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Disadvantaged Students in the Distance Education: An Analysis Specific to Science Lesson

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ABSTRACT

In this study, it was aimed to reveal the situation of disadvantaged students in the science lesson of the COVID-19 pandemic distance education period in Turkey. For this purpose, the experiences of science and primary school teachers in distance education were examined. The research was a case study, which is one of the qualitative research methods. Participants comprised 58 science and primary school teachers. The data collected via a semi-structured interview form was subjected to content analysis. The results show that the disadvantaged groups most affected by distance education are poor students, inclusive students, students without parental care, gifted students, and immigrant students. Teachers stated that disadvantaged students have experienced deep learning losses in science, their interest in science has decreased, and multiple disadvantages have made science teaching difficult. Also, it has been concluded that in science teaching with disadvantaged students, teachers show individual attention to students, cooperate with stakeholders, and create an inclusive education environment. Another important result is that many students could not receive science education in distance education.

Uzaktan Eğitimde Dezavantajlı Öğrenciler: Fen Bilimleri Dersine Özgü Bir Analiz

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ÖZ

Bu araştırma ile Türkiye'de COVID-19 pandemisi uzaktan eğitim döneminde dezavantajlı öğrencilerin fen bilimleri dersi özelindeki durumlarının ortaya çıkarılması amaçlanmıştır. Bu amaç doğrultusunda fen bilimleri ve sınıf öğretmenlerinin uzaktan eğitim sürecindeki tecrübelerine başvurulmuştur. Araştırma nitel araştırma yöntemlerinden durum çalışması deseninde yürütülmüştür. Araştırmaya Türkiye'nin çeşitli bölgelerinde ilkokul ve ortaokullarda görev yapan 58 fen bilimleri ve sınıf öğretmeni katılmıştır. Yarı yapılandırılmış görüşme formu ile toplanan veriler içerik analizine tabi tutulmuştur. Sonuçlar uzaktan eğitim sürecinden en çok etkilenen dezavantajlı grupların yoksul öğrenciler, kaynaştırma öğrencileri, ebeveyn ilgisinden mahrum öğrenciler, üstün yetenekli öğrenciler ve göçmen öğrenciler olduğu yönündedir. Öğretmenler dezavantajlı öğrencilerin fen bilimleri dersinde derin öğrenme kayıpları yaşadıklarını, fen başarılarında ve fene yönelik ilgilerinde düşüş olduğunu ve çoklu dezavantajların fen öğretimini zorlaştırdığını ifade etmişlerdir. Ayrıca, dezavantajlı öğrenciler ile yapılan fen öğretiminde öğretmenlerin bireysel ilgi gösterdiği, veli-rehberlik servisinin kurumlar ile iş birliği yaptığı, kapsayıcı eğitim ortamı oluşturduğu sonucuna ulaşılmıştır. Bir diğer önemli sonuç ise uzaktan eğitim sürecinde dezavantajlı öğrencilerin önemli bir çoğunluğuna öğretmen ya da öğrenci kaynaklı faktörlerden dolayı hiçbir fen öğretiminin yapılamadığıdır.

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INTRODUCTION

The effects of the global disruption in education caused by the COVID-19 pandemic on learning have been severe (The United Nations Educational Scientific and Cultural Organization [UNESCO] et al., 2021a). Among the first measures of many countries around the world to control the spread of the virus, the idea of closing schools has become widespread. However, this situation significantly interrupted education and negatively affected many students (Pal & Vanijja, 2020). Around 1.6 billion students worldwide have been affected by this educational disruption, and 214 million have been denied the opportunity to learn (UNESCO et al., 2021b). Looking at this situation from the perspective of Turkey, the data of the UNESCO (2021) shows that schools were closed for 49 weeks in Turkey because of the effect of the Pandemic process. "Turkey became the second country where schools were closed for the longest period, after Mexico, among the Organization for Economic Co-operation and Development (OECD) countries between March 16, 2020, and March 16, 2021" (Kıygı, 2021, p. 16). During school closures, governments' first response was primarily to conduct distance education-related activities, such as online or televised broadcasting, to enable children to learn continuously (Pal & Vanijja, 2020; TEDMEM, 2021). 12,069,331 students received online learning support from the Education Information Network (called EBA in Turkey) between 2020-2021 academic year, 21 September-11 December 2020 (Ministry of National Education [MoNE], 2020). This data covers approximately 67% of the students in formal education in Turkey (Aydın Ceran, 2021). In this context, we can say that a substantial number of students cannot access distance education in Turkey, at least according to official data. So, this situation in Turkey brings to mind that there may be disadvantages preventing access to education. The reasons for disadvantaged can be nationality, ethnic group, economy, culture, language, region, or other factors (Albert Gómez et al., 2018). According to European Institute for Gender Equality [EIGE] (2022), disadvantaged groups are defined as ethnic minorities who are at risk of poverty, social exclusion, discrimination and violence, immigrants, people with disabilities, individuals with special needs, isolated elderly people and children. Lack of access to digital technology due to the impact of the pandemic (O'Shea et al., 2021) and limited technological know-how are also listed, among other disadvantages (Bray et al., 2021). In fact, the chaos caused by the inability to understand the scientific aspect of the pandemic, which makes up a significant disadvantage in our lives today, has also created a significant disadvantage.

