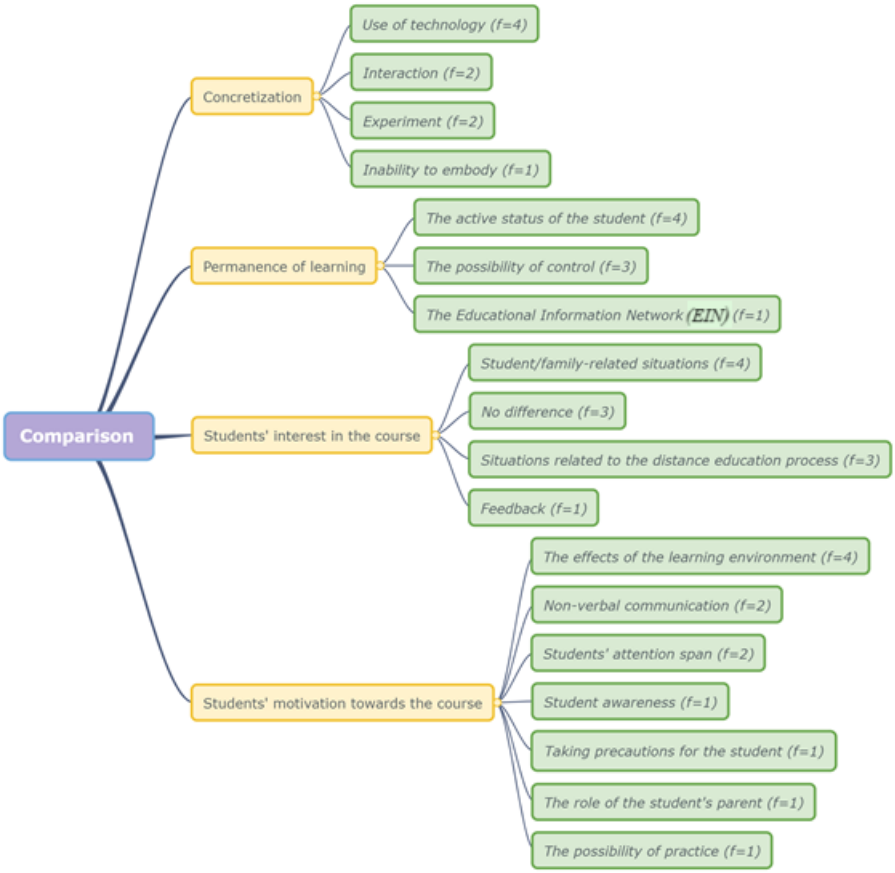

Figure 3. Coding distributions for the comparison theme

As seen in Figure 3, the theme of comparison consists of codes of "concretization", "permanence of learning", "students' interest in the course" and "students' motivation towards the course". In addition, the concretization code consists of the sub-codes of "the use of technology" (*f*=4), "interaction" (*f*=2), "experiment" (*f*=2) and "inability to embody" (*f*=1). The code of permanence of learning consists of the sub-codes of "the active status of the student" (*f*=4), "the possibility of control" (*f*=3) and "the Educational Information Network (EIN)" (*f*=1). The code of students' interest in the course consists of "student/family-related situations" (*f*=4), "no difference" (*f*=3), "situations related to the distance education process" (*f*=3) and "feedback" (*f*=1) sub-codes. The code of students' motivation towards the course consists of "the effects of the learning environment" (*f*=4), "non-verbal communication" (*f*=2), "students' attention span" (*f*=2), "student awareness" (*f*=1), "taking precautions for the student" (*f*=1), "the role of the student's parent" (*f*=1), and "the possibility of practice" (*f*=1) sub-codes.

The statements of the teachers regarding the sub-codes of the concretization code are given below.

> "*I had no difficulty in concretizing the information in distance education. The situations that we had difficulty in concretizing in the child's mind were embodied in a better way by reflecting on the children's screen with videos on the internet and other kinds of audio/visual works. Distance education provided us more convenience in concretization. .... For example, while I was describing the phases of the moon in face-to-face education, no matter how much I drew on the board, I could not embody it in the child's mind. But when you download a video in distance education, it shows the world beautifully in that video, shows the moon around it, and embodies them very well. The information that we have difficulty in drawing by hand embodies it very well with that video. As I mentioned, I had no difficulty in presenting the subject with videos and other visual documents*" (T2) (Use of technology).

The sample teacher expression for the interaction sub-code is as follows: "*Face-to-face training was more advantageous in concretizing information. As there is more interaction between the students and the teacher, the exchange of ideas also increases*" (T1).

> "*In distance education, the fact that the children were at home gave them the opportunity to try out the knowledge they had acquired. For example, when the student asked "Does the towel absorb water?", we could say "Run immediately, get a towel, bring a glass of water and try". In other words, children could immediately try the things they were curious about at that moment. Of course, there were some advantages in distance education as well*" (T5) (Experiment).

> "*Since sufficient concretization could not be made, knowledge remained again as abstract in distance education. Because concretization means that the child sees, touches, and feels it. Even if it is an experiment, students have to do it individually themselves*" (T9) (Inability to embody).

Considering the frequency distributions of the sub-codes of the concretization code, it is seen that the teachers mainly benefit from the possibilities of technology to ensure the concretization of the concepts in the distance education process. When the statement presented by T2 is examined, it is seen that the drawings made by the teacher in face-to-face education are insufficient to concretize, but the videos offer this opportunity better. It is seen that this result is supported by another teacher's statement presented below.

