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Contact Info

Journal of Education in Science, Environment and Health (JESEH)
Email: jesehoffice@gmail.com
Web : www.jeseh.net

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What do Teachers Say about Inclusion of Epidemic Diseases in the Science Curriculum?

Aynur Cevik, Sibel Saracoglu, Hasan Kaya

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Abstract

This study was carried out to determine the views of science teachers about the inclusion of epidemic diseases in science curriculum. Phenomenology, one of the qualitative research designs, was used as the research design in the study. The study group consists of six science teachers who have at least five years of experience and have participated in the development of science curriculum in previous years. A semi-structured interview form consisting of five questions, whose content validity was provided by taking expert opinion, was used as a data collection tool. Code, category and themes were created by analyzing the content of the teachers' opinions. As a result of the study, inclusion of epidemic diseases, which has become a current topic all around the world, into the science curriculum; reasons, advantages and disadvantages, class level, achievements that can be included in the program were evaluated according to the views of science teachers in terms of teaching methods-techniques and materials also it was emphasized that the subject of epidemic diseases should be included in the science course curriculum. Suggestions that in line with the findings of the research were made to the developers of the science course curriculum and researchers.

Introduction

The need for qualified and well-equipped manpower, which arises from the changing social needs in the light of developments in science and technology, can only be met with a qualified education. Therefore, curricula should be prepared in line with the requirements of the era, the needs of the individual and society, and should include innovations and advances in the fields they cover (Coşkun, 2017). In this context, curricula are being reviewed and renewed in many countries (Donnelly & Ryder, 2011, Ulutan, 2018). In the updated curriculum, a human-oriented education approach is adopted and it is aimed to train individuals to have 21st century skills (Çepni, 2017). The effect of science course is high in gaining these skills, which are necessary for increasing the quality of life of individuals and societies (Kaptan, 1999; Yılmaz, 2013). The science course aims to raise individuals who are open to development, have developed thinking skills, have strong social skills, and use information and technology effectively, and provides an opportunity to the student in order to comprehend and research himself and the environment he lives in through scientific methods and thinking (Akbaş, 2011; Rudolph, 2020). In this context, science curricula should be capable of adapting to the renewed world conditions in line with the changing social requirements with the developments in science and technology (Wiles & Bondi, 2002).

Science curriculums, in the light of the principle of inseparability of human and life, should be prepared in a way that will facilitate each individuals lives and contribute to a healthy and happy living is has been emphasized in the Ministry of National Education (MoNE) science curriculum objectives and MEB 2023 Education Vision Reports (MoNE, 2018a; MoNE 2023 Education Vision, 2018b). In this context, as in many countries, the science curriculum has been updated in order to prepare an individual and society-oriented curriculum in Turkey. In the science curriculum, which was updated twice in the last ten years, in 2013 and 2018, it was aimed to develop the basic life skills, life skills were included in the curriculum as a new skill area. One of the striking points in the updates made in 2013 and 2018 is the inclusion of socio-scientific issues in the program. In this way, it is aimed to make students gain the habit of scientific thinking and to make students aware of taking a role in the solution of social issues (MoNE, 2013; MoNE, 2018a). Socio-scientific issues attract the attention of students who are interested in daily life and social issues, encourage them to think. For this reason, the inclusion of socio-scientific issues in the curriculum is seen as one of the best ways to enable individuals to gain skills such as decision making, problem solving, analytical thinking and generating new ideas (Değirmenci & Doğru, 2017; Gologlu, 2009).

Socioscientific issues are controversial issues that require generating ideas and making choices in a personal or social sense, have local and general social and political dimensions, and are discussed from different perspectives in all societies. Socioscientific issues covered within the scope of science courses in Turkey; global warming, genetically modified foods, nuclear energy, ozone depletion, reduction of biodiversity, hydroelectric power plants, cloning, recycling of waste materials, etc. (MoNE, 2018a). It is stated that similar subjects are also included in studies on socioscientific issues in Turkey (Genç & Genç, 2017). It is inevitable that new subjects should be included in socio-scientific issues according to the conditions and needs of the developing world. In the MoNE 2023 Education Vision Report, it is stated that awareness and skill training on current health issues should be given importance in science course curriculum (MoNE, 2023 Education Vision, 2018b). Considering the inclusion of diseases in the 2018 Turkish science curriculum; at sixth grade, dwarfism, giantism, diabetes, goiter, sensory organ diseases, bone fractures, rheumatism, diarrhea, ulcer, cancer, jaundice, anemia, pneumonia, influenza, kidney stones, kidney failure, dialysis, alcohol, smoking, organ donation, first aid and health of receptor organs, and at the eighth grade concept of consanguineous marriage are discussed, but the issue of epidemic diseases is not among these said learning outcomes (MEB, 2018a). The content of the science program has been prepared by examining national and international academic studies and taking the opinions of the teachers who are the implementers of the curriculum. However, in the examinations made, it was determined that although some socioscientific issues were included in the 2018 science curriculum, the objectives were limited and the subject of diseases was not included enough (Deveci & Aydiz, 2021; Saraç & Yıldırım, 2019; Yapıcıoğlu, 2020). In this context, it is thought that the issue of epidemic diseases such as Covid 19, which has recently occupied the world in the field of health, which is included in the 2023 vision, should be included in science education programs as a socio-scientific issue.

The Covid 19 pandemic is a socio-scientific issue that affects the society at a high level, as the other socio-scientific issues, involves controversial situations with its applications in society and has the characteristics of different opinions among scientists. (Yapıcıoğlu, 2020). The Covid 19 epidemic emerged in Wuhan, China in December 2019 and has become a pandemic that has affected the whole world as of March 2020. Changes have been made in the functioning of many areas such as health, education, tourism, business sector and economy all over the world since 2020 due to the Covid 19 pandemic. With this disease, terms such as pandemic, symptomatic, asymptomatic, physical distance, SARS, virus, epidemic, immunity, vaccine, quarantine, isolation and ways of protection from viruses began to be heard frequently in all media, among politicians and scientists, in short in all areas of life these terms tried to understand. Thus, it has been revealed that the epidemic is a multidimensional health problem that touches every aspect of life and needs to be understood in different disciplines (Dillon & Avraamidou, 2020). There is no guarantee that the pandemic experienced today with Covid 19 will not be repeated with similar or different diseases in the future. According to Yapıcıoğlu (2020), this epidemic period "although it seems like a break from daily life in the world, it is actually an internship period in which efforts are made against the effects of a scientific event that is happening now and is predicted to happen in the future". The Covid 19 pandemic is a global socio-scientific issue, and scientific studies and discussions on the subject still continue. All individuals should take an active role in the solution of the global problem. In general, this shows that there are new needs in the field of education, especially in science curricula, in socio-scientific issues that concern all humanity, such as epidemics (Saunders & Rennie, 2013).

What is expected from individuals during the epidemic is, as a good science literate, to make sense of the explanations made by different sources, to distinguish between scientific and non-scientific views, to make decisions by evaluating socio-scientific aspects, to exhibit behaviors that take into account scientific results, and to take an active role in solving the problem that concerns all humanity (Holbrook & Rannikmae, 2009; Yapıcıoğlu, 2020). Dillon and Avraamidou (2020) in their study, in which they investigated how much science education programs prepared the society for the Covid 19 pandemic period, they claimed that although the importance of science literacy is often emphasized in science education programs, individuals are not science literate and described people's behavior during the pandemic process as science illiterate. In addition, in some studies evaluating cognitive skills on the subject of diseases, it has been determined that students have misunderstandings and misconceptions about this subject (Takmaz, 2019). In the studies, it is stated that the information sources of individuals are mostly from social media, and there is a lot of information pollution in the media and digital platforms that will expose the public to false beliefs and misconceptions (Konuk & Güntaş, 2019; Yapıcıoğlu, 2020). In this regard, schools have important duties to individuals in the process of making decisions by using high-level thinking skills in the light of scientific data and implementing them in their daily lives (Koçakoğlu, 2016; Takmaz & Yılmaz, 2020). Schools are preparation environment for life that are important for the healthy development of students academically, socially and emotionally (Erduran, 2020; Follari & Navaratne, 2019; Şirin, 2020; Taneri & Kılıç, 2020). As a matter of fact, the education programs that implemented in schools aims to contribute to the solution of social problems (Coşkun, 2017). In this direction, it is of great importance that teachers and students have knowledge about a subject such as epidemic diseases that

seriously affect the whole world, considering the place and role of the teacher and student in society (Hacettepe University, 2017; İnceoğlu, 2004; Köse & Demir, 2014; Meşeci, 2008; The sun, 2020).

The emergence and subsequent developments of the Covid-19 pandemic, which encountered all over the world, the danger of epidemics and the changes and developments in vaccination methods reveal that the acquisitions related to epidemic diseases should be included in science teaching programs. Including the subject of epidemic diseases in science education programs like other socio-scientific subjects will contribute to the development of individuals' judgment and decision-making skills by confronting individuals with some scientific, moral and ethical dilemmas (Yapıcıoğlu, 2020). This situation requires that today's education programs be planned in a way that will form the basis for raising responsible, conscious and sensitive citizens of the future (UNICEF, 2020). In this context, science education programs should comply with the requirements of the age and meet the needs of the individual and society (Koçakoğlu, 2016; Takmaz & Yılmaz, 2020). In order to evaluate the curriculum in terms of functionality in the planning process, it is considered important and necessary to get the opinions of teachers who take an active role in the implementation of the curriculum (Handal & Herrington, 2003; Karaman & Karaman, 2016; Özcan et al., 2018; Saraç & Yıldırım, 2019; Takmaz, 2019). In this context, national and international academic studies on education and training programs are examined and opinions are taken from teachers (MoNE, 2018a). In some studies, in which the opinions of teachers on the curriculum were taken, it was concluded that the objectives related to socio-scientific issues in the updated 2018 science curriculum did not find enough place among the achievements at some grade levels (Coşkun, 2017, Demirci Güler & Açıkgöz, 2019; Deveci, 2018; Deveci & Aydiz, 2021; Kalemkuş, 2021; Özcan & Koştur, 2019; Saraç & Yıldırım, 2019; Yapıcıoğlu, 2020).