The current COVID-19 pandemic "has raised reflection on the new roles of science education in citizen education in a world characterized by civilization risks, derived from the current socioeconomic development" (Pietrocola et al., 2021, p. 209). UNESCO (2020) has offered to ensure scientific literacy within curricula as one of nine ideas for concrete actions that advance post-pandemic education. "This is the right time for deep reflection on curriculum, particularly as we struggle against the denial of scientific knowledge and actively fight misinformation" (UNESCO, 2020, p. 6). This idea once again emphasizes the importance of scientific literacy in societies to consciously perceive the effects of the pandemic and to use scientific knowledge by assimilating it into real life. Valladares (2021) stated that with the effect of the pandemic and the revival of science and technology in formal and non-formal education environments in this way, it is urgent to raise the question of why scientific literacy is important and what is the meaning. In studies conducted with teachers in Turkey, findings such as distance education is insufficient in science teaching due to the applied content of the science lessons and teachers are worried about not being able to complete the lesson for this reason (Bakioğlu & Çevik, 2020; Balaman & Hanbay Tiryaki, 2021). However, in Turkey, in distance education, we still do not know exactly how many of the activities suitable for the dynamics and nature of the science lesson were done especially for disadvantaged groups and how the science teaching process is carried out. For example, UNESCO et al. (2021a) showed that eighth-graders lost the equivalent of approximately one and a half years of learning in science literacy because of the closure of schools in a region in Russia. As a matter of fact, Engzell et al. (2021) think that the most learning loss is experienced by disadvantaged students and emphasizes that it is very important to know whether students learn less in quarantine and how disadvantaged students do it. Also, Banerjee (2016) conducted a study on the reasons for the failure of disadvantaged students in science and mathematics, and it was proved that the lack of a positive environment and lack of support leads to failure. For this reason, the researches of Engzell et al. (2021), Banerjee (2016) and UNESCO's report titled "Education in a post-COVID world: Nine ideas for public action" published in 2020, have been informative for the examination of disadvantaged students and science lessons in our research. In addition, we predict that teacher support can be one of the important factors in the effective use of educational environments by disadvantaged student groups during the pandemic period. As a matter of fact, Moreno et al. (2016) proved that after-school research-based inquiry support activities for

disadvantaged students increase students' interests, attitudes, and knowledge levels towards science. Dietrichson et al. (2017) stated in the meta-analysis of studies on supportive education given to disadvantaged students that supportive education (private tutoring, feedback, follow-up development, and collaborative learning) increases the academic success of disadvantaged students in primary and secondary schools. These studies are the basic foundations of our prediction. It is one of the Sustainable Development Goals of the United Nations to help disadvantaged groups develop their human capital, ensure their employability through education and training, and ensure that they have fair rights in the acquisition of resources (Lee, 2021). In addition, there are many studies in the literature that calls for the creation of roadmaps for the compensation of learning losses due to distance education (Akkaş Baysal & Ocak, 2021; Andrew et al., 2020; Baz, 2021; Borman, 2020; Kaffenberger, 2021; Kuhfeld & Tarasawa, 2020). Despite these papers, the limited number of studies in the literature on the processes of disadvantaged student groups in science lessons, especially during the pandemic period, which may cause learning losses and their problems, made it necessary to bring this issue to the agenda. So, we think that the article will fill the gap in the field in terms of redefining disadvantaged student groups in the COVID-19 pandemic distance education process, revealing the situation of disadvantaged students in science lessons, and determining the experiences of teachers in conducting science lessons with disadvantaged students. Considering all these aspects, the main purpose of the research is to reveal the situation of disadvantaged students in primary (3rd and 4th grades) and secondary (5-6-7- 8th grades) schools in Turkey during the pandemic period in science lessons based on teachers' experiences. From this point of view this main purpose, the following sub-objectives were investigated.

1) According to the experience of science and primary school teachers, who are the disadvantaged student groups that are adversely affected by the COVID-19 pandemic distance education process?

2) What have science and secondary school teachers noticed when teaching science to disadvantaged students via distant learning during the COVID-19 pandemic process?

3) How did science and primary school teachers implement education and instruction programs for disadvantaged students' science classes in primary and secondary schools during the COVID-19 pandemic?

METHOD

This study is a qualitative case study. There is a fundamental phenomenon that we want to explore in qualitative research (Creswell & Báez, 2020). The case study, on the other hand, is based on the researchers' close examination of real-life events in a specific context, and their studies and research to reveal the holistic and meaningful features of the events through the data they obtained from the source of this situation (Creswell, 2015; Yin, 2003). An unexpected event or problem you experience can be a small case study of how your life has developed (Patton, 2014, p. 145). In this direction, in the research, students who are defined as disadvantaged by science and primary school teachers in distance education due to the pandemic and their experiences with these students in the context of science lesson are realized in the case study pattern of qualitative methodology.

Study Group

The study group of the research comprises primary school teachers and elementary school science teachers who taught science in the 2020-2021 academic year during the COVID-19 pandemic distance education process. In line with the main purpose of the research, certain criteria were considered in the determination of the study group. In this direction, the study group was determined through criterion sampling, one of the purposeful sampling methods. In the determination of the teachers to be included in the research, it is the basic criteria to select primary school teachers who teach 3rd or 4th grades at the primary school level and to select science teachers at the secondary school level. Also, disadvantaged students in the classrooms of the selected primary school teachers and science teachers are another basic criterion. In line with these criteria, 58 teachers including 25 science teachers and 33 primary school teachers were reached. In line with this information, the descriptive characteristics of the participants included in the study are given in Table 1.