> "*I was making use of these videos by examining the videos prepared on the subject that I will be covering during the distance education process. Abstract concepts such as the shape of our world, its layers, the formation of day and night, these remain abstract for children and cannot be understood. But I found videos while explaining these issues in distance education. There were some very good videos. Through these videos, children were enabled to observe the information and it became easier for them to grasp this information. .... We benefited from the opportunities of technology in distance education*" (T6).

The expressions of the teachers belonging to the sub-codes examined under the code of permanence of learning are given below.

> "*Face-to-face training is more advantageous in terms of permanence. …. When we do the experiments together in the classroom, the children never forget him. In other words, they do not forget because they learned by doing and living together. .... Face-to-face training is definitely better. .... The child should take magnet in his hand, and be able to try it by holding it everywhere. In distance education, those who had magnets at home made the prepared teaching activity, but the others only looked from afar. The opportunity for trial and error was plentiful in face-to-face education*" (T5) (The active status of the student).

> "*Face-to-face training was more effective in terms of permanence of information. Because we could get immediate feedback. It was easy for us to control the student. Incorrect or incomplete information could be corrected in face-to-face training. Students who do not listen to the lesson can be provided to listen to the lesson. But in distance education, the child is looking at you, but you cannot control whether he is listening to you or not. Also, if the students' cameras were off, it was being even harder to control them*" (T10) (The possibility of control).

The teacher's statement regarding the EIN sub-code is as follows: "*There was no problem in distance education regarding the permanence of information. Because thanks to EIN, the information has been concretized. That's why I don't think there is a difference between face-to-face education and distance education*" (T1).
The examination of expressions of the teachers in the permanence of the learning code reveals that the highest frequency belongs to the "The active status of the student" sub-code. When we look at the teacher's statement belonging to this sub-code, it is seen that face-to-face education is thought to be more advantageous than distance education in terms of the permanence of learning. The reason for this situation is that students are thought to be more active in face-to-face education. This is also supported by the statements of T3 and T7 given, respectively. "*Of course, I prefer face-to-face training in terms of permanence. .... Teachers are constantly telling during the distance education process. The child cannot get involved*" and "*Face-to-face training is more advantageous. Because the child is involved. Students ask, question, try and can object*".

The statements of the teachers belonging to the sub-codes examined in the code of students' interest in the course are given below.

> "*In distance education, the students who are interested in the course are more active and their motivation is higher. However, we can reach passive students in face-to-face education. Face-to-face education is more effective in reaching students who do not receive support from their families. In distance education, these are broken. In other words, the situation changed from student to student*" (T1) (Student/family-related situations).

An example expression for the no difference sub-code is as follows: "*There was no difference in their interests*" (T6).

> "*Face-to-face training is more advantageous. .... Students participating in the online course were enthusiastic in distance education as in face-to-face education, but after a certain time they got bored. It was boring for them to look at the screen all the time, not being able to touch the teacher, not being able to come near him, and not being able to ask questions*" (T5) (Situations related to the distance education process).

The teacher's expression for feedback, the last sub-code examined within the same code, is as follows: "*Students are more interested in face-to-face education. Because the student can get feedback from us. It is sometimes very difficult to get feedback from the teacher in distance education*" (T9).

Accordingly, it can be said that the "student/family related situations" sub-code has the highest frequency value within the code of students' interest in the course. The expression of the teacher examined in this sub-code reveals the characteristics of the students are taken into account, and accordingly, face-to-face education is considered more advantageous in terms of interest in the lesson.

Another comparison that teachers made between distance education and face-to-face education was about students' motivation towards science lesson. The teacher's statements regarding the sub-codes examined in the code of students' motivation towards the course are given below.

> "*Face-to-face education is definitely more advantageous in terms of students' motivation for the science course. Because we have a chance to control, it is more possible for students to socialize in the classroom environment, share information with their friends and peers, create a competitive environment, and express themselves in understanding or presenting the lesson in face-to-face education*" (T2) (The effect of the learning environment).

An example of a teacher expression related to the non-verbal communication sub-code is as follows: "*Face-to-face education is more advantageous in terms of students' motivation for science lessons. Because nonverbal communication is also important to ensure student motivation, and this aspect of nonverbal communication can be effectively utilized in face-to-face education*" (T1).

> "*Face-to-face education is definitely more advantageous in terms of students' motivation for the science course. .... In distance education, it is seen that students are interested in different things after 5 minutes. .... Even in face-to-face education, their attention span is 10 minutes. After 10 minutes, you need to do a different activity*" (T2) (Students' attention spans).

> "*Face-to-face education is definitely more advantageous in terms of students' motivation for the science course. .... Especially primary school children are not like high school students. Students in high school may be more aware. He may say, 'I will take an exam and I need to pay attention to the lessons in order to be successful'. But primary school children do not have such concerns. Whatever the child likes and finds fun at that moment, he turns to it. This is because of the nature of children*" (T2) (Student's awareness).

The teacher's explanation regarding the sub-code of taking precautions for students is as follows: "*In face-to-face education, we can identify children with low motivation and take precautions. However, we can miss even the successful children in distance education*" (T2).

> "*At the beginning of the distance education process, I held a meeting with parents via Zoom. From the beginning, I explained to the parents what the education would be like and what would be required. I haven't had any problems after that. Because parents also motivated their students*" (T4) (The role of the student's parent).
> "*In face-to-face education, children were involved in education. While all children in the classroom had the chance to practice, students who had materials in distance education were able to practice. This negatively affected the motivation of some students in distance education*" (T8) (The possibility of practice).