In the literature review, it is seen that there is a limited studies on the inclusion of epidemic diseases, which gained importance with the Covid 19 epidemic, in the curriculum. In this context, Yapıcıoğlu (2020), in his study to examine the Covid 19 pandemic as a socio-scientific issue in science education and to offer model application suggestions for science teaching, examined why “Covid 19” is a socio-scientific issue and presented examples of applications such as cartoons, dilemma cards and problem scenarios that can be used in teaching this subject in science programs. Although this study contributes to science teaching with applications that can be used in teaching the subject of epidemic diseases, there is a need for new studies on teaching approaches and course materials that can be used in the teaching of socioscientific issues in science courses (Genç & Genç, 2017; Tyrrell & Calinger, 2020). It is thought that the data obtained with this study will contribute to the arrangement of the to be updated science curriculum and It is thought that it will contribute to the academic studies in the field of science curriculum in terms of interview questions and emerging findings.

In this study, it is aimed to reveal the views of science teachers working in Turkey about the inclusion of epidemic diseases in science curriculum. In line with the purpose of the study, the research question was determined as "What are the teachers' views on the inclusion of epidemic diseases in the science curriculum?"

Method

Research Design

In this study, phenomenology was used as a research design. Phenomenology provides a suitable ground for the investigation of phenomena that individuals are not completely unfamiliar with but at the same time cannot fully grasp. The phenomenology design focuses on phenomena that are awared of but do not have in-depth knowledge about (Yıldırım & Şimşek, 2016; Creswell, 2007).

Working Group

The participants of this study were determined by purposeful sampling methods. Purposeful sampling method is a type of sampling that emerges in qualitative research and allows many events and phenomena to be discovered and explained. (Yıldırım & Şimşek, 2016). Purposeful sampling allows for in-depth study of events that are assumed to contain rich information. In purposeful samples, researchers select participants according to their characteristics suitable for the purpose of the research. Participants can be selected in this sample type because of their experience in the subject studied or their knowledge of the subject studied (Patton, 2002). In this study, criterion sampling, which is one of the purposeful sampling types, was used. The criterion sampling method is aimed at studying situations that meet a predetermined group criterion (Yıldırım & Şimşek, 2016). In criterion sampling selection, the criterion that meets the situation studied is determined by the researcher or the

appropriate one is selected from the prepared list of criteria (Marshall & Rossman, 2014). Any situation or event that is included in the subject of the research can be determined as the criterion of the study (Grix, 2010). The criterion in this study, in accordance with the purpose of the research, is that the sample consists of science teachers with a certain experience. In this direction, the sample of the study consisted of six science teachers who had at least five years of experience and were involved in the development of science curriculum in previous years. The reason why the experienced teacher is the criterion while determining the sample is that the teachers have knowledge about the recently updated science course curriculum. The reason for choosing the teachers involved in the science curriculum process is that teachers who have previously gained experience regarding to new updates in the curriculum are thought to have rich knowledge.

In order to determine the teachers to be included in the study, 10 teachers were interviewed at first and the teachers to be included in the study were determined according to the results of that interview. During the interview, the teachers were asked how many years of professional experience they have and whether they participated in the preparation of science course curriculum or undergo any information training. As a result of the interview, six teachers, two women and four men, who had at least five years of experience and were involved in the curriculum development process, formed the sample of the study. Demographic information of the working group is shown in Table 1.

Table 1. Demographic information of teachers participating in the study

Participants	Gender	Professional Experience	Training in Program Development
P1	Male	19 years	Master's, development study of 2013-2018 science course curriculum
P2	Male	13 years	Introduction of 2018 science course curriculum
P3	Female	11 years	Development study of 2018 science course curriculum
P4	Male	22 years	Introduction of 2018 science course curriculum
P5	Male	16 years	Master's, development study of 2013-2018 science course curriculum
P6	Female	9 years	Introduction of 2018 science course curriculum

Data Collection Tool

As a data collection tool in the study, a semi-structured interview form was used to determine the opinions of teachers about the inclusion of epidemic diseases in the science curriculum. In phenomenological studies conducted to reveal and interpret the perceptions of individuals about a certain phenomenon, generally interview questions are used (Fraenkel & Wallen, 1993). Interviewing provides the participants with the opportunity to express their thoughts on a determined subject in a more detailed and a deeper way (Çepni, 2012). In this study, interview questions were included in the collection of data in accordance with the design and purpose of the research.

The interview form was created by the researchers. The interview form consisting of five questions was asked to two research associates who are experts in the field of science education, two science teachers and one Turkish language teacher, and it was rearranged after the received feedbacks. In this context; In line with the opinions of the science education specialists, “Do you think it is important to have knowledge about epidemics? question was added to the interview questions; After the feedbacks received from the science teachers and the Turkish language teacher, the question “Do you think there are advantages and difficulties in including the subject of epidemic diseases in science curriculum?” was changed to “Do you think it would provide an advantage or disadvantage to include the subject of epidemics in science curriculum?”. The interview form which consists of six questions is finalized with the arrangements made after the feedback received.

Interview Questios:

1. Do you think it is important to be informed about epidemics?
a. If your answer is yes, explain the reason by evaluating it from the perspective of the teacher and the student.
b. If your answer is no, explain why.
2. Do you think that school is important for students to have knowledge about epidemic diseases?
a. If your answer is yes, explain why.
b. If your answer is no, explain why.

3. What do you think about the inclusion of epidemic diseases in science curriculum?
a. If you think it is necessary to include this subject in the program; Evaluate in terms of achievement, content, grade level and time (beginning, middle or end of the semester).
b. If you do not think it is necessary to include this topic in the program, explain why.
4. Do you think it would be advantageous to include the subject of epidemic diseases in science education programs?
a. If yes, what are these advantages?
b. If your answer is no, explain why.
5 Do you think it would be disadvantageous to include the subject of epidemic diseases in science education programs?
a. If yes, what are these disadvantages?
b. If your answer is no, explain why.
6. How do you think the subject of epidemic diseases should be taught effectively if it is included in the science curriculum?
a. Evaluate in terms of teaching/learning method.
b. Evaluate in terms of teaching material.

Data Collection Process, Validity and Reliability

It was stated to the science teachers in the study group before the interview that the interviews would be recorded and the records would only be used by the researchers. Interviews were held online via Zoom and each interview lasted approximately 20 minutes. The audio recordings were documented. In order to ensure internal validity in the study; a long-term interaction was ensured between the researcher and the participant, after the audio recordings taken at the end of the interview are documented, the participant's confirmation was obtained by allowing them to be read again by them, direct quotations were included in the findings section. In order to ensure external validity; purposeful sampling was made and the sample was selected suitable for the research topic of the study, the data obtained at the end of the study were described in detail and analyzed in depth. In order to ensure internal reliability; the codes, categories and themes created for the data obtained from the study were reviewed by two science education experts and a consistency analysis was carried out, in the findings section, the data was presented without any comment. In order to ensure external reliability, the data obtained from the study were compared with the raw data by two science education experts and a confirmation survey was made.

Data Analysis

The data obtained as a result of the interviews with the science teachers were analyzed by content analysis. Inductive analysis, which is one of the content analysis types, was used in the analysis of the data obtained within the scope of the research (Yıldırım & Şimşek, 2016). The main purpose of content analysis is to reach the concepts that will fully explain the obtained data and to establish relationships between them (Miles & Huberman, 1994). For this purpose, first of all, the data obtained from the participants' opinions were examined and codes were created. Afterwards, the similarities and differences of the codes were examined, and the related codes were brought together to determine category and themes. While doing content analysis, the transcripts were first examined by one of the researchers and the codes, categories and themes based on the data were determined, then the transcripts were revised by two science education specialists and the codes, categories and themes were rearranged accordingly. The four themes determined as a result of these arrangements are given in Table 2.

Table 2. Themes created by data analysis

Theme Number	Theme
1	The Role of School, Teacher and Student in Having Knowledge on Epidemics
2	Reasons, Advantages and Disadvantages of the Inclusion of Epidemic Diseases in Science Curriculum
3	Suggested Outcome Contents, Grade Levels and Term/Unit to Include Epidemic Diseases in Science Curriculum
4	Teaching Methods and Materials of Epidemic Diseases Subject

Results

The findings of the research were obtained from interviews with science teachers who participated in curriculum development trainings and had at least five years of experience. The codes created as a result of the analysis of the data obtained from the interviews with the teachers were collected under four different themes and presented in the form of tables.

The First Theme: The Role of School, Teacher and Student in Having Knowledge on Epidemics

In the study, the participants were asked to evaluate the roles school, teacher and student in having knowledge about epidemic diseases. The categories, codes and the distribution of participants, which was created by considering the data obtained in this context, which created accordingly to the theme of *"The Role of School, Teacher and Student in Having Knowledge on Epidemics"* are given in Table 3.

Table 3. The Role of School, Teacher and Student in Having Knowledge on Epidemics

Categories	Codes	Participants
The role of school	Reliable source of information	P1, P2, P3, P5, P6
	Effective force	P1
	Problem solving environment	P1
	Primary source	P1
	Widespread influence	P1
	Effective teaching/education environment	P2, P3, P6
	Effective communication environment	P4
	Long time frame	P6
The role of teacher	Education leader	P1, P2, P3, P4, P5, P6
	Role model	P1, P4
The Role of student	Conscious individual	P1, P2, P3, P5, P6
	Widespread impact	P1, P2, P3, P4, P5

The majority of the teachers think that the school has an important place in having knowledge about epidemic diseases because it is a source of reliable information. P2 expressed his thoughts on this subject, "*The most accurate resource will be the school here. The media may not be an accurate enough source or there may be very different predictions and opinions. Not every information on the media, on the television, is correct. That's why it's very important for them to learn at school*". P3 expressed his opinion in support of P2's view, "...*I think the true knowledge is learned at schoo*l". In addition to this, participant P1 thinks that the school is important because of "effective force", "problem solving environment", "primary resource" and "widespread influence". P1's thought on the school being an effective power, "*You can gather millions of children and give education to them at the same time in institutions we refer as schools. This is actually a very powerful force. In other words, imagine that you are providing education to 15-16 million students living in Turkey at the same time. Imagine training them at the same time and on the same day, and that's 48 million when 16 million go to their home and at least tell these into two person. When you compare it to this population, this is a very large and rapid determination, which is really the place for schools, why schools are important in terms of another aspect of this, that is, the speed of this work is important in terms of improving maneuverability immediately*." While expressing his opinion, he also touches the subject "widespread influence" as following: "*Education from schools spreads to the environment. It is a spiral, in this respect, it can spread to the environment, that is, the child goes home, tells it to parents at home, tells it to the neighbor, it spreads like this and becomes effective*". While P2 referred to the school as an effective teaching environment, P3 and P6 drew attention to the school's being an educational environment. P3 made a statement for the educational environment, "*School is not just a teaching place. The minister of national education and training, that is in the name, is not teaching its actually education. Education means a place where we can learn not only information about courses but also the whole social life*." While P4 expressed the importance of effective communication at school, P6 stated that it has an important place in this regard due to the time period the student spends at school. On this subject, P6 expressed his opinion as, "*If we consider the process he spent from the age of 5-6 until the age of 17-18, he spends more time at school than at home. He needs to learn this at school or he should have knowledge about it at school*".