Table 1. *Descriptive Characteristics of the Teachers Participating in the Research*

No.	Teacher	Seniority year	Gender	No.	Teacher	Seniority year	Gender
1	st1	12	f	30	pst5	7	f
2	st2	21	m	31	pst6	30	f
3	st3	9	f	32	pst7	8	f
4	st4	20	m	33	pst8	22	f
5	st5	6	f	34	pst9	21	f
6	st6	14	m	35	pst10	11	f
7	st7	3	f	36	pst11	20	m
8	st8	6	f	37	pst12	23	f
9	st9	9	f	38	pst13	14	f
10	st10	13	m	39	pst14	18	m
11	st11	19	m	40	pst15	16	f
12	st12	9	m	41	pst16	4	f
13	st13	13	f	42	pst17	4	f
14	st14	3	f	43	pst18	5	f
15	st15	15	f	44	pst19	10	f
16	st16	26	f	45	pst20	13	m
17	st17	11	f	46	pst21	1	f
18	st18	11	m	47	pst22	10	f
19	st19	16	m	48	pst23	13	f
20	st20	13	m	49	pst24	13	f
21	st21	8	f	50	pst25	11	f
22	st22	24	f	51	pst26	15	f
23	st23	16	m	52	pst27	43	m
24	st24	39	m	53	pst28	9	m
25	st25	2	f	54	pst29	30	m
26	pst1	14	f	55	pst30	6	f
27	pst2	34	f	56	pst31	10	f
28	pst3	9	f	57	pst32	4	f
29	pst4	9	f	58	pst33	10	f

Note. st: science teacher, pst: primary school teacher, f: female, m: male

Data Collection

In this research, semi-structured interviews were chosen to allow a degree of freedom for the interviewees to express their thoughts and to emphasize the special interests and areas of expertise they feel they have (Horton et al., 2004). The issue of ensuring the validity and reliability of the semi-structured interview form is included in the ethics and credibility section. The interview form consists of an introductory part and the main part consisting of two stages. In the introduction, there is an informative text about the purpose of the research, how long the data will be collected, how and for what purpose this data will be used, and ethical principles. In the first stage of the main part, there is demographic information about the teachers. In the second stage of the main part, the teachers were asked who the disadvantaged student groups are that have been adversely affected by the COVID-19 pandemic distance education process, what they have observed in the science lesson about disadvantaged students, and how they have carried out the science education. Probing questions were used in the second stage to get in-depth information. For example, teachers were asked about the learning losses of disadvantaged students in science lessons, the teaching methods used in teaching science lessons with these students, and how they followed individual follow-up paths. The raw data for the study were collected over a period of approximately one and a half months and in the online meetings or by sending an e-mail because of pandemic conditions (Creswell & Báez, 2020).

Credibility and Ethics

Credibility is confidence in the 'truth' of the finding in qualitative research (Lincoln & Guba, 1985). For the data collection tool used in the research to give valid and reliable results, first, international/national reports and publications published during the COVID-19 process were scanned. Necessary comparisons and examinations were made between the science curriculum (MoNE, 2018) and these reports-publications. Eventually, a draft interview form was created by the researchers. This draft interview form was examined by

an academician in science education, an academician in Turkish education, a science teacher, and a primary school teacher. As a result of the examinations, the form was approved to be utilizable. A pilot study was conducted by applying the revised form to eight primary schoool teachers and seven science teachers. Thus, the intelligibility, functionality, and usefulness of the interview form were tested. Some questions in the piloted interview form were corrected to further increase clarity, and some probing questions were added. To ensure the validity of the research, the participants were determined by criterion sampling, one of the purposive sampling methods, in accordance with the purpose of the research, and direct quotations from the teachers' views were frequently included. The results of the analysis made by each researcher were discussed in-depth for the credibility of the research data. Similar codes were combined under categories. A new evaluation has been made on the different situations in terms of reasons and perspectives. Because of this evaluation, new codes were created for situations with different opinions. Miles and Huberman's (1994) percentage agreement method (Reliability = Consensus/ (Agreement + Disagreement)) was used for the data got. The percentage of agreement calculated according to the formula was 94%. The data with disagreement were re-examined and recoded to reach an agreement. This process was followed by a different expert and his opinion was taken in case of dilemmas. Thus, the final data classification was carried out. Findings and comments were presented based on the determined categories, sub-categories, and codes. In the research, code names were used instead of the real names of the participants. In the presentation of the findings, codings such as st1_6_f (science teacher[st]1, seniority, gender) was made. In addition, official permission with numbered E.69778 for this study was obtained from the Ethics Committee Commission of the university (XXX University) numbered 154897555 de on 06/05/2021.

Analysis of Data

The study's data were analyzed by using content analysis. Content analysis is a family of systematic, rule-guided techniques used to analyze the informational contents of textual data (Mayring, 2000). The content analysis of the data set obtained from 25 science teachers and 33 primary teachers was made by both researchers in the data analysis from raw data to codes, as suggested by Creswell (2015, pp. 153-156). In this context, first, a general reading was made on the data transferred to the electronic environment by the researchers, and notes were taken regarding possible codes that may occur in the following stages. Then, detailed, and repetitive reading was started by the researchers and appropriate coding was determined. Within the scope of content analysis, similar data in line with the research questions were coded within the framework of certain concepts and categories, brought together, and interpreted in a way that the reader could understand. To facilitate clarity, the answers given to the questions were tabulated as frequency and percentage, and direct quotations were also included from time to time. All the answers given by the teachers to a question were considered.

RESULTS

Findings related to the sub-objectives of the research are presented under the following headings, respectively.

Disadvantaged Student Groups Negatively Affected by the COVID-19 Pandemic Distance Education Process According to Science and Primary School Teachers' Views

The students that science and primary schoool teachers identified as disadvantaged during the COVID-19 pandemic distance education process are presented in Table 2.