When teacher statements are examined, it is seen that face-to-face education is thought to be more effective on students' motivation for the lesson.

Findings on "Need for Repetition"

The answers given by the teachers to the questions were examined and coded in order to determine the opinions of the teachers about whether the science teaching reached the expected goal in the distance education process. Information on the coding performed is given in Figure 4.

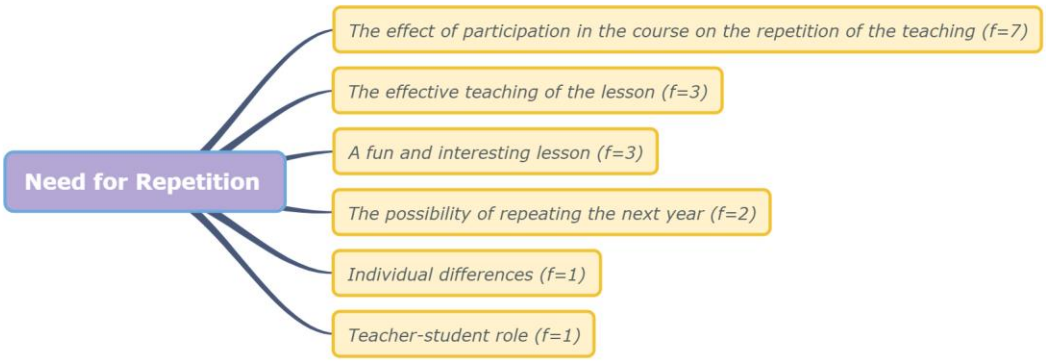

Figure 4. Coding distributions for the theme of need for repetition

As seen in Figure 4, the theme of need for repetition consists of "the effect of participation in the course on the repetition of the teaching" (*f*=7), "the efficient teaching of the lesson" (*f*=3), "a fun and interesting lesson" (*f*=3), "the possibility of repeating the

next year" (*f*=2), "individual differences" (*f*=1), "teacher-student role" (*f*=1) codes. The expressions of the teachers belonging to these codes are given. "*For the students who do not attend the course in distance education, it may be necessary to repeat the science course topics, but it is not necessary for the students who attend the course*" (T8) (The effect of participation in the course on the repetition of the teaching). Moreover, "*There was no difference between face-to-face and distance education as it was efficient. Therefore, I do not think that the subjects taught in distance education should be repeated when face-to-face education is introduced*" (T8) (The effective teaching of the lesson).

> "*There was also a need for repetition for the participating students. Because it has been forgotten. Even though it seems like students participated in distance education, there were people who were dealing with other things in the background. These students turned the camera off the microphone and did different things with the background. He's not actually listening. When you are not face to face, you cannot see what the student is doing. .... We cannot say that distance education has achieved many of its goals*" (T9) (The effective teaching of the lesson).

> "*But in my own opinion, my students enjoyed the science class. Because it was the subjects that caught their attention. When we made these fun, the students also enjoyed it. Sometimes they took the pleasure they couldn't get from math class in science class. Because mathematics is a slightly heavier subject, boring and difficult, but science attracted their attention and enjoyed it because it was their own life. Students who did not speak or attend the lesson in the mathematics lesson or the Turkish lesson, attended the lesson in the science lesson. Because there were subjects they could encounter in their daily lives*" (T4) (A fun and interesting lesson).
> "*When we look at the curriculum, some of the science subjects are taught in the 5th grade. Although not every subject, the repetition of these subjects is taught in a more expanded way in the 5th grade. .... But if the subjects were not repeated in the 5th grade, of course, the lessons would have to be repeated after distance education*" (T4) (The possibility of repeating the next year).

The teacher's statement on the individual differences sub-code is as follows: "*It should have been repeated. Because the children's learning styles are very different from each other. Some learn by seeing, some learn by hearing. Since there are individual differences, I think it should be to be repeated, but quickly*" (T3).

> "*Of course it must be repeated. .... In distance education, you are in the role of the constant narrator, it was easier to forget because the student's participation was lower and not active. It was necessary to go back and repeat the topics*" (T7) (Teacher-student role).

When the frequency distributions of the codes in the related theme are examined, it is seen that the code "The effect of participation in the course on the repetition of the teaching" contains the most expressions. As a result of this point of view, it can be interpreted that participation in the course is considered important by the teachers in achieving the purpose of teaching in the distance education process.

Findings on "Measures for Distance Education"

The answers given to the questions were examined and coded in order to determine what kind of measures teachers take during the distance education process in order to realize permanent learning, to attract students' interest in their lessons and to increase their motivation. Information about this coding is given in Figure 5.