The science teachers have opinions about the "education leader" and "role model" codes of the teachers regarding the "The Importance of Having a Knowledge about Epidemics for Teachers" (Table 3). All of the participants think that teachers should have knowledge about epidemic diseases due to their profession. In this context, his opinion of P1 on the education leader code is, "*Teachers are a professional group that can*

penetrate into the smallest capillaries in societies. That's why, because we educate people's children, children can spread about the information about epidemic disease that we teach them by telling their families, neighbors, relatives, elders and minors at home." In addition to these, P1 and P4 think that teachers should have knowledge about this subject in order to be a positive role model in society. P4's opinion on this issue is expressed as, "*I think we need to have detailed information about the epidemic in order to protect ourselves, protect our students and be a positive role model for the society*."

The teachers expressed their views on the codes of "conscious individual" and "pervasive influence". Five of the participants think that students should have knowledge about epidemic diseases in order to be conscious individuals. In this regard, the participants emphasized the contribution of the conscious individual to the formation of a conscious society. For example, P4 thought, "*You know, each student means a family. The cornerstone of society means that the better we explain these to our children, and the better we can teach them in the desired direction, that is, in the educational dimension, they teach their families. If their families are educated, what will the society do, they will be more conscious*", while in P5 "*Learning this and raising awareness about it will cause such epidemics to be prevented before it spreads in a much shorter time, I think. In the future, they will know and apply to their lives, they will grow up, they will raise their children themselves accordingly*". Five of the participants agree that students' knowledge about epidemics will have a widespread effect on society. Regarding the widespread effect, P2 said, "*If the student has information on this subject, he will have an impact on the people around him, his family, I don't know, his friends around him. The student is actually a light of the environment, in my opinion, the building of the environment. It will also illuminate the environment somehow. That is why it is very important for students to have knowledge about this issue*".

Second Theme: Reasons, Advantages and Disadvantages of the Inclusion of Epidemic Diseases in Science Curriculum

The categories, codes, and the distribution of participants regarding these codes are given in Table 4 under the theme of "*Reasons, Advantages and Disadvantages of the Inclusion of Epidemic Diseases in Science Curriculum*", which was formed by taking into account the reasoned opinions of science teachers regarding the inclusion of epidemic diseases in science curriculum.

Table 4. Reasons, advantages and disadvantages of the inclusion of epidemic diseases in science curriculum

Categories	Codes	Participants
Reasons	Raising a conscious generation	P1, P3, P4, P5, P6
	Topicality	P1, P3
	Socio-scientific issue	P3
	Daily life relationship	P2, P4
	Early education	P4
Advantages	Reliable knowledge	P3, P6
	Social awareness	P1, P2, P4, P5
	Widespread effect	P2, P3
Disadvantages	Increasing the number of learning outcomes	P1
	The teacher can share his/her opinion	P3
	Some learning outcomes may be deducted.	P5

P1, P3, P4, P5 and P6 think that epidemic diseases should be included in the science curriculum in order to raise a conscious generation. P5's thought on this subject was, "*It should be. Of course, the most important factor here is science learning and teaching, raising students' awareness, but the best course to explain the reasons and studies related to them is science courses*." P1 also thinks that the science course should cover the issue of epidemics because science course is up-to-date information. P1 thinks that "*Science course is a course that follows the current. For example, based on the recent developments in the world on space, our ministry of national education has reflected the space subject in the programs of 6, 7, 8. grades*". P3 stated similar to P1 that current issues should be included in the science course, and also expressed that the issue of epidemic diseases should be included in the curriculum because it is a socio-scientific issue. P3 expressed this opinion as, "*Actually, we try to include all global problems and social problems in science educational books and curriculum. We see applications such as recycling, global warming, genetic engineering, biotechnology as a whole in science books, which are actually current and socioscientific issues. That's why the issue of epidemic diseases related to this sudden pandemic should be placed at grade levels and in relation to other subjects definitely included in the program*". P4 of the participants explained their views on the need for the subject of epidemic diseases to be included in the science course based on the contribution of the science course to daily

life and educating the individual at an early age. P2 expressed as, "*I think that the importance of this has been understood much more after the covid disease. Because I attend the classes of the 5th, 6th, 7th, 8th grades, science lessons are not given detailed information about other diseases, even measles, typhoid or cholera, let alone epidemic diseases. In other words, there is no information that we can explain the essence of many issues related to infectious diseases, epidemics, yes, infectious diseases*".

In Table 4, it is seen that some of the science teachers think that the inclusion of epidemic diseases in science teaching programs will provide an advantage in terms of reliable knowledge, social awareness and widespread impact. Referring to the advantage of the teacher's role in sharing relable knowledge, P6 expressed as, "*If this subject is included in the program, at least they will have learned the information from the right place. Maybe the teacher is not the one who conveys the information directly, but the one who guides in learning the information. In this way, correct information can be provided to students through teaching*". P2 made a statement for social awareness and widespread impact as, "*Children are at the center of learning. Since children sits in the center for teaching to the environment, I think that if these topics will include in our programs and if we can explain them in a really good way and teach them to the children, we can increase the awareness of this society*". P1 stated referring to the advantages of social awareness as, "*Scientific literacy is important here. In such events, it is to our advantage to give this education in the science curriculum in order to read the scientific course of the event and to predict how it will progress scientifically*".

The participants' views on the disadvantages of the inclusion of epidemic diseases in the science course curriculum are limited (Table 4). While P1 of the participants stated that adding the subject of epidemic diseases to the programs would increase the number of achievements as a disadvantage, P3 thought that it would be a disadvantage for the teacher to share his/her own opinion because the subject of epidemics is a socio-scientific subject. P3 expressed this thought as "*It may be a disadvantage for the teacher to share his/her own opinion, that is, an opinion of his/her own, not the information*". Thinking that it might cause elimination of some attainments, P5 said, "*For example, plate movements were telling before that. Not at the moment, for example, we put the climate instead. When we are talking about the occurrence of an earthquake, we explain what an earthquake is without telling about destructive natural events. You know, it's just a wobble, something is destroyed and you can see them, I think it was good, but now it has been eliminated, so adding topics might be a disadvantage since it may cause some topics to come out*". Participants P2, P4 and P6 stated that inclusion of epidemic diseases in science education programs would not cause any disadvantage.

Third Theme: Suggested Outcome Contents, Grade Levels and Term/Units to Include Epidemic Diseases in Science Curriculum

The categories, codes and the distribution of the participants for the theme of "*Suggested Outcome Contents, Grade Levels and Term/Units to Include Epidemic Diseases in Science Curriculum",* which was formed with opinions of science teachers, are given in Table 5.

Table 5. Outcome contents, grade levels and term/units to include epidemic diseases in science curriculum

Categories	Codes	Participants
Suggested outcome contents	Ways to avoid epidemics	P1, P2, P3, P5, P6
	Definition of epidemic disease	P3, P4, P5, P6
	Ways of spreading epidemics	P1, P3, P6
	History of epidemics	P1, P5
	Effects of epidemics	P5, P6
	Treatment methods of epidemic diseases	P1, P4
	Vaccine	P1, P3
	Virus and mutation	P3
	Causes of epidemic disease	P4
	The importance of epidemics	P5
Suggested grade levels	All grades from kindergarten	P4
	from 1 to 8	P1, P2
	from 5 to 8	P3, P5, P6
Suggested term/unit	First semester unit	P1, P2, P3, P4, P6
	According to the relationship status with current learning outcomes	P3
	After the subject of systems and living things	P5

The majority of the participants think that the concept of ways to protect against epidemic diseases should be included in the learning outcomes. P2 made a statement on the ways of protection from epidemic diseases as, "*Paths of prevention from diseases for each class level. You know, the mask distance and cleaning issues we are talking about can be given in a little more detail. Maybe we can emphasize that the cleaning habit that we always try to gain is more important here*". After this suggestion, the most frequently mentioned concepts are the definition of epidemic disease and the ways of spreading epidemics. P3 on her view of the ways in which epidemics spread as, "*What is a mask, how is it used? Who does it hurt when it goes under the nose, why do we have to close our mouths? For example, we can teach this, we can teach that the virus is transmitted through droplets*". Two participants each think that the history of epidemic diseases, the effects of epidemic diseases, treatment methods of epidemic diseases and vaccine concepts should be included in the learning outcomes. P3's explained her opinions on these as, "*My opinion is that keeping general hygiene in the first stages a learning program and the history of epidemic diseases as general rules and from the fifth grade on, including how the course of epidemics progresses should be made by a scientific commission based on the data obtained in the light of scientific facts and scientific articles and theses by from*". In addition to these, P3 stated in the concepts of virus and mutation, P4 stated causes of epidemics, and P5 stated the importance of epidemic diseases and whether it should be included in the learning outcomes. P4 expressed his opinion on this subject as, "*First, the child should be given a definition of the disease, the factors that cause the disease should be explained, what can be done for the treatment of the disease and what are the technological developments used in the treatment of the disease? Content suitable for that class can be prepared at each grade level and these can be taught in the lessons*".