Table 2. *Disadvantaged Students Who were Negatively Affected by Distance Education Process*

Categories*	n	%
Poor Students	21	34,42
Students with Special Education Needs	14	22,95
Students Deprived of Parental Interest	11	18,03
Gifted Students	8	13,11
Immigrant Students	7	11,47

*Note. More than one category was specified by the teachers.

According to Table 2, disadvantaged students who science and primary school teachers think are negatively affected by the distance education process are poor students, students with special educational needs, students deprived of parental interest, gifted students, and immigrant students. The findings show that the disadvantaged group most negatively affected by the distance education process is the poor students. Some quotations of teacher opinions regarding these determinations are as follows:

"Unfortunately, students with financial difficulties could not attend because of technical deficiencies and they experienced a lot of disconnection." (st9_9_f, poor students' category).

"I was trying to determine the learning levels of my inclusive students at school. However, I do not know if they regressed during the distance education process. Because most of them did not come to online lessons and school." (st7_3_f, students with special education needs category).

"Unfortunately, the parents of some of my students are completely uninterested. I think this situation puts students at a more disadvantageous position." (st20_13_m, category of students deprived of parental interest).

"I have a gifted student. He was very interested in the lesson, but there are times when it is very difficult in this process." (pst32_4_f, gifted students' category).

"There are seven foreign students in my class, and they do not speak Turkish." (pst10_11_f, category of immigrant students).

The Conduct of Science Lessons with Disadvantaged Students in The Distance Education Process: teachers' determinations

The categories created in line with the opinions of the teachers regarding the conduct of the science lesson with the disadvantaged students in the distance education process are given in Table 3.

Table 3. *Categories Related to The Conduct of Science Lessons with Disadvantaged Students in The Distance Education Process*

Categories*	Subcategories	n	%
Learning Losses in Science	learning losses due to nature of the science course learning loss deepened by disadvantages	40	51,28
Decline in Science Achievement	decline in achievement among poor students decline in achievement among gifted students	16	20,51
Decline in Interest in Science	decrease in expectation of success not attending class	14	17,94
Science Teaching Made Difficult by Multiple Disadvantages	opening the scissors in learning differences difficulty making up for learning differences	8	10,25

**Note.* More than one category was specified by the teachers.

Table 3 shows that teachers' opinions in conducting science lessons with disadvantaged students are toward "Learning Losses in Science, Decline in Science Achievement, Decline in Interest in Science, Science Teaching Made Difficult by Multiple Disadvantages". Two main emphases draw attention to the opinions of teachers regarding the deep learning losses in science. The first is the learning losses caused because the processes that should be followed in the lesson due to the nature of the science lesson cannot be realized in distance education. The other emphasis is that while there are some learning losses for disadvantaged students, even in face-to-face education, the losses for these students become deeper in distance education. Some statements regarding the opinions that there are deep learning losses in science are presented below.

"We used web 2.0 tools much more in distance education as science lessons require experimentation, research and laboratory use. However, especially children who do not have internet or tablet could not

attend these classes regularly. They had serious losses throughout the year in distance education." (st20_13_m).

"In order to learn science concepts, interaction is absolutely necessary. For this reason, most of my students, especially those with special learning difficulties, could not understand the concepts sufficiently. During the evaluation phase, I saw they had a lot of misconceptions. Concepts such as natural and artificial, properties of matter, animate and inanimate were mixed with each other." (pst10_11_f).

"My students who have no internet access or tablet/phone etc. or have a disability experienced learning loss compared to my other students. These learning losses I observed as a primary school teacher were more in science class. I think such a result came about because the principles of conducting the lesson were different compared to other lessons." (pst21_1_f).

Science and primary school teachers' opinions show that there is a decrease in the science achievement of disadvantaged students in the distance education process. When the teachers' opinions were examined, it was emphasized that a significant majority of the students whose science achievement decreased were poor students and gifted students. Some of the teachers' opinions regarding this determination are presented below.

"I have gifted students. Unfortunately, they could not adapt to distance education. They have even forgotten the topics we covered the previous year. Among them, there are students who will take the entrance exam to high schools. They don't even have exam anxiety because they don't even try anymore because they think they can't do it." (st14_3_f).

"There are internet connection problems in the village. Especially at home, I have poor students who used the same phone with their siblings in turns. As a result, it is not possible to keep up with the subjects and achievements, even with constant repetition. Because of this, there is a significant decrease in the achievements of even my successful students." (st18_11_m).

"Unfortunately, the achievement gaps between students widened. This difference was more pronounced in the science class." (pst25_11_f).

The opinions of science and primary school teachers about disadvantaged students are that these students' interest in science decreases during the distance education process. When this category is examined in detail, the decrease in the interest of children who cannot adapt to distance education because of their disadvantages is tributed to the decrease in their expectations for success in the lesson. Some of the teachers' opinions about the decrease in interest in science are presented below.

"The learning losses experienced by my students who could not attend the class also caused a decrease in their interest in the lesson. This situation is difficult to compensate. It was a great loss." (pst22_10_f).

"In this process, there was a regression in the success of my gifted student. I was personally interested, but I observed that he was not as interested in the lesson as before" (st13_13_f).

"Learning losses are compensated somehow, but more importantly, these children have lost their interest and motivation towards my lesson" (st10_13_m).

In the category of science teaching made difficult by multiple disadvantages, science and primary school teachers emphasized that some students have more than one disadvantage and that there is much more difficulty in teaching science to these students. Some of the teacher's opinions related to this category are presented below.