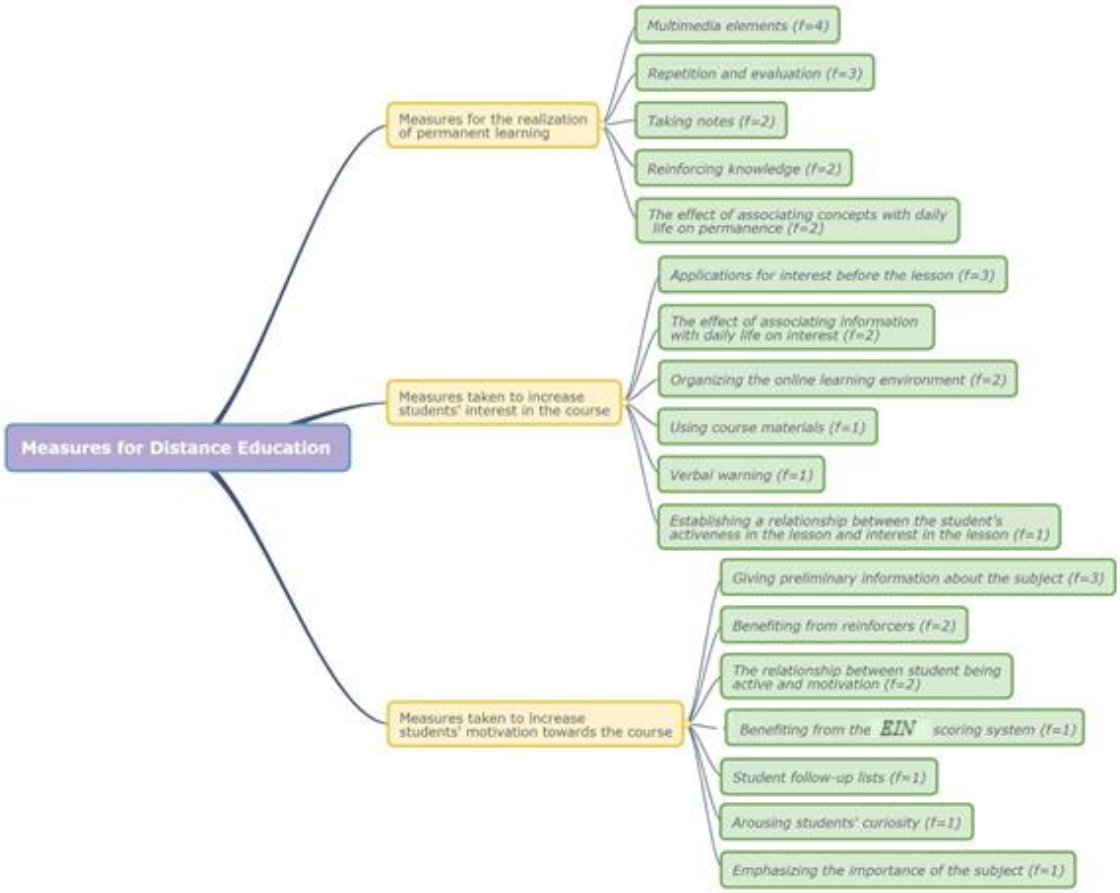

Figure 5. Coding distributions for the theme of measures for distance education

As seen in Figure 5, the theme of measures for distance education consists of the codes of "measures for the realization of permanent learning", "measures taken to increase students' interest in the course", and "measures taken to increase students' motivation towards the course". In addition, the code of measures for the realization of permanent learning consists of sub-codes of "multimedia elements" (*f*=4), "repetition and evaluation" (*f*=3), "taking notes" (*f*=2), "reinforcing knowledge" (*f*=2) and "the effect of associating concepts with daily life on permanence" (*f*=2). The code of measures taken to increase students' interest in the course consists of sub-codes of "applications for interest before the lesson" (*f*=3), "the effect of associating information with daily life on interest" (*f*=2), "organizing the online learning environment" (*f*=2), "using course materials" (*f*=1), "verbal warning" (*f*=1), and "establishing a relationship between the student's activeness in the lesson and interest in the lesson" (*f*=1). The code of measures taken to increase students' motivation towards the course consists of sub-codes of "giving preliminary information about the subject" (*f*=3), "benefiting from reinforcers" (*f*=2), "the relationship between student being active and motivation" (*f*=2), "benefiting from the EIN scoring system" (*f*=1), "student follow-up lists" (*f*=1), "arousing students' curiosity" (*f*=1) and "emphasizing the importance of the subject" (*f*=1).

An example of expressions related to multimedia elements sub-code in code of measures for the realization of permanent learning is as follows:

> "*In distance education, I made the children watch the videos on the EIN regarding the explained subject. Then we talked about these videos. .... In this way, we ensure that the information is permanent. Because the child does not forget when he sees it*" (T5).

Examples of expressions examined in sub-codes repetition and evaluation, taking notes, reinforcing knowledge and the effect of associating concepts with daily life on permanence are as follows, respectively:

> "*We made continuous repetitions, made continuous evaluations. We did one each week. We have renewed the missing topics again. .... We tried to see the deficiencies by doing an exam once a month. Deficiencies were constantly checked*" (T7), "*I sent them too many lecture notes. I asked them to write it in the notebook. Because I think that what they read and write is more permanent*" (T10), "*I tried to reinforce the topics described with experiments and various activities*" (T8) and "*I asked the students to give examples from their own lives. In this way, we ensure that it is permanent. .... When we associate it with daily life, it never forgets*" (T5).

When the frequency values of the sub-codes examined within the scope of the "measures for the realization of permanent learning" code are examined, it is seen that the value of the multimedia elements sub-code is the highest.

The statements of the teachers regarding the sub-codes included in the code of measures taken to increase students' interest in the course are given below.