In Table 5, when the answers given by the science teachers regarding the grade levels recommended to be included in the curriculum of the epidemic diseases are examined, it is seen that the opinions on the codes of "all classes starting from kindergarten", "from 1 to 8", "from 5 to 8" are appears to have arisen. P4 stated that these codes should be started from kindergarten and expressed as, "*It should even be started from pre-school, because a tree bends when it is wet. The child will make it a habit and you know that habits in us need to be repeated a lot in order to fit together, and it is much easier for young children to gain such habits. You know, as the individual gets older, it becomes difficult to gain this*". There are three participants who think that it should be given from the fifth to the eighth grade. Among them, P5 stated as, "*These should be given from the fifth grade. Then, sixth grade and seventh grade will of course learn about cells. They will learn the subject of living things, in the fifth grade, they will learn cells and systems in later subjects. Therefore, after these subjects are covered, especially after the biology subjects, they learned about the epidemic diseases such as the cell, they learned about the living things, what kind of creatures they cause epidemics in us, what can be done to prevent such epidemics should be given*".

The science teachers have suggestions regarding the term/unit recommended to be included in the science curriculum such as "first semester first unit", "according to the current learning outcomes", "after systems and living things". P3 suggested that the first unit should be in the first semester: "Actually, the beginning of the semester seems to be more appropriate for this. It can be integrated into a subject at the beginning of the semester, because a learned subject can be talked about for a year." While P1 states, "*If the issue of epidemics is given to our children, especially at the beginning of the year, maybe in the first units, we can prevent our children from getting sick as a result of our children knowing the ways of infecting each other throughout the year when we teach them the importance of washing their hands and using cologne, or not using each other's private belongings.*" P5 expressed this while stating that the topic of epidemics should be given after the topic of systems and living things, as "*I think the topic of epidemics can be added to the end of the topic of systems and living things in a spiral way as an outcome as 5,6,7 learned the topics*".

Fourth Theme: Teaching Methods and Materials of Epidemic Diseases Subject

The categories, codes and distribution of participants for the theme of "*Teaching Methods and Materials of Epidemic Diseases Subject*", which was created in line with the views of science teachers on the methods and materials that can be used in the learning of the subject of epidemic diseases, are given in Table 6. All of the participants think that the case study method can be used in learning the subject of epidemic diseases. P2 expressed this thought as, "*It may be that someone who has experienced this event, who has gone through this epidemic disease process, comes to the class and somehow tells what happened to them.*" P3 and P6 of the participants think that the project method can be used. P3 expressed his opinion on the project as, "*We can even carry it out of school in order to raise awareness of the benefits of the vaccine. In other words, we can make this promotion in nursing homes and social places. I think that with this kind of project, teaching can be much more enjoyable and permanent*". P2 and P5 presented the expert invitation technique as a suggestion. P5 expressed

his opinion as, "*The doctors living in this period can be very important, I think they can come and give seminars at schools and tell their experiences*". P5 also thinks that the experimental method can be used. P3, who had a similar view with P5 about the test method, expressed his opinion as, "*For example, we can test how the mask prevents a droplet, we can put a cotton ball on the outside, we can show that it does not settle at the cotton, with such activities*". Some of the participants think that scenario writing, discussion, drama, problem solving, observation, role playing, research analysis, simulation and demonstration methods/techniques can be used in the learning of the subject of epidemics.

Table 6. Teaching Methods and Materials of Epidemic Diseases Subject

Categories	Codes	Participants
Teaching methods	Case study	P1, P2, P3, P4, P5, P6
	Project	P3, P6
	Expert invitation	P2, P5
	Experiment	P3, P5
	Writing a script	P1, P6
	Discussion	P1, P3
	Drama	P2, P6
	Problem solving	P3, P6
	Observation	P4, P6
	Role playing	P2
	Research review	P4
	Simulation	P4
	Show	P5
Teaching materials	Video	P1, P2, P3, P4, P5, P6
	Picture/Photo	P4, P6
	Printed materials	P3, P4, P6
	Real object	P5
	Slide	P4

Six participants think that videos related to epidemic diseases can be used as material. P6 thought that documentary films could be used as material and explained as, "*For example, if they watch a documentary that tells a story about the process of an epidemic, maybe it will be a more effective learning*". P1 expressed this opinion as, "*For example, when we sneeze, why should we sneeze into the elbow? Animation can be developed on such topics. Animations can be developed that can see the bacteria and viruses on the hand with animated or ultraviolet rays between washing our hands for five seconds and ten seconds with soap for five seconds and washing our hands for 30 seconds, depending on the extent of the effect or the importance of ventilation or how well it effects an area when we open the door or the window*". P4's opinion on the printed materials proposal was, "For example, a good set of posters can be made or promotional books can be made and sent to families".

Discussion

This study was carried out to evaluate the views of science teachers about the inclusion of epidemic diseases in the science curriculum. As a result of the data analysis, the case of inclusion of epidemic diseases in the science curriculum was examined under four themes. Schools are teaching and learning environments where teachers and students are together. When we look at the opinions of teachers about the importance of school in having knowledge about epidemic diseases, reliable knowledge source, effective power, problem solving environment, primary source, widespread effect, effective teahing and educationa environment, effective communication environment and the concepts of long time period become prominent. According to Martin, Tett and Kay (1999), schools have an effective structure in preparing individuals for life as well as learning new information, and school and community elements are complementary elements. According to Follari and Navaratne (2019), the primary purpose of school education is to enable students to develop a positive tendency towards learning and develop ability to apply what they have learned. Saban (2008) researched metaphors for school and reached the metaphors of information and enlightenment, guiding and guiding metaphors about school, similar to the results of this study. In addition to being a place of information and guidance, schools also have the task of creating an important environment for promoting wellness (Bentsen et al., 2020). According to Erduran, (2020), students need to understand not only what scientists do, but also how science relates to school lessons, in order to understand a complex subject like the pandemic. According to Taneri and Kılıç (2020), schools are one of the most important environments where students can access the right attitudes and behaviors during epidemics. The studies and the results of this study show that schools are the most effective primary source where students

reach the reliable knowledge and prepare for life. Schools have an important place in providing reliable information on a subject that is closely related to the society, such as epidemics, and make students to experience what they have learned.

With the views of the teachers in the research on the role of teacher in having knowledge about epidemic diseases, it was seen that the concepts of education leader and role model become prominent. Teachers have an important role in shaping the society by raising individuals who are the future of society. It is an indispensable fact that the behaviors of teachers, who are role models for students, are taken as an example by students (İnceoğlu, 2004). Köse and Demir (2014) revealed in their study that teachers impressing the students as role models. The social status of the teaching profession changes over time. However, the teaching profession is a respected profession that plays an active role in the personal, social and academic development of individuals and societies and the development of countries, and has important effects on the transfer of social and cultural values to new generations (Hacettepe University, 2017; Öztürk, Bilir, Uslu, Çalıkoğlu & Çağatay, 2018). In this context, it is very important to have a good education policy in order to strengthen the status of the teaching profession.

Considering the role of student in having knowledge about epidemics diseases, opinions about the students' growing up as conscious individuals and having a widespread effect have emerged. The student can maintain the skills and behaviors he has acquired in school in his life outside of school and in his future life (Meşeci, 2008). In this context, it is important for a student to grow up as a conscious individual in his life outside of school and to transfer this to his environment in terms of the student's role in society. According to the news of National Geographic News, 10-year-old British Tilly Smith while playing on the beach in front of the hotel where they stayed as a tourist in Thailand, he predicted the tsunami caused by the earthquake that occurred in the Indian Ocean on December 26, 2004, and saved about 100 peoples lives around him with the information he learned in geography class and the warnings he made accordingly (Owen, 2005). According to the report, when the tsunami occurred, the student, who was on vacation with his family, realized that the tsunami would come from the movement of the waters while on the beach, and ensured the evacuation of the hotel he was in and saved the lives of the people around him. (The sun, 2020). This news also shows that students have the potential to have a widespread impact by transferring what they have learned. It is thought that a student's knowledge about epidemics is a necessary condition for the student both to raise awareness about these diseases and to share what they have learned with others.

When the reasons for the inclusion of epidemic diseases in the science curriculum are examined according to the views of the teachers, ideas about raising a conscious generation, up-to-dateness, socio-scientific topic, daily life relationship and education at an early age are revealed. Due to its nature, the science course has a quality that sheds light on current issues. It is an important requirement to include current events in the science curriculum in order for students to keep up with the renewed world, because students can access current issues through the curriculum offered (Drake et al., 2014; Taber & Akpan, 2017). The issue of epidemic diseases has become current all over the world with Covid 19 and has gained a socio-scientific character. According to Yıldız (2014), epidemics have existed since ancient times, but societies are not aware of the epidemics. However, it is very important for students to have some prior knowledge of the relevant subjects so that they can reasonably understand the epidemics and act consciously. As stated by the participants, the subject of epidemic diseases is not among the current science curriculum achievements. For this reason, it is an important need to raise public awareness of epidemic diseases, which are suitable for the nature of the science course and have a vital importance, as a socio-scientific subject in the science curriculum. Similarly, Yapıcıoğlu (2020) emphasized in his study that it is important to include the Covid 19 pandemic period in teaching programs because it has a socio-scientific quality. Pietrocola et al. (2021) also emphasized in their studies that the roles of science education should be considered in the education of individuals with the Covid 19 pandemic. Karakuyu and Can (2020) also stated in their studies that science teaching programs should be revised according to the dynamics of life in an applicable way. Also, it is easier to transform the information learned at an early age into behavior, and the education received at an early age forms the basis for the behavior of the individual in the future (Bredekamp, 2015; UNICEF, 2003). For this reason, it is important to give the training for the behaviors desired to be gained to the individual as early as possible.