"I have a student with special need. When I was at school, I was one-on-one personally involved to him, and he was in harmony with his friends. However, during the distance education process, it was not his turn to reach a phone because of his siblings, and he almost never attended the classes. I could never reach either. I think we lost these types of children. I'm trying to make up for it, but there will be no compensation." (pst27_43_m).

"Actually, I have so many students whose only solution is school. The child's home environment is not suitable, his/her economic situation is troubled, he/she does not have a tablet or PC, he/she has many

siblings, his/her parents do not care. Especially among these students, there are those who are gifted or IEP students. Distance education has been a complete chaos for these children and for us. I had a hard time educating these students in the science curriculum." (pst33_10_f).

The findings on the how did science and primary school teachers implement education and instruction programs for disadvantaged students' science classes in primary and secondary schools during the COVID-19 pandemic

The categories created based on teacher opinions on how education and instruction activities are carried out for disadvantaged individuals within science lesson in the distance education process are given in Table 4.

Table 4. *Opinions on How Science Education Is Carried out for Disadvantaged Individuals in Distance Education*

Categories*	Subcategories		n	%
Individual Interest	Extracurricular Time		36	34,21
	Providing Educational Resource			
No Teaching Practices	Teacher factor	Limited ability in distance education for science	22	28,94
	Student factor	Lack of access to distance education		
		Psycho-social problems		
Close Collaboration	Collaboration with parents		10	13,15
	Collaboration with guidance			
	Collaboration with institutions			
Creating an Inclusive Education Environment	Include All Students		8	10,52
	Encouragement to Group Work			

**Note.* More than one category was specified by the teachers.

According to Table 4, teachers stated that they deal with disadvantaged students individually, cooperate (parent-guidance service, institutions-organizations) and create an inclusive educational environment in the science lesson in the distance education process. However, the rate of teachers who stated that they did not make any teaching practices is also high. Opinions, which are divided into 4 main categories in total, are divided into subcategories within themselves. When the main category of individual interest was examined, it was observed that the teachers made a separate planning for the students in extracurricular times and provided educational resource support by reaching the students who did not have the opportunity to access distance education. Some of the teachers' statements in the individual interest main category are presented below.

"I spared time outside of class for my student who has learning difficulties. I tryed to help in the subjects that she did not learn in the lesson via WhatsApp as as face to face" (st1_12_f, extracurricular time subcategory).

"Most of my students who have no tablet, etc. could not join the distance education process. I tried to provide book and resource support during the distance education" (st7_3_f, subcategory of sourcing).

When the main category of close collaboration was examined, it was observed that science and primary school teachers preferred to cooperate with parents, guidance service, and institutions. Teachers tried to involve all stakeholders in the process to overcome the negativities experienced by disadvantaged students. The opinions of teachers belonging to the main category of cooperation are presented below.

"I contacted the parents and determined a common route. During the teaching process, I followed up my

students in constant communication." (st22_24_f).

"I requested tablets for my students from the public or governmental institutions for students who cannot have a technological device. I contacted the parents and the school administration and directed my students to the guidance service." (st23_16_m).

"I determined that a gifted student did not want to attend classes due to the psycho-social problems he experienced during the COVID-19 process, and I tried to support him by contacting the Guidance Service." (pst3_9_m).

The third category regarding how science teaching activities are carried out for disadvantaged individuals in the distance education process is the creation of an inclusive educational environment. When this category was examined, it was observed that the teachers followed two paths. These were as involve all students in the lesson and encouraging group work.

"I try to draw them all into the lesson in different ways. With group work, I create opportunities for them to learn." (pst22_11_f).

"We try to choose materials so that anyone can create them. We create activities with alternatives." (pst26_15_f).

"It is very important for them to be accepted by their friends in the classroom first. For this reason, I bring them together in science activities and enable them to complete the activities together." (pst27_43_m).

Another main category is "No teaching practice". It was seen that a significant part of the teachers participating in the research did not carry out any educational activities for their disadvantaged students in distance education. When the sub-categories of this finding are examined, it is observed that there are factors originating from teachers and students. When the student factor is examined, students who cannot access distance education are a remarkable finding. However, there are children who are disconnected from distance education because of psycho-social effects. When the teacher factor is examined, teachers stated that their ability to conduct science education online for disadvantaged students is limited.

"In this process, we could not fully reach a significant part of the students who had socio-economic difficulties" (pst11_20_m).

"Distance education has affected children psycho-socially in a very negative way. We could not include these children in the lessons" (pst18_5_f).

"We need applications that are carried out by doing and experiencing in science lessons. I have difficulties in this regard. Science is a lesson that especially disadvantaged children need to learn with more than one sense. From this standpoint, I could not be useful to these children in distance education" (pst31_10_f).

CONCLUSION AND DISCUSSION

The results obtained from the research can be evaluated in three dimensions. First, science and primary schoool teachers defined five different disadvantaged student groups that were adversely affected by the COVID-19 pandemic distance education process. The largest proportion of these student groups is composed of poor students. It has been concluded that the disadvantaged groups most affected by the pandemic process after poor students are students with special needs, students who lack parental interest, gifted students, and immigrant students. Unfortunately, the sudden and unplanned transition to online learning caused by the pandemic has exacerbated pre-existing inequalities of opportunity due to various disadvantages and has intensified the risks and vulnerabilities of already disadvantaged communities (Ardington et al., 2021; Bray et al., 2021; Khan & Ahmed, 2021; O'Shea et al., 2021). In addition, research has shown that children from poor households are greatly affected by the adverse effects of the COVID-19 pandemic, as children from poorer households are more vulnerable to inadequate digital tools, internet connectivity, and low parental education (Devitt et al., 2020; Green, 2020; Kuhfeld et al., 2020; Maldonado & De Witte, 2021; Mundy & Hares, 2020; Rollston & Galea, 2020). UNESCO et al. (2021) underlines in its data-based evaluation that parents play an important role in the prevention of learning losses,

especially when schools are closed. In addition, it is stated in the same report that children who are successful when the school is open are more affected by the uneducated parent element in the pandemic.