> "*Before starting the teaching, I tried to attract the attention of the students by reflecting pictures about whatever the subject was related to, and watching videos during the pre-learning stage of the subject. In addition, I tried to attract the attention of the students by asking funny/witty riddles, if any. All of this was done to get their attention before they started explaining the issue*" (T9) (Applications for interest before the lesson).
> "*For example, let's say you are dealing with the subject of the World. First of all, after explaining to the children that we are also a part of this world, that we live in this nature and that you are a part of science, that the subject is not far from us, we actually live within the subject, we move on to the application part. In order to attract the child's attention, the child must realize that the subject is related to daily life. .... When it is associated with daily life, the child becomes more excited and curious*" (T2) (The effect of associating information with daily life on interest).

The example of the expression examined in the organizing the online learning environment sub-code is as follows: "*I enabled them to use the screen comfortably*" (T7).

> "*I was using different objects during the lesson. For example, I was lighting the lamp and asking the children questions about it. While describing electrical circuits, I was showing the battery and showing materials like this and getting their attention. I was showing materials on the topic. .... I was trying to get students' attention to the lesson with things like this*" (T3) (Using course materials).
> "*Since the science lesson had subjects from the daily life of the children and attracting attention, distraction was less than the other lessons. But if student got distracted, we were warning the student to get his attention again. I was attracting the attention of the students with warnings such as 'Look at me', 'Look at the board', 'Look at the question'. There was little distraction in this regard anyway, and we were trying to prevent this by warning*" (T4) (Verbal warning).

The expression "During the lesson, it was tried to ensure that the students learn by doing and living" (T8) is included in sub-code establishing a relationship between the student's activeness in the lesson and interest in the lesson.

It has been determined that the sub-code of "applications for interest before the lesson", which is evaluated within the code of "measures taken to ıncrease students' ınterest in the course", has the highest frequency value. In addition, it has been determined that teachers associate information with daily life and make some arrangements in online environments in order to increase their interest in the lesson in distance education.
The statements of the teachers regarding the sub-codes examined under the code "measures taken to increase students' motivation for the course" are given. "*I was informing beforehand by saying 'Our subject in science will be the properties of substances'. Giving information about what new things they would learn, motivated the students*" (T5) (Giving preliminary information about the subject).

> "*To motivate, I would applaud the student along with the other students. Apart from that, I was telling his parents to buy a gift for the student. .... For example, the children liked to open their camera, I would open their cameras and say "what would you like to say to your friends". Something like that. Saying "well done, you're very good" motivated them anyway. Unfortunately, we couldn't do anything else*" (T3) (Benefiting from reinforcers).
> "*I planned experiments that could be done by students to increase their motivation. For example, I say, 'Put water in a plastic or cardboard glass and put it in the freezer. Check it from time to time and see what happens'. The student does this and comes and says, 'Teacher, I did it and the water froze in the freezer, it became ice'. Then I said again, 'Take the ice out and put it on the counter. Check it from time to time'. The child does this and gives information. Then I say, 'What was the difference between the two situations?'. The child says, 'Teacher, freezer was cold, but the kitchen is warm'. In this way, I want the student to find the temperature difference himself. An activity in which they are involved motivates them more. Also, the idea of 'I am doing something' develops. If you do the activities instead of them, half of the students will listen and the other half will not, so it doesn't make any sense. But when they do it themselves, they get jobs and duties and take responsibility*" (T6) (The relationship between student being active and motivation).

The expression examined in the benefiting from the EIN scoring system sub-code is "*The scoring system available in EIN increased their motivation. As homework was done, as videos were watched, as they participated in activities, the students were getting points. This had a positive effect on the students' motivation*" (T1). In addition to that the expression examined within the student follow-up lists sub-code is "*I had prepared +/- lists, students were aware of these lists, and the results of these lists were shared with the students' parents. I think that these situations increase student motivation*" (T1).

> "*One of the methods I use most to increase the motivation of students is to arouse their curiosity. 'Guys, we are going to talk about a very important issue with you today. We will talk about a subject that helps us in our nutrition, energy and protection from diseases'. I said, arousing curiosity in the students. Children have a curiosity. They*

wonder what plants do to protect us from diseases. It's the same when talking about animal foods. Because, as the proverb says, 'A person's interest is his motivation'" (T2) (Arousing students' curiosity).

"*In order to increase their motivation, I explain what the information obtained is useful for us. .... I tried to increase their motivation by talking about situations where this knowledge can be used in daily life*" (T9) (Emphasizing the importance of the subject).

It was determined that the "giving preliminary information about the subject" sub-code had the highest frequency among the sub-codes examined within the code of "measures taken to increase students' motivation towards the course." When the statements of other teachers are examined, it is seen that online environments are used in this process. Examples of these teachers' statements are given: "*I used to download videos on the subject appropriate to their level from YouTube and then send them to the students. Thus, I enabled the students to come with preliminary preparations*" (T7) and "*I used Zoom and EIN to increase their motivation before the subject*" (T9).

Findings on "Experiences on Instructional Technologies in Distance Education"

In order to obtain information about the teachers' experiences with instructional technologies in the distance education process, their answers were examined and coded in line with the answers given. The coding of the related theme is given in Figure 6.