When the answers given by the teachers regarding the advantages of including the epidemic diseases in science teaching programs are examined, it is seen that the concepts of sharing reliable knowledge, providing social awareness, ensuring widespread influence. The courses in schools are learning environments that play an important role in transforming scientific knowledge into practice and helping students reach reliable information (Takmaz & Yılmaz, 2020; Taneri & Kılıç, 2020). Similarly, in Afacan (2011)'s study, aimed to science lesson in a similar way with metaphors of, facilitating life, enlightening scientifically and guiding with teacher's guidance

become prominent. According to Deboer (2000), all individuals need to adapt to scientific changes, whether they are dealing with science or not. Science education is a way of increasing the quality of social life, apart from preparing individuals for specific scientific professions. Individuals with a good science education and science literacy can understand the relationship between science, technology and society, apply the information they learned theoretically at school in their daily life, and use their ability to make decisions on issues that concern society (Çepni et al., 2003). In this respect, considering that the issue of epidemic diseases is a subject that should be explained scientifically and that concerns the society, it is obvious that it will be advantageous to include this subject in the science curriculum. In addition, teachers who think that the inclusion of this subject in the curriculum may also provide a disadvantage, have put forward ideas that the number of learning outcomes will increase and that teachers may make wrong interpretations about epidemic diseases. However, considering the advantages that can be taken from of such an important subject, it is thought that it would be a good decision to minimize the effects of these disadvantages and to include the subject of epidemic diseases in the science curriculum.

If the subject of epidemic diseases is included in the science course curriculum, when the contents of the learning outcomes that can be included in the program are asked to the teachers, the following views that should be included become prominent, the ways of protection from epidemic diseases, the definition of epidemic disease, the ways of spreading epidemics, the history of epidemic diseases, the effects of epidemic diseases, the treatment methods of epidemic diseases, vaccine, virus, mutation , the causes of epidemics and the importance of the epidemic diseases. The results contain evidence that teachers have difficulties in deciding what should actually be included in the curriculum regarding the teaching of epidemics. Even in a small and selected sample, participants state that different content should be included in the teaching of epidemics. Epidemic is a multidimensional socioscientific issue with a wide content, controversial situations, where there may be disagreements (Yapıcıoğlu, 2020). Therefore, it is not surprising that participants have different views on this issue. In this direction, if the subject of epidemic diseases is included in the science course curriculum, it is thought that it will be right to focus on the content that individuals are trying to make sense of. Similarly, Dillon and Avraamidou (2020) stated in their study that the issues of virus, pandemic, epidemic, quarantine, symptom, and social distance often become top in the agenda in the society and individuals are trying to understand these concepts. Considering in terms of science lesson, what is expected from individuals is while being a good science literate writer, to make sense of the explanations made for these concepts in their own minds and to pass them through a scientific filter (Yapıcıoğlu, 2020).

Teachers have expressed opinions about the class level where epidemic diseases can be included in the curriculum, starting from the kindergarten, first grade and fifth grade. There are differences of opinion among the participants about the class level where the topic of epidemic diseases will be included. This data reflects the difficulty of teachers themselves to define it. The fact that epidemics are a socioscientific issue may be a reason for this. However, each participant provides reasonable justification for their proposed grade level. The participants, who stated that it should be included from kindergarten, explained the reason for this as that it would be easier to transform the information learned at an early age into behavioral acts. Some participants explained their reasons with the principle of spirality. In order to raise a conscious generation, it is an important requirement for individuals to receive a qualified education from pre-school and to comply with the spiral principle for the academic, social and emotional development of students in this education process (MEB, 2018a; Şirin, 2020). Early life is the basis for a child's behavior in the later years of his life. Early interventions in this period will have a lasting effect on individuals' cognitive personalities and social behaviors (Bredekamp, 2015; UNICEF, 2003). Research findings support these data.

In the research, the teachers put forward their ideas that the subject of epidemic diseases in the science curriculum should be in the first unit of the first semester, by associating it with the current achievements or after the systems and living unit. Especially the teachers who stated that the first semester should be in the first unit are in the majority. The participants explained the reason for this as the opportunity to apply the knowledge learned about epidemics throughout the year. In this context, it has been revealed by the results of the study that if the subject of epidemic diseases is included in the science curriculum, it would be appropriate to have the first semester starting from the early grade levels.

When the views of science teachers on teaching methods on epidemic diseases are examined, it is seen that case studies, projects, expert invitations, experiments, scenario writing, discussion, drama, problem solving, observation, role playing, research analysis, simulation, demonstration methods come to the fore. When the opinions about the materials that can be used in the teaching of epidemic diseases are examined, the materials such as video, picture/photographs, printed material, real obje and slide are the emerging opinions for appropriate materials. It is of great importance to use appropriate teaching methods for an effective teaching

(Aydede et al., 2006). It is important to choose teaching methods and techniques that can provide applicability and permanence by students, especially depending on the content of the subject to be taught. Aydede et al. (2006), stated in their study that the nature of the subject should be taken into account in addition to the course materials in the selection of teaching methods and techniques by science teachers. According to Akerson (2005), teachers should choose activities that will make students active in their lectures. In the literature, there are studies stating that teachers frequently use methods such as role playing, drama, experiment, laboratory and demonstration in which students are active (Bardak & Karamustafaoğlu, 2016; Oh & Kim, 2013). On the other hand, there are also studies that teachers stated, these activities such as drama will cause problems in classroom management and cause loss of time (Timur & İmer, 2012; Tekbıyık & Akdeniz, 2008; Kırıkkaya, 2009). With this study, it was emphasized that it would be appropriate to use teaching methods and materials that would make the student active and provide permanent learning in teaching the subject of epidemic diseases. Teaching such an important subject, which affects the whole world deeply, with appropriate teaching methods and techniques is of great importance in terms of both the content of the subject and making what is learned into living.

Conclusion and Suggestions

In this research, the situation of the epidemic diseases and its inclusion in the science curriculum, which has become the agenda of the whole world with the Covid 19 pandemic and which is also a socio-scientific issue, evaluated according to the views of science teachers in terms of school's role, teacher's role, student's role, reasons, advantages and disadvantages, grade level, learning outcomes that can be included in the program, teaching methods-techniques and materials. As a result of the research, it was determined that the teachers thought that the issue of epidemic diseases should be included in the science programs in order to evaluate the issue from a socioscientific perspective. The inclusion of epidemic diseases in science programs is considered important in terms of access to reliable information, ensuring widespread effect, raising conscious individuals, social awareness, daily life relationship, and early education. Teachers think that this education can be given at pre-school, primary and secondary education levels. He has a similar opinion that the topic of epidemic diseases should be in the first semester of the program, but opinions differ on the topics that can be taught. Teachers suggest that the subject of epidemic diseases should be taught with methods and materials that will activate the student and provide permanent learning. Pandemic is a socio-scientific issue that concerns all humanity and needs to be addressed on a global scale. The pandemic needs to be handled in a multifaceted way, with its sociological, economic, political, health and educational dimensions. For this reason, it is suggested that the developers of the science curriculum programs should examine the results of this study, and the researchers should investigate the status of the epidemic diseases in international science curriculums with teachers from different country.

Scientific Ethics Declaration

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

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Author(s) Information

Aynur Cevik
Erciyes University
Institute of Educational Sciences, Kayseri, Turkey
ORCID iD: 0000-0002-7032-6191

Sibel Saracoglu
Erciyes University
Faculty of Education, Department of Mathematics and Science, Kayseri, Turkey
Contact e-mail: saracs@erciyes.edu.tr
ORCID iD: 0000-0001-9023-7383

Hasan Kaya
Erciyes University
Faculty of Education, Department of Mathematics and Science, Kayseri, Turkey
ORCID iD: 0000-0003-3529-9762

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Causes, Consequences and Solitions to Environmental Problems from the Eyes of Preschool Children

Eda Erdas-Kartal, Ezgi Ada

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Abstract

This study is a case study that investigates the perceptions of preschool children about the causes, consequences, and solutions to environmental problems. A total of 41 children participated in the study. The data were obtained by using the draw and explain the technique, which included 3 different drawings and telling the children about the causes, consequences, and solutions of environmental problems. In the analysis of the data, the content analysis method was used. As a result of the research, it was found that the preschool children's perceptions were limited; however, as the age group grows, it has been determined that the icons used in the pictures related to the causes, consequences, and solutions of the environmental problems vary. It was revealed that the children associate the causes and consequences of environmental problems with pollution and the ways of solving environmental problems with the prevention/elimination of this pollution. It has been observed that the number of children related to the destruction of nature and irresponsible consumption of natural resources with environmental problems is very limited. In order to improve children's perceptions of environmental problems, it is suggested that teachers and parents should give more space to activities and games related to the environment in daily flow.

Introduction

The environment is all of the living and inanimate objects that living things can meet all their needs in order to survive (Zayimoğlu-Öztürk et al., 2015). The intense need for raw materials, energy, and space as a result of advances in technology and rapid population growth; has caused the destruction of the natural environment and resources and the deterioration of the natural balance in our environment (Kahyaoğlu & Kaya, 2012). The density of wastes accumulating in nature has reached levels that threaten the ecological balance (Yücel & Morgil, 1998). These events, which directly or indirectly affect the life of living things negatively, are defined as environmental problems (Göney, 2004). Many negativities such as unplanned urbanization, drying up and polluted water resources, diminishing biodiversity, destroyed nature, consumed natural resources, increasing traffic density, fertile agricultural lands filled with residential areas or industrial facilities, increasing pollution, climate changes, global warming, melting of polar glaciers. It is one of the environmental problems that people try to take precautions (Efe, 1999). Due to the current environmental problems reaching unmanageable levels, children are now born into a more polluted, poorer world, where climate changes are intense, natural products are decreasing and biodiversity is being destroyed (Ahi & Alisinanoğlu, 2016). The increase in today's environmental problems, where human impact is felt intensely, directly or indirectly, has revealed the necessity of educating people in a more conscious and sensitive manner towards the environment. In other words, informing people about the causes and possible consequences of environmental problems and making them sensitive to these problems; These problems have reached a critical level today because they threaten vitality (Harman & Çelikler, 2016). Training to be given to individuals about protecting the environment from their childhood years will yield more effective results than the laws arranged to prevent environmental problems (Aksoy & Karatekin, 2011). Unless people make certain changes in their lifestyles that pollute the environment and cause environmental problems, it is obvious that environmental problems that threaten the vitality and the world cannot be solved (Selvi, 2007). For this reason, it is very important to provide environmental education to individuals of all age groups that will enable them to be more conscious and sensitive to the environment (Pınar & Yakışan, 2016).