The second issue we will discuss is the situation of disadvantaged students in science lessons during the distance education process due to the pandemic. The results show that disadvantaged students experience deep learning losses in science, there is a significant decrease in science achievement, and students' interest in science decreases during the distance education period. In addition, science teaching has become much more difficult for children with multiple disadvantages. Acording to our results, there are two main reasons for deep learning losses in science. The first of these is that learning environments suitable for the nature of the science lesson in which learners are given oppoprtunities to do and experience science cannot be created. The other is that while there are some learning losses for disadvantaged students, even in face-to-face education, the losses for these students increase in distance education. Wilson et al.'s (2020) research results reveal that the COVID-19 pandemic has created great inequality among students in terms of access and use of digital resources. The research of Balaman and Hanbay Tiryaki (2021), on the other hand, showed that the teaching of science in distance education is insufficient due to its practical content. The results of this research also show that inequality and related losses are deeper for disadvantaged groups in terms of science education. On the other hand, in the study, teachers emphasized that a significant majority of students whose science achievement decreased were poor students and gifted students. Accordingly, the decrease in students' interest in science was attributed to the decrease in their expectations of success in the lesson and their inability to integrate into distance education. Even more thought-provoking is the situation of children with multiple disadvantages. Also, our research revealed that the science teaching process for these students is quite challenging. Based on the results, the distance education process, which already provides some problems for all students, has caused more complex problems in terms of scientific literacy for disadvantaged students. As a matter of fact, this research shows that inequality and related losses are more considerable for disadvantaged groups in terms of science education. The importance of a scientifically literate society in understanding scientific reality and its application in life is obvious. This necessity has once again come to light with the unconscious and panic reactions of societies in the face of the COVID-19 pandemic (Pietrocola et al., 2021; UNESCO, 2020; Valladares, 2021).

The last result of the research is discussed in the context of conducting science lessons with disadvantaged students. The results of the research show that teachers spare individual time outside the classroom for their students in conducting the science lesson, cooperate with the family-guidance service and various institutions, and try to establish an inclusive educational environments. The results show that teachers who try to provide a qualified science education process to disadvantaged students have difficulties in carrying out the process in a healthy way. In addition, an important result obtained from the research is that a large proportion of teachers have not made any application in terms of teaching science to disadvantaged students. Teachers who make an effort but have difficulties in teaching science for disadvantaged students and who also say that they cannot do anything, bring up the issues of "teacher's competence in distance education" and "students who cannot be included in education". The results of this study based on teacher experiences show that teachers' abilities in distance science education for disadvantaged children are limited. Indeed, teachers in many low- and middle-income countries received limited professional development support for the transition to distance learning, leaving them unprepared to interact with students and caregivers (UNESCO et al., 2021b). In addition, Bakioğlu and Çevik (2021), stated in their research that science teachers are concerned about changes in the teaching methods and materials used in the lesson and not being able to complete the curriculum/laboratory activities in the distance education process. It can be said that teachers have distance education skill gaps, especially in disadvantaged groups, in the teaching of science lessons that require experimentation, observation, research and questioning processes. In summary, the results reveal the importance of the relationships established between teachers and disadvantaged students who are more vulnerable in the distance education process. According to Bray et al. (2021) states that establishing meaningful connections between teachers and students increases participation in distance education, especially for students at risk of being disadvantaged in education, and that teachers' use of innovative teaching and learning methods encourages the development of students' basic skills. Another reason why teachers have difficulties in teaching science or not being able to teach science at all is the disadvantaged children who cannot be included in distance education during the pandemic. For example, the results of our research show that there are children who drop out of distance education due to psycho-social effects. According to UNESCO et al. (2021b), beyond addressing learning losses, it is essential to address children's socio-emotional losses as well. School closures not only disrupted education, but also affected the delivery of essential services such as school nutrition, protection, and psychosocial support, affecting children's overall well-being and mental health.

Resently the pandemic itself has shown that a lack of scientific literacy is also a disadvantage. Indeed, In the aftermath of the pandemic, there has been a consensus among different countries that scientific literacy is vital

and strategic to meet the global challenges ahead (Valladares, 2021). The results obtained from this research show that this dramatic gap in science literacy is getting wider to the disadvantage of disadvantaged students. For this reason, it is recommended to adopt a national scientific literacy policy that includes remedial measures for disadvantaged students, who are determined to be more affected by long school closures socially, emotionally, and academically, and to support teachers in science teaching practices for disadvantaged students in unexpected situations (pandemic, disaster, etc.).

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TÜRKÇE GENİŞLETİLMİŞ ÖZET

COVID-19 pandemisinin eğitimde neden olduğu küresel kesintinin öğrenme üzerindeki etkileri şiddetli olmuştur (Birleşmiş Milletler Eğitim Bilim ve Kültür Örgütü [UNESCO] ve diğerleri, 2021a). Dünya genelinde birçok ülke ise virüsün yayılmasını kontrol altına almada ilk önlem olarak okulları kapatmıştır. Ancak bu durum eğitimi önemli ölçüde kesintiye uğratmış ve birçok öğrenciyi olumsuz etkilemiştir (Pal ve Vanijja, 2020). UNESCO (2021) verilerine göre; Türkiye'de pandemi sürecinin de etkisiyle okulların 49 hafta kapalı kaldığı söylenebilir.