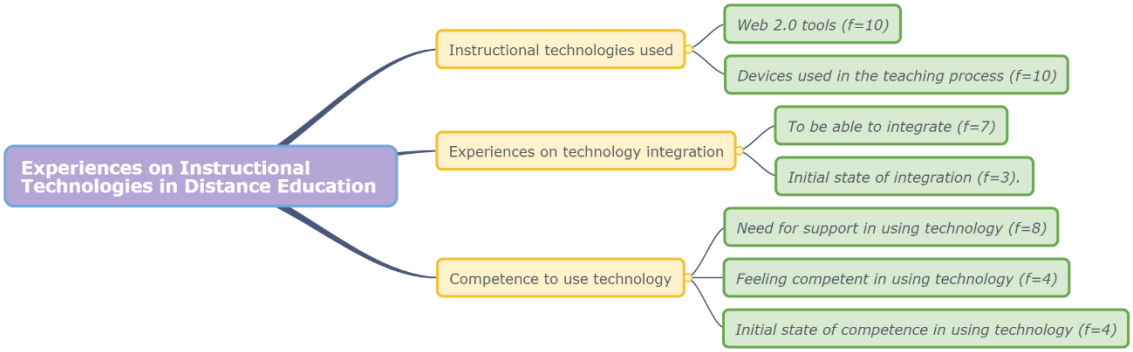

Figure 6. Coding distributions for the theme of experiences on instructional technologies in distance education

As can be seen in Figure 6, the theme of "experiences on instructional technologies in distance education" consists of the codes of "instructional technologies used", "experiences on technology integration", and "competence to use technology". The "instructional technologies used" code consists of the sub-codes "Web 2.0 tools" (*f*=10) and "devices used in the teaching process" (*f*=10). The "experiences on technology integration" code consists of the sub-codes "to be able to integrate" (*f*=7) and "initial state of integration" (*f*=3). The code of "competence to use technology" consists of sub-codes of "need for support in using technology" (*f*=8), "feeling competent in using technology" (*f*=4) and "initial state of competence in using technology" (*f*=4).

The expression for the Web 2.0 tools sub-code in the instructional technologies code used is as follows: "*I benefited from MorpaKampüs, Okulistik and EIN in distance education. I used MorpaKampüs the most. I am using it even now*" (T3). The expression examined within the devices used in the teaching process sub-code is "*I used the computer more. The telephone did not work very well in information mirroring, video mirroring, image mirroring. The computer was more convenient*" (T9).

The examination of expressions of the teachers about the Web 2.0 tools they used during the distance education process shows that EIN comes to the fore. In addition to different Web 2.0 tools, it was determined that all teachers mentioned EIN. This situation was expressed by a different teacher as follows: "*I benefited from EIN. I did not use any other platform other than EIN. The content of EIN was very good. I used it effectively in science and other lessons*" (T4). According to analysis from the above statement about the devices used claims that the phones do not offer enough opportunities in this process. This statement was supported by T6 as follows:

"*I definitely needed a computer a lot. Because I had problems with my computer a few times, I had more difficulty in doing lessons on the phone. The screen is small on the phone, I cannot see the children properly, I cannot share the page, so I did not get much efficiency from the phone. The children were not very productive either. The student, who was connected to the lesson by phone, said, 'Teacher, I can't see the page'. I don't think even a tablet is enough. It must be a computer with a big screen.*"

The statements of the teachers regarding the sub-codes examined within the code of "experiences on technology integration" are as follow: "*Yes, I think I have provided the technology integration. Because I always try to benefit from technology in order for students to grasp the information correctly and to ensure permanence*" (T8) (To be able to integrate) and "*Technology integration was difficult at the beginning*" (T1) (The initial state of integration).

When the experiences of teachers regarding technology integration in the distance education process are examined, it is seen that most of them (*f*=7) think that they provide technology integration. Considering the expression presented above; the teacher states that she constantly benefits from technology. This situation was supported by T10 as follows: "*I was able to provide. I was already using it before. It was not a problem for me, but there were many teachers who could not use it*". T5 explained the situation of the students regarding integration as follows: "*I was able to use it effectively, but some of my students could. 70% of students could use it*". It is seen that a small number of teachers (*f*=3) mentioned the initial state of integration and at the beginning the difficulty of integration was mentioned.

Examples of teacher statements examined within the scope of the sub-codes of the "competence to use technology" code are given: "*There was no one at school that I could get support from. I mostly asked those who are dealing with computer work outside of school. Because we don't have an information technology teacher anyway*" (T7) (Feeling competent in using technology), "*At first, I didn't feel very competent. Because we encountered distance education for the first time. We had difficulties in sharing videos, sharing images, starting and ending lessons*" (T9) (Initial state of competence in using technology) and;

> "*I was fine with technology, no problem. But it was difficult to explain to the parents. The seminar was given, but it was too late. I learned about Zoom, but the parents had problems. You know, but the parent does not know*" (T10) (Feeling competent in using technology).

Findings on "Content Development Experiences"

The answers given by the primary school teachers were examined and coded in order to determine whether they developed content within the scope of science course in the distance education process. The coding of the related theme is given in Figure 7.

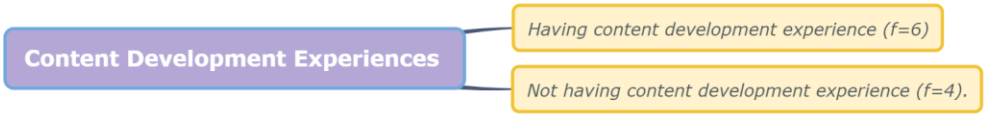

Figure 7. Coding distributions for content development experiences theme

As seen in Figure 7, the theme of "content development experiences" consists of "having content development experience" (*f*=6) and "not having content development experience" (*f*=4). Teacher statements regarding these codes are given below.