Environmental education was defined in the Tbilisi Conference, the first international conference on the environment, held in 1977. It is defined as 'all the efforts made to prevent a new one to these problems, aiming to develop the population of the country' (UNESCO, 1978; cited in Kurt Gökçeli, 2015). A qualified

environmental education provides support to individuals in making effective decisions in order to protect the environment in which they live and transforming this into behavior (Nagra, 2010). It is very important to start environmental education from an early age (Wells & Davey-Zeece, 2007). Because children who recognize their environment from an early age and display sensitive and protective attitudes and behaviors towards their environment tend to continue this approach in the later stages of their lives (Robertson, 2008). In addition, most of the children today live away from nature due to increasing environmental problems and the necessity of living in urban conditions. Under these conditions, it seems possible for children to get to know the natural environment and develop positive attitudes and behaviors towards the environment only with environmental education given to them from an early age (Kurt Gökçeli, 2015). Children who have a sufficient understanding of the environment can be a part of the solution of these problems over time, as they have knowledge about environmental problems (Marin & Yıldırım, 2004). Therefore, raising children's awareness of the causes and consequences of environmental problems and environmental protection from their childhood is important in terms of raising a generation that is more sensitive to the environment and protecting the environment and can produce solutions to existing environmental problems (Özkul, 2018).

The preschool period, as in all development areas and concepts, has critical importance in acquiring and transferring the acquisitions aimed at protecting the environment (Essa, 2005; Güler-Yıldız, 2017; Smith, 2001). In Palmer et al.'s (1999) study, which aimed to increase the knowledge level of preschool children about the environment, to enable them to develop positive attitudes towards the environment, to enable them to acquire meaningful environmental experiences in order to understand the events occurring in the environment, and to enable them to transfer their experiences to their own lives, when appropriate environmental education is given, children's concepts about the environment They have revealed that they can perceive and begin to exhibit more responsible behaviors, that is, they transfer what they have learned to their lives. Environmental education should be addressed at younger ages in order for children's perceptions of the environment to be shaped at an early age and for their gains at this age to form the basis for their future attitudes and behaviors (Erten, 2004; Smith, 2001). In one of the studies conducted in the context of environmental education in the preschool period, Grodzinska-Jurczak, Stepska, Nieszporek, and Bryda (2006) revealed that preschool children in Poland have sufficient basic concepts about the environment, but exhibit inappropriate behaviors towards the environment. Meiboudi et al. (2011) revealed in their research that preschool children's attitudes towards the environment could be improved by having pictures about the environment made on the wall. In another study, Akbayrak and Kuru Turaşlı (2017) revealed that environmental activities to be carried out in the preschool period improve children's environmental perceptions and awareness. Özkul (2018), on the other hand, revealed that children's perceptions of the environment and environmental problems in this period are mostly limited to garbage and pollution.

Before planning a qualified environmental education program that will raise awareness of children about the environment and environmental problems; it is necessary to reveal the perceptions of these children about the environment and environmental problems, to identify the deficiencies, and to plan the education program accordingly. Although the preschool period has critical importance in the context of environmental education, academic studies are very limited at the national and international levels (Özkul 2018; Kurt Gökçeli, 2015). Studies conducted to determine the perceptions of children about the environment and environmental problems and to develop these perceptions are mostly at primary and secondary school level (Keleş & Keleş, 2018; Laura & Alfredo, 2010; Pınar & Yakisan, 2016; Yalçınkaya, 2013). In addition, the findings of these studies; reveal that children's perceptions of environmental problems are limited to "garbage" and "environmental pollution" even at the primary school level. Again, the findings of these studies reveal that children's perceptions of protecting the environment are limited to "not polluting" and "preventing/warning polluters" (Gülhan & Yurdatapan, 2014; Yılmaz et al., 2016).

This study, it is aimed to reveal the perceptions of preschool children about the causes, consequences, and solutions of environmental problems. In this context, answers to the following research problems were sought in this study:

1. What are the perceptions of preschool children about the causes of environmental problems?
2. What are the perceptions of preschool children about the consequences of environmental problems?
3. What are the perceptions of preschool children about solutions to environmental problems?

It is thought that the findings of this research will guide preschool teachers and educators who design preschool education programs to include environmental education more in daily practices.

Method

Research Design

A qualitative case study design was used in the research since it was aimed to determine the perceptions of children about environmental problems in detail through the pictures they drew and interviews. A case study is a qualitative approach in which researchers collect detailed and in-depth information about a current situation or situation (Creswell, 2007). This research was designed with a single case-holistic design, one of the qualitative research designs. The holistic single-case design is a case design in which there is an analysis unit for a particular case, and the anomalies or peculiarities of this unit are examined holistically (Yin, 1984).

Research Sample

41 children aged 3-6 years (8 children 3 years old, 15 children 4 years old, 18 children 5 years old) attending a public kindergarten in Turkey participated in this research. The sample was determined by a convenient sampling method. The school where the data is collected is also the practice kindergarten of the university. The sample was chosen from among the students whose parents gave permission and who wanted to participate in the study voluntarily.

Data Collection

In this study, the draw-and-tell technique was used to determine children's perceptions of the causes, consequences, and solutions of environmental problems (Bracett- Milburn, 1999; Özsoy, 2012; Shepardson, 2005). This technique is a diagnostic technique that includes children's drawings and explanations about their drawings and is used to understand the concepts that children have and how they structure their thoughts about these concepts (McWhirter et al., 2000). Studies reveal that pictures to be drawn by children are a powerful tool in analyzing the images in children's minds (Rodari, 2007). Again, studies reveal that drawing is the easiest way for children to express their feelings and thoughts, and especially young children can explain situations that they cannot express verbally enough with the pictures they made (Yavuzer, 2005). Drawing a picture is both instructive and ensures that children do not feel any pressure during the research (Barraza, 1999). Drawing a picture makes it possible for young children to visually identify the information in their inner world, to understand their emotions, and to reveal their true thoughts (Minkof & Riley, 2011). When the drawings are analyzed well, it is known that no matter how complex the concept is, it clearly reveals the cognitive structures of individuals and is also effective in revealing the existing schemas in the mind and the relations of these schemas with other schemas (Schafer, 2012). For these reasons, drawing pictures is a popular method used in research for many years (Ahi & Sinanoğlu, 2010).

In this study, data were collected by having children draw 3 different pictures on different days about environmental problems (causes, consequences, and solutions). On the first day, a blank picture paper was distributed to the children, and the children were asked, 'What do you think are the causes of environmental problems? Can you explain your thoughts on this subject by drawing pictures on the blank papers given to you? On the second day, he distributed a blank picture paper to the children again and asked the children, 'What do you think are the consequences of environmental problems? Could you explain your thoughts on this subject by drawing pictures on the blank papers given to you?' On the third and last day of the application, a blank picture sheet was distributed to the children, and the children were asked, 'How do you think environmental problems can be solved? Could you explain your thoughts on this subject by drawing pictures on the blank papers given to you?' The children were asked to explain each picture they drew immediately after that drawing, and the researchers noted the children's explanations about the pictures down. It is used in order to define the explanations about the pictures drawn by the children, the icons they use in their drawings, and to place these icons under the correct themes.

Data Analysis

The interpretative content analysis method was used in the analysis of the data (Banks, 2001). Interpretive content analysis is a qualitative data analysis method in which various themes, topics, and phenomena are determined and interpreted based on data from the data (Giarelli & Tulman, 2003). For this purpose, in the analysis of the data, all the pictures (41x3 pieces) were first examined in order to get a general idea, and all the

icons drawn by the children in their pictures were defined as the codes of the research. New codes obtained during the analysis were added to the code list. In order for the coding to be reliable, two researchers analyzed the pictures semantically separately and the symbols in the pictures were coded using the prepared code list. The coding made by the researchers was compared and a common point of view was tried to be developed in the analysis. The reliability formula of Miles and Huberman (1994) was used to calculate the consistency between encoders. In the first calculation, the inter-coder consistency was calculated as 92%. Icons on which there is no consensus were revised and a common understanding was developed for analysis. In this way, the coding was completed and these codes were gathered under various themes determined based on the relevant literature. The research findings were reported using descriptive tables containing percentages and frequencies, and together with these tables, the pictures drawn by the children and their explanations about the pictures were included in the findings section.

Findings

Children's Perceptions of the Causes of Environmental Problems

Most of the children stated (75.60%) that garbage caused environmental problems in their pictures. It has been revealed that 7.31% of children associate environmental problems with industrial wastes, 2.43% with the destruction of nature, and 2.43% with irresponsible consumption of natural resources. It was determined that these children mostly included the theme of garbage and industrial waste in their pictures (Table 1). The distribution of the themes related to the causes of environmental problems in children's pictures by age is summarized in Table 2.

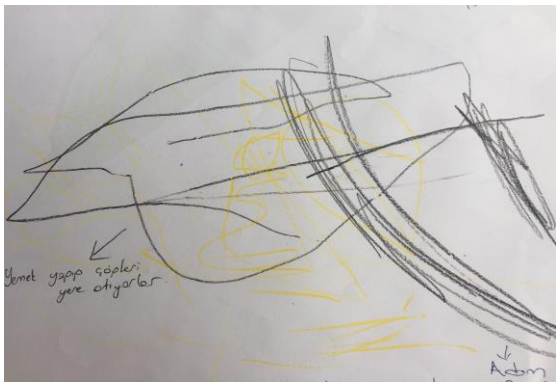
Table 1. The intensity of the detected themes on the causes of environmental problems in the pictures (N:41)

Themes	f	%
Garbage	31	75.60
Industrial waste	3	7.31
Destruction of nature	1	2.43
Irresponsible consumption of natural resources	1	2.43

Table 2. Distribution of themes on causes of environmental problems by age

	Age 3 (N=8)		Age 4 (N=15)		Age 5 (N=18)	
Themes	f	%	f	%	f	%
Garbage	5	62.50	13	86.66	13	72.22
Industrial waste	0	0	1	6.66	2	11.11
Destruction of nature	0	0	0	0	1	5.55
Irresponsible consumption of natural resources	0	0	1	6.66	0	0

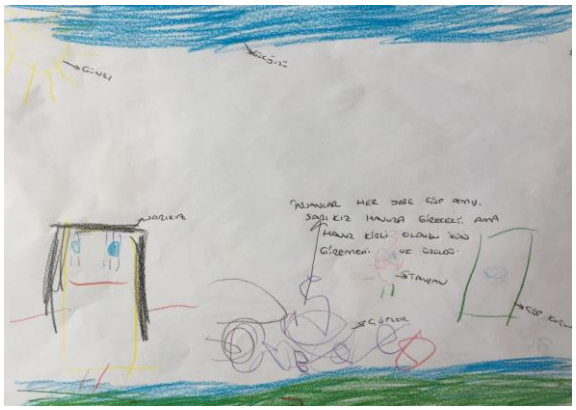
When Table 2 is examined, it is seen that the majority of children in the 3-year-old group (62.50%) associate the reason of environmental problems with not throwing garbage on the ground (Picture 1). The rest of the children in this group did not make any drawings about the causes of environmental problems.