Türkiye, 16 Mart 2020 ile 16 Mart 2021 tarihleri arasında Ekonomik İşbirliği ve Kalkınma Teşkilatı (OECD) ülkeleri arasında Meksika'dan sonra okulların en uzun süre kapalı kaldığı ikinci ülkedir (Kıygı, 2021, s. 16). Türkiye'de izlenen politikaya göre 2020-2021 eğitim öğretim yılında Eğitim Bilişim Ağı'ndan (EBA) çevrimiçi öğrenme desteği alan öğrencilerin oranı %67'dir (Aydın Ceran, 2021). Bu bağlamda, Türkiye'de en azından resmi verilere göre önemli sayıda öğrencinin uzaktan eğitime erişemediğini söyleyebiliriz. Dolayısıyla Türkiye'deki bu durum, "eğitime erişimi engelleyen dezavantajların" olabileceğini akla getirmektedir.

Dezavantajlı teriminin nedenleri milliyet, etnik grup, ekonomi, kültür, dil, bölge veya diğer faktörler olabilir (Albert Gómez ve diğerleri, 2018). Pandeminin etkisi nedeniyle dijital teknolojiye erişim eksikliği (O'Shea ve diğerleri, 2021) ve sınırlı teknolojik bilgi birikimi de diğer dezavantajların yanı sıra listelenmiştir (Bray ve diğerleri, 2021). Aslında günümüzde hayatımızda önemli bir dezavantaj oluşturan pandeminin bilimsel yönünün anlaşılamamasının yarattığı kaos da önemli bir dezavantaj oluşturmuştur. Mevcut COVID-19 pandemisi, mevcut sosyoekonomik gelişmeden türetilen medeniyet riskleriyle karakterize edilen bir dünyada vatandaş eğitiminde fen eğitiminin yeni rolleri üzerine düşünmeyi artırmıştır (Pietrocola ve diğerleri, 2021, s.209). Valladares (2021), pandeminin etkisiyle bilim ve teknolojinin örgün ve yaygın eğitim ortamlarında bu şekilde canlanmasıyla birlikte "bilim okuryazarlığının neden önemli olduğu" sorusunun gündeme getirilmesinin acil olduğunu belirtmektedir. Türkiye'de öğretmenlerle yapılan araştırmalarda, fen bilgisi derslerinin uygulamalı içeriği nedeniyle uzaktan eğitimin fen öğretiminde yetersiz kaldığı ve öğretmenlerin bu nedenle dersi tamamlayamama endişesi yaşadıkları tespit edilmiştir (Bakioğlu & Çevik, 2020; Balaman & Hanbay Tiryaki, 2021). Ancak Türkiye'de uzaktan eğitim sürecinde özellikle dezavantajlı gruplara yönelik olarak fen bilimleri dersinin dinamiklerine ve doğasına uygun etkinliklerin ne kadarının yapıldığını ve fen öğretiminin nasıl yürütüldüğünü hala tam olarak bilmiyoruz. Nitekim Engzell vd. (2021), en fazla öğrenme kaybının dezavantajlı öğrencilerde yaşandığını düşünmekte ve öğrencilerin karantinada daha az öğrenip öğrenmediğini ve dezavantajlı öğrencilerin bunu ne kadar yaptığını bilmenin çok önemli olduğunu vurgulamaktadır. Bu araştırmada ise dezavantajlı öğrenci gruplarının özellikle pandemi döneminde fen derslerinde öğrenme kayıplarına ve çeşitli sorunlara neden olabilecek süreçleri ile ilgili literatürde sınırlı sayıda çalışma bulunması bu konunun gündeme getirilmesini gerekli kılmıştır. Bu kapsamda araştırmanın temel amacı, Türkiye'de ilk ve orta dereceli okullardaki dezavantajlı öğrencilerin pandemi döneminde fen bilimleri derslerindeki durumunu öğretmenlerin tecrübeleri doğrultusunda ortaya çıkarmaktır.

Bu çalışma nitel bir durum çalışmasıdır. Araştırmanın çalışma grubu, COVID-19 pandemisi uzaktan eğitim sürecinde (2020-2021 eğitim öğretim yılı) fen bilimleri dersi veren 33 sınıf öğretmeni ve 25 fen bilimleri öğretmeni olmak üzere 58 öğretmenden oluşmaktadır. Araştırmada, görüşülen kişilere düşüncelerini ifade etmede bir dereceye kadar özgürlük tanımak ve sahip olduklarını hissettikleri özel ilgi alanlarını ve uzmanlık alanlarını vurgulamak için yarı yapılandırılmış görüşmeler kullanılmıştır (Horton ve diğerleri, 2004). Çalışmaya ilişkin ham veriler, yaklaşık bir buçuk aylık bir sürede ve pandemi koşulları nedeniyle çevrimiçi toplantılarda veya e-posta gönderilerek toplanmıştır (Creswell & Báez, 2020). Araştırmanın verileri içerik analizi kullanılarak çözümlenmiştir.