> "*Yes, I prepared lecture notes. In order not to waste time, students did not take notes in the lesson. I was preparing the notes on the subject and sending them to the parents via WhatsApp after the lesson*" (T8) (Having experience in content development).

> "*Unfortunately, I've never done anything like that. In fact, sometimes I get so angry with myself when I watch certain videos. Because I did better activities in these videos in class. I made it with more care. For example, we prepare different ones in the classroom, even as unit assessments. But I guess we're just being a little lazy*" (T6) (Having no content development experience).

Analyzing the data belonging to the "content development experiences" theme, it can be concluded that the majority (*f*=6) have content development experience. Moreover, the statement given above regarding the "have content development experience" code, the following statements can also be included: "*I prepared slides, lecture notes. It took time because we were not practical and we had difficulties at times*" (T1) and "*I was preparing notes for students*" (T10). When these statements are examined, it is seen that the contents developed by the teachers are limited to the lecture notes.

DISCUSSION & CONCLUSION

In this study, which was carried out based on teacher opinions, the experiences of primary school teachers in teaching science lessons in the distance education process were examined in detail. Considering the research's purpose, the answers to the questions asked to the teachers were analyzed, and various results were obtained.

When the methods used by teachers for teaching science lessons during the distance education process are examined, it has been determined that adaptations have been made for the application of these methods in the distance education process. This result is similar to a different research finding that determined that similar or identical methods used in face-to-face education were preferred in the distance education process (Duman, 2020). It has been determined that experiment, question-answer, and lecture method, which are among the most frequently used methods and techniques by teachers within the scope of science lessons in face-to-face education, are also frequently preferred in the distance education process. However, it has been discovered that teaching based on demonstration and game-based learning, which is rarely used by teachers in face-to-face education, has never been realized in the distance education process. Furthermore, the study has concluded that the experimental method, frequently preferred in science lesson teaching, is mostly carried out by teachers by adapting it according to the distance education process. Thus, it can be said that teachers make an effort to ensure that students are as active as possible in the learning-teaching process. However, despite these,

the activity of the student is partially provided in face-to-face education, and teacher-centered methods come to the fore in the distance education process. In the research conducted by Arslan and Görgülü Arı (2021) it was determined that science teachers thought that teachers were active, but students were passive in the distance education process. In addition to that, similar findings were reached, and it was determined that students were more passive in the distance education process conducted in another study by Balaman and Hanbay-Tiryaki (2021). Based on the results of this research, it can be concluded that teachers should be encouraged to use different teaching methods and techniques that will enable students to be active both in face-to-face and distance education. On the other hand, it was determined that the primary school teachers thought that the science course subjects taught in the distance education process should be repeated, taking into account the individual differences among the students, the students who do not attend the lessons, and the passiveness of the students in the teaching process. Besides, there is also the opinion that the related course topics should be repeated since the teaching of science courses in the distance education process cannot be carried out efficiently. Considering that there may be learning losses in the distance education process can support this requirement (Aydın Ceran & Ergül, 2022). Nevertheless, creating hybrid learning environments instead of repetition can minimize these losses. Therefore, through hybrid learning environments, the advantageous aspects of distance education and face-to-face education environments can support each other (Yılmaz, 2018). However, it was stated that the teaching of science in the distance education process was carried out efficiently and there was no need for repetition. The reason for this difference of opinion can be seen as the difference between teachers' levels of integrating technology into the teaching process. Based on this, it can be assumed that the successful integration of technology in the distance education process can be a determining factor in achieving the purpose of education. Technology integration supports students' understanding, and the process is facilitated for teachers (Arslan & Şendurur, 2017; Özmen, 2017). With the integration of technology, different teaching methods and techniques can be preferred by teachers so students can be more active in the process. Also, it has been determined that primary school teachers do not consider it necessary to repeat the subjects taught in distance education when they think that science will be taught again in the 5th grade and that science teaching is more interesting and fun for students than other lessons.

As a result of the research, some teachers could not reach the desired level in embodying the soft information of the science course due to the low level of interaction in the distance education process. It was even observed that some of the teachers thought that they could not achieve concretization at all. On the contrary, the vast majority of teachers benefit from the advantage of technology, and the concretization of knowledge is well provided by technology. Thanks to technology, while teachers can easily teach abstract concepts, students can make sense of these concepts more easily (Sarı & Akbaba Altun, 2015; Büyükcengiz, 2017; Kesik & Baş, 2021; Reguera & Lopez, 2021). Technology concretizes intangible information and contributes to the students' correct structuring of this information. However, it is seen that some teachers can benefit from the advantages of technology in the teaching process, but some teachers cannot benefit from these advantages sufficiently. The differences in the level of technology integration of teachers in the teaching process can be seen as the reason for this situation. Teachers who can provide technology integration can be expected to carry the advantages of technology to the learning environment.