In this picture about the causes of environmental problems, a girl who wants to enter the pool by the pool, a trashcan and garbage on the ground are drawn. In this picture, the child stated that the garbage thrown on the ground caused the environmental problems, this garbage also polluted the water, the girl who wanted to enter the pool could not enter the pool because of the garbage, and therefore she was upset.

Picture 1. A picture with the theme of 'garbage' (3 years old)

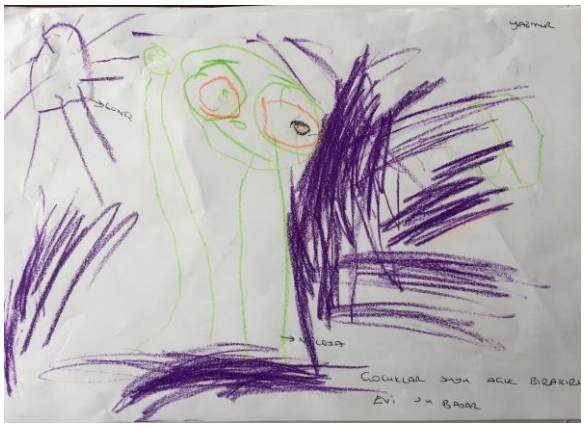
When Table 2 is examined, it is seen that a great majority (86.66%) of children in the 4-year-old group associate the cause of environmental problems with not throwing garbage on the ground, as in the 3-year-old group (Picture 2).



In this picture about the causes of environmental problems, a girl who wants to enter the pool by the pool, a trash can, and garbage on the ground is drawn. In this picture, the child stated that the garbage thrown on the ground caused environmental problems, that this garbage also polluted the water, that the girl who wanted to enter the pool could not enter the pool because of the garbage, and therefore she was upset.

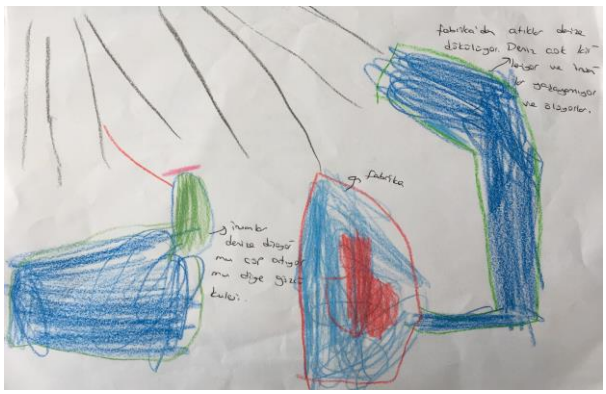
Picture 2. A picture with the theme of 'garbage' (4 years old)

6.66% of the children in this group included the theme of irresponsible consumption of natural resources (Picture 3) and 6.66% of them included the theme of industrial waste (Picture 4) in their drawings.



In this picture about the causes of environmental problems, the sad children are drawn in green, and the surrounding waters are drawn in purple and scattered. In this picture, the child stated that the water left open causes environmental problems, that we should not waste water unnecessarily, and that if we leave the taps open at home, the house may flood.

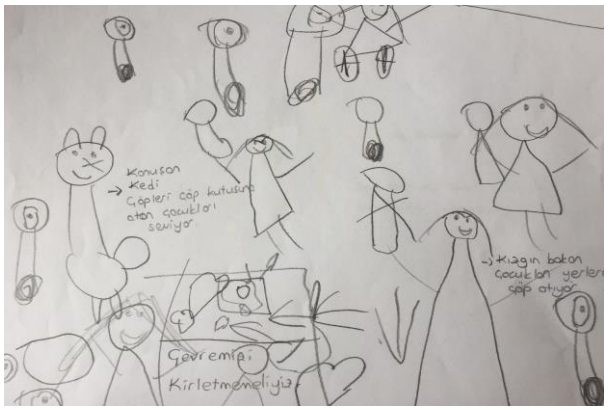
Picture 3. A picture with the theme of 'irresponsible consumption of natural resources' (4 years old)



An observation tower and a factory are drawn in this picture
about the causes of environmental problems. In this picture, the child stated that the wastes left in the sea from the factories caused the environmental problems, that the sea was polluted in this way, and that this situation threatened people's lives.

Picture 4. A picture featuring the theme of 'industrial wastes' (4 years old)

When Table 2 is examined, it is seen that the majority of children in the 5-year-old group (72.22%) associate the cause of environmental problems with not throwing garbage on the ground as in other age groups (Picture 5).



In this picture, which is about the causes of environmental problems, figures of people who throw garbage and do not throw garbage are drawn. Children who do not throw garbage on the ground are depicted as happy; children who throw garbage on the ground are depicted as angry. In this picture, the child stated that the garbage thrown on the ground caused environmental problems.

Picture 5. A picture with the theme of 'garbage' (5 years old)

11.11% of the children in this group included the theme of industrial waste (Picture 6) and 5.55% including the theme of the destruction of nature (Picture 7) in their drawings.

In this picture, which describes the causes of environmental problems, the sea, black oil, and pale algae are drawn on the surface of the sea. In this picture, the child stated that oil wastes polluting the seas cause environmental problems and algae disappear due to pollution.

Picture 6. A picture with the theme of 'industrial wastes' (5 years old)

In this picture about the causes of environmental problems, children jumping into the dirty sea with a slide are drawn. In this picture, the child has associated environmental problems with polluted seas; He stated that throwing the killed animals into the sea pollutes the seas and that there are no trees because they cut down the trees.

Picture 7. A picture featuring the theme of 'destruction of nature' (5 years old)

Children's Perceptions of the Consequences of Environmental Problems

When thepicturesof the children in the study group were examined, it was revealed that the majority of the children (56.51%) associated the consequences of environmental problems with water pollution. In the category of the consequences of environmental problems, 19.5% of the children included the impact on humans, 17.07% on animals, 9.75% on air pollution, 9.75% on natural disasters, 4.87% on plants and 4.87% on soil pollution. determined (Table 3).

Table 3. The intensity of the themes identified about the consequences of environmental problems (N:41)

Themes	f	%
Water pollution	23	56.09
Impact on humans	8	19.51
Impact on animals	7	17.07
Air pollution	4	9.75
Natural disasters	4	9.75
Impact on plants	2	4.87
Soil pollution	2	4.87

It is summarized in Table 4 that the themes related to the content of environmental problems in children's pictures can be experienced.

Table 4. Distribution of themes on the consequences of environmental problems by age

	Age 3 (N=8)		Age 4 (N=15)		Age 5 (N=18)	
Themes	f	%	f	%	f	%
Water pollution	0	0	10	66.66	13	72.22
Impact on humans	1	12.50	4	26.66	3	16.66
Impact on animals	1	12.50	3	20.00	3	16.66
Air pollution	0	0	1	6.66	3	16.66
Natural disasters	2	25.55	0	0	2	11.11
Impact on plants	1	12.50	0	0	1	5.55
Soil pollution	0	0	1	6.66	1	5.55

As seen in Table 4, it has been determined that the majority of children in the 3-year-old group (25.55%) associate the consequences of environmental problems with natural disasters (Picture 8).

In this picture about the consequences of environmental problems, a very hot sun has been drawn. In this picture, the child stated that environmental problems caused the sun to be very hot and that the sun could explode and cause disasters.

Picture 8. A Pictures featuring the theme of 'natural disasters' (3 years old)

It was revealed that some of the children in the 3-year-old group included the themes of the effects of environmental problems on people, animals and plants in their pictures (Picture 9).

In this picture about the consequences of environmental problems, human, animal and plant figures are drawn. In this picture, the child expressed that environmental problems can make people, animals and plants sick.

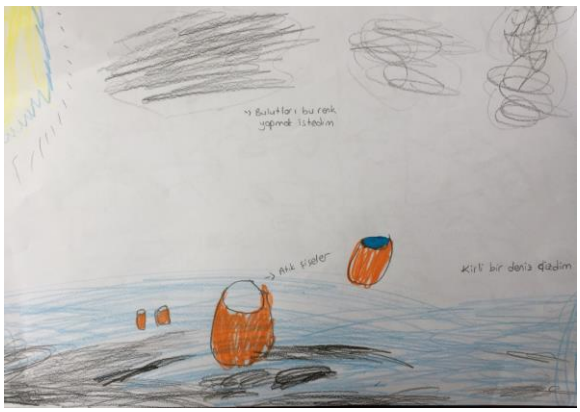
Picture 9. A Picture with themes of 'impact on humans', 'impact on animals' and 'impact on plants' (3 years old)

As can be seen from Table 4, it was revealed that the majority of children in the age group of 4 (66.66%) included the theme of water pollution in their pictures about the consequences of environmental problems (Picture 10).

In this picture about the consequences of environmental problems, various garbage is drawn in the sea and the sea. In this picture, the child expressed that one of the environmental problems, garbage can cause water pollution.

Picture 10. A picture with the theme of 'water pollution' (4 years old)

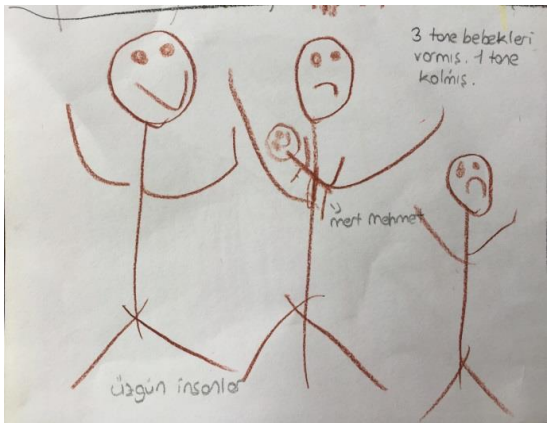
As seen in Table 4, it has been revealed that children in the age group of 5 mostly associate the consequences of environmental problems with water pollution (Picture 11).



In this picture about the consequences of environmental problems, the sea surface is drawn in black because it is dirty, and the clouds on the sea are also drawn in black because the environment is polluted. In this picture, the child stated that the water was polluted as a result of environmental problems.

Picture 11. A Picture with the theme of 'water pollution' (5 years old)

It was determined that the children in this group mostly included the themes of the effects of environmental pollution on humans and animals (Picture 12, Picture 13, Picture 14).

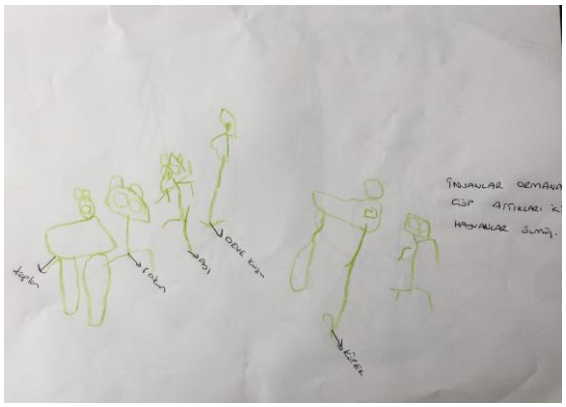


Sad human figures are drawn in this picture about the consequences of environmental problems. In this picture he drew, the child stated that two babies of a family with three babies died due to environmental problems.

Picture 12. A Picture with the theme of 'effect on people' (5 years old)

Sad people and a polluted sea are drawn in this picture about the consequences of environmental problems. In this picture he drew, the child stated that people's boats were sunk due to environmental problems (pollution of the sea) and people were harmed by it.

Picture 13. A picture with the theme of ''effect on people' (5 years old)



In this picture, which is about the consequences of environmental problems, figures of animals and animals are drawn. In this picture, the child stated that people throwing garbage in the forests causes environmental problems and this situation kills the animals in the forest.

Picture 14. A picture with the theme of 'the effect on animals' (5 years old)

Children's Perceptions of Solutions to Environmental Problems

When the pictures drawn by the children about the solutions to environmental problems are examined, it is seen that 14.63% of the children warn/prevent the pollutants, 12.19% do not throw the garbage on the ground, again 12.19% collect the garbage, 7.31% use the recycling and 4.87% save the living things. It was seen that they included protection themes (Table 5).

Table 5. The intensity of the detected themes on the solutions of environmental problems in the pictures (N:4**)**

Themes	**f**	**%**
Warn/prevent the pollutants	6	14.63
Do not throw the garbage on the ground	5	12.19
Collect the garbage	5	12.19
Rcycling	3	7.31
Save the living thing	2	4.87

The distribution of the themes that children include in their pictures about the solutions to environmental problems, according to age, is summarized in Table 6.

Table 6. Distribution of themes on solutions to environmental problems by age

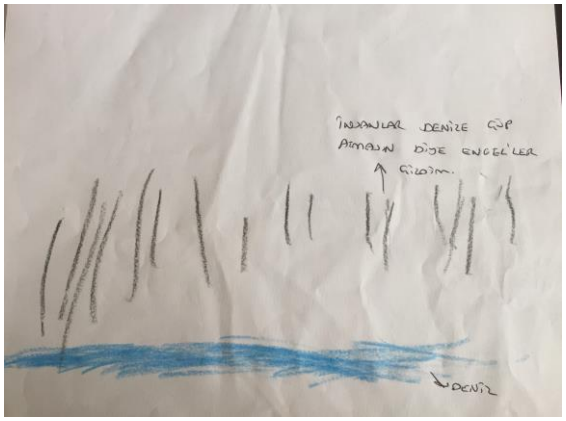
Themes	Age 3 (N=8)		Age 4 (N=15)		Age 5 (N=18)	
	f	%	f	%	f	%
Warn/prevent the pollutants	0	0	3	20.00	3	16.66
Do not throw the garbage on the ground	3	37.50	1	6.66	1	5.55
Collect the garbage	1	12.50	2	13.33	2	11.11
Rcycling	0	0	1	6.66	2	11.11
Save the living thing	0	0	0	0	2	11.11

As can be seen from Table 6, children in 3 garbage can think that all problems can be solved by collecting the garbage they cause. In the pictures of the buttons, the themes of recycling, living things and improving the environment are put in the pictures.

In this picture, the child can express that environmental problems can be solved by throwing the garbage into the trashcan and with garbage trucks.

Picture 15. A picture with the theme of 'don't throw garbage on the ground' (3 years old)

When Table 6 is examined, it is seen that children in the age group of 4 see throwing garbage into nature as the cause of environmental problems, and they focus more on preventing those who do this (Picture 16) and collecting garbage (Picture 17) in order to eliminate this problem.



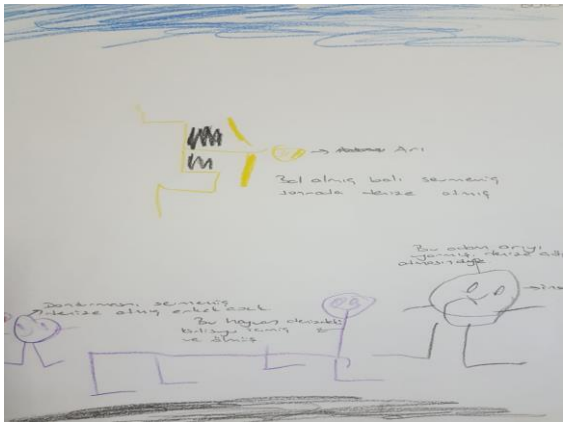
In this picture, which is about the solution to environmental problems, obstacles are drawn around the sea and the sea. In this picture, the child stated that obstacles to be built around the sea can prevent those who throw garbage in the sea, and environmental problems can be solved in this way

Picture 16. A picture with the theme of 'warning/preventing polluters' (4 years old)

This garbage bag, filled garbage bags and garbage is thrown on the ground, made on the solution ways of environmental problems, were drawn. In this picture, the child stated that environmental problems can be solved by collecting the garbage thrown on the ground by people by finding garbage bags.

Picture 17. A picture with the theme of 'collecting garbage' (4 years old)

Finally, when the pictures were drawn by children in the age group of 5 about the solutions to environmental problems are examined; it has been observed that children mostly use the theme of warning/preventing those who pollute the environment in their pictures (Picture 18).



In this picture, which is about the solutions to environmental problems, human and animal figures polluting the sea, an animal dying in a polluted sea, and a person warning those who pollute the sea are drawn. In this picture, the child stated that the bee throwing honey into the sea and the child throwing his ice cream cause pollution of the sea, animals die in the polluted sea, and warning those who pollute the sea can solve environmental problems.

Picture 18. A picture with the theme of 'warning/preventing polluters' (5 years old)

Some of the 5-year-old children participating in the study included the theme of recycling in their pictures and stated that using recycling could prevent environmental problems (Picture 19).

Recycling boxes are drawn in this picture about solutions to environmental problems. In this picture, the child stated that environmental problems can be solved by separating garbage and using recycling bins.

Picture 19. A picture with the theme of 'recycling' (5 years old)

Results and Discussion

As a result of the research, it was determined that the preschool children included in the study generally associated the causes of environmental problems with pollution (garbage and industrial wastes) (Table 1). Especially all of the children in the age group of 3 used only the theme of garbage in their pictures about the causes of environmental problems. It has been determined that the themes used regarding the causes of environmental problems have diversified as the age group gets older (Table 2). When the children's pictures of the consequences of environmental problems were examined, it was revealed that the children in the age group of 4 and 5 mostly included the theme of water pollution in their pictures (Table 3). In general, it has been determined that children in these age groups associate the consequences of environmental problems with the formation of pollution (water, air and soil pollution), as well as the causes of environmental problems. It has been revealed that the children in the 3-year-old group symbolize that environmental problems cause natural disasters, unlike children in the 4- and 5-year-old groups (Table 4). In general, it has been determined that the effect of environmental problems on living things (humans, animals, plants) is mostly focused on the effect of environmental problems on humans. It was observed that the children in the study group had a limited understanding of the solutions to environmental problems. In general, it has been determined that they associate the solutions to environmental problems with the prevention/elimination of pollution (warning/blocking the polluters, not throwing the garbage on the ground, collecting the garbage) (Table 5). In terms of age group; It has been determined that the children in the 3-year-old group mostly associate solving environmental problems with not throwing garbage on the ground and collecting the garbage on the ground, and the children in the 4 and 5 age groups use the theme of warning/preventing the polluters in their pictures more than the other themes. It was noted that children in the age group of 3 did not include the theme of recycling in their pictures. It has been revealed that as the age group related to the consequences of environmental problems grows, the diversity of the themes used in the pictures increases. There were children in the age group of 5 who stated that the use of recycling and the protection of living things are effective in tackling environmental problems. When the findings are evaluated in general, it is seen that preschool children's perceptions of environmental problems are

limited; however, as the age group gets older, it has been determined that the themes in the pictures related to the causes, consequences, and solutions of environmental problems diversify. Again, in general, it has been revealed that preschool children associate the causes and consequences of environmental problems with pollution, and the solutions to environmental problems with the prevention/elimination of this pollution. It has been observed that the number of children who associate the destruction of nature and the irresponsible consumption of natural resources with environmental problems is very limited.

This study is limited only to the sample group, but when the literature is examined, it is revealed that our findings are in line with the findings of the limited number of studies conducted with preschool children. Akbayrak and Kuru Turaşlı (2017) also conducted an experimental study; revealed that the children gave the most garbage answer about those polluting the environment in the preliminary and final interviews. They have determined that environmental activities designed as games improve children's environmental awareness and provide diversification of their answers to the questions asked in the research. For example, children who do not mention factors such