Araştırmadan elde edilen verilere dayalı sonuçlar üç boyutta değerlendirilebilir. İlk olarak fen bilimleri ve sınıf öğretmenleri, COVID-19 pandemisi uzaktan eğitim sürecinden olumsuz etkilenen beş farklı dezavantajlı öğrenci grubu tanımlamıştır. Bu öğrenci gruplarının en büyük bölümünü yoksul öğrenciler oluşturmaktadır. Yoksul öğrencilerden sonra pandemi sürecinden en çok etkilenen dezavantajlı gruplarının özel gereksinimli öğrenciler, veli ilgisinden mahrum öğrenciler, üstün yetenekli öğrenciler ve göçmen öğrenciler olduğu sonucuna varılmıştır.

Uzaktan eğitim sürecinde dezavantajlı öğrencilerin fen derslerindeki durumu ile ilgili sonuçlar, dezavantajlı öğrencilerin fen bilimleri dersinde derin öğrenme kayıpları yaşadığını, fen başarılarında önemli bir düşüş olduğunu ve uzaktan eğitim döneminde öğrencilerin fene olan ilgilerinin azaldığını göstermektedir. Ayrıca uzaktan eğitim sürecinde fen öğretimi birden fazla dezavantajı olan çocuklar için çok daha zor hale gelmiştir. Sonuçlara göre fen derslerinde derin öğrenme kayıplarının iki ana nedeni vardır. Bunlardan ilki, fen bilimleri dersinin doğasına uygun, yaparak ve yaşayarak öğrenme ortamlarının oluşturulamamasıdır. Diğeri ise dezavantajlı öğrenciler için yüz yüze eğitimde bile bazı öğrenme kayıpları olurken, uzaktan eğitimde bu öğrenciler için kayıplar daha da derinleşmektedir. Öte yandan araştırmada öğretmenler, fen başarısı düşen öğrencilerin önemli bir çoğunluğunun yoksul veya üstün yetenekli öğrenciler olduğunu vurgulamıştır. Buna göre öğrencilerin fen bilimleri dersine olan ilgilerinin azalması dersteki başarı beklentilerinin azalmasına ve uzaktan eğitime entegre olamamalarına bağlanmıştır. Elde edilen sonuçlara göre, tüm öğrenciler için halihazırda bazı sorunları olan uzaktan eğitim süreci, dezavantajlı öğrenciler için fen öğretimi açısından daha karmaşık sorunlara neden olmuştur. Nitekim bu araştırma, fen eğitimi açısından dezavantajlı gruplar için eşitsizliğin ve buna bağlı kayıpların daha derin olduğunu göstermektedir.

Araştırmanın bir diğer sonucu dezavantajlı öğrencilerle fen derslerinin yürütülmesi bağlamında tartışılmıştır. Araştırmanın sonuçları öğretmenlerin fen dersini yürütürken öğrencilerine sınıf dışında bireysel olarak zaman ayırdıklarını, aile rehberlik servisi ve çeşitli kurumlarla iş birliği yaptıklarını ve kapsayıcı bir eğitim ortamı oluşturmaya çalıştıklarını göstermektedir. Elde edilen sonuçlar dezavantajlı öğrencilere nitelikli bir fen

eğitimi süreci sunmaya çalışan öğretmenlerin süreci sağlıklı bir şekilde yürütmekte zorlandıklarını göstermektedir. Ayrıca araştırmadan elde edilen önemli bir sonuç da öğretmenlerin büyük bir bölümünün uzaktan eğitim sürecinde dezavantajlı öğrencilere yönelik fen öğretimi açısından herhangi bir uygulama yapmamış olmasıdır. Öğretmen deneyimlerine dayalı bu çalışmanın sonuçları, dezavantajlı çocuklara yönelik uzaktan fen eğitiminde öğretmenlerin yeteneklerinin sınırlı olduğunu göstermektedir. Deney, gözlem, araştırma ve sorgulama süreçleri gerektiren fen derslerinin öğretiminde özellikle dezavantajlı gruplarda öğretmenlerin uzaktan eğitim beceri boşlukları olduğu söylenebilir. Özetle sonuçlar, uzaktan eğitim sürecinde daha savunmasız olan dezavantajlı öğrenciler ile öğretmenler arasında kurulan ilişkilerin önemini ortaya koymaktadır. Bununla birlikte öğretmenlerin fen öğretiminde zorluk yaşamasının veya hiçbir fen öğretimi uygulaması yapamamalarının bir diğer nedeni de pandemi döneminde uzaktan eğitime dahil edilemeyen dezavantajlı çocuklardır. Örneğin araştırmamızın sonuçları psiko-sosyal etkilerden dolayı uzaktan eğitimi bırakan çocukların olduğunu göstermektedir.

Son zamanlarda pandeminin kendisi, bilimsel okuryazarlık eksikliğinin de bir dezavantaj olduğunu göstermiştir. Öyleki pandemi sonrasında, farklı ülkeler arasında bilimsel okuryazarlığın önümüzdeki küresel zorlukların üstesinden gelmek için hayati ve stratejik olduğu konusunda bir fikir birliği oluşmuştur (Valladares, 2021). Araştırmadan elde edilen sonuçlar, fen okuryazarlığındaki bu dramatik uçurumun dezavantajlı öğrencilere karşı derinleştiğini göstermektedir. Bu nedenle, okulların uzun süre kapalı kalmasından sosyal, duygusal ve akademik olarak daha fazla etkilendiği belirlenen dezavantajlı öğrencilere yönelik düzeltici önlemleri içeren ulusal bir bilim okuryazarlığı ve fen eğitimi politikasının benimsenmesi ve beklenmedik durumlarda (salgın, afet vb.) dezavantajlı öğrencilere fen öğretimi uygulamalarında öğretmenlerin desteklenmesi önerilmektedir.