It has been determined that the teachers think face-to-face education is more advantageous due to the limitation of their control over the learning of their students in the distance education process and the passiveness of the students in distance education. In this process, it is seen that the teachers use EIN at the desired level to ensure the permanence of learning. The research conducted by Balaman and Hanbay-Tiryaki (2021) determined that teachers considered EIN sufficient in terms of education. Based on this result, the fact that EIN was used to ensure permanence in learning during distance education can be based on the idea that this platform is sufficient. Another study by Sarışık et al. (2021) determined that primary school teachers thought that EIN supports permanence in learning. Teachers attributed this situation to the richness of visual and auditory resources and the possibility of instant access to these resources. Considering the statements of the teachers in the research conducted by us, it was determined that EIN was used to make the concepts in the science course concrete for the students during distance education. Therefore, while teaching is supported in other courses thanks to EIN, it is seen that EIN is used to concretize the information in the science course. In other words, it can be said that while EIN is used for teaching in courses such as mathematics and Turkish, it is used to concretize information in science courses. It can be argued that meaningful learning will occur based on this concretization opportunity, and thus, learning will be permanent. It is seen that another measure taken to ensure permanence is to make students active as much as possible. Considering that students' being passive in distance education will decrease learning permanence (Dilmaç & Dilmaç, 2022), it can be thought that this measure will support permanence. In addition, project and performance studies can be included in order to ensure that students continue their learning activities outside the classroom environment and to ensure their activeness in the learning process. Thus, it will be possible for students to use the knowledge they have acquired through distance education.

When comparing face-to-face education and distance education in terms of students' motivation, it was determined that the majority of teachers thought that face-to-face education was more advantageous. As a result of the research conducted by Duman (2020), it was determined that there was a loss of motivation during the distance education process. This result reached by Duman (2020) supports teachers' evaluation of face-to-face education as more advantageous in terms of motivation. It is seen that teachers mostly attribute this situation to the differences between the learning environments of the two educations. It has been found that teachers mostly give preliminary information on the subject in order to eliminate this limitation in the distance education process. Giving preliminary information about the lesson before teaching shows that the teachers adapt the flipped classroom to the online learning environment. This precaution taken by the teachers may be effective in increasing the motivation of the students. This notion is supported by research by Ng et al (2022). In the study conducted by Ng et al. (2022), it is emphasized that online flipped classrooms can effectively motivate students. As well as the online flipped classroom, Uçar (2016) emphasized that motivational strategies can be used to minimize motivational problems in the distance education process. In addition, in the research carried out by Erdoğdu (2020), it was determined that motivational strategies increase the motivation of students. The effects of using these strategies in

the distance education process on motivation of primary school period can be examined, and their use in the teaching process can be ensured. Therefore, it can be thought that flipped classroom practices should be supported with motivation strategies in order to increase students' motivation in this process.

It has been determined that teachers generally think that they can provide technology integration in distance education. Teachers' use of technology in face-to-face teaching environments is thought to facilitate technology integration in the distance education process. Therefore, it can be argued that teachers who had difficulty integrating technology at the beginning of the distance education process did not make much use of technology in teaching environments before the distance education process because teachers' readiness, beliefs, and computer availability have a significant impact on technology integration (İnan & Lowther, 2010). Another reason for this situation may be the difference in professional seniority among teachers. The study by Çok and Günbatar (2022) determined that teachers with low professional experience have a higher tendency to use technology. In other words, as teachers' professional experience increases, there is a decrease in integrating technology into the teaching process (İnan & Lowther, 2010). In order to support these predispositions of all teachers, it is suggested by Kalemkuş and Bulut Özek (2022) that the curricula of teacher training institutions should be arranged in a way to increase the ability of educators to integrate effective information and communication technologies in learning-teaching environments. Professional development training to integrate technology into the teaching process can be provided for teachers with much professional experience. In addition, cooperation should be established with information and communication technologies teachers so that teachers can receive support for integration.

It has been demonstrated that teachers mostly need support for using technology in distance education and they refer to their colleagues, families, seminars, and informative videos on the internet for these needs. Since instructional technologies are not only used during distance education but can be used at every stage of the teaching process, their importance in educational institutions increases. The use of these technologies in the teaching process starts from the pre-school and primary school levels, not from the secondary school level. Therefore, it should be ensured that information technology teachers take part in preschool and primary school levels, not starting from the secondary school level. In this way, it will be ensured that teachers can easily access the support they need for technology, benefit from the advantages of technology not only during distance education but also at every stage of teaching, and facilitate the learning of their students. Since the distance education process involves students and parents as well as the teacher, it shows that technology competence for teaching is not limited to the teacher alone and that the competence of the student-parent is also essential (Martínez-Hernández, 2022). Therefore, for distance education applications to reach their teaching purpose, students and parents should also easily reach the support they need.

In the distance education process, it has been determined that teachers mostly prepare content for lecture notes and deliver this content to their students via WhatsApp. Based on this, it has been determined that teachers tend to prepare traditional printed content and do not transfer the content they have prepared to EIN. Eser (2020), in his research, examined the self-efficacy beliefs of pre-service teachers towards Web 2.0 rapid content development and determined that they had moderate self-efficacy beliefs. In the research conducted by Polat (2014), it was determined that teacher candidates experience anxiety during the content development process. The reason for experiencing anxiety in the process may be pre-service teachers' low content development skills and the negative impact on their self-efficacy perceptions as a result. This situation necessitates the participation of teacher candidates and teachers in various training programs on content preparation.

The research is limited to the opinions of primary school teachers who taught science through distance education during the pandemic. In addition, the opinions of teachers, students, and parents regarding the teaching of other courses during the distance education process can be examined. In addition, by examining the effects of different teaching methods on students in distance education, the methods that come to the fore during distance education can be determined.

STATEMENTS of PUBLICATION ETHICS: I declare that the study has no unethical problems and ethics committee approval (approval date: 20.10.2021/23-10) was obtained from the Social and Human Sciences Scientific Research and Publication Ethics Committee of Kafkas University.

CONFLICT of INTEREST: The author declares that there is no conflict of interest.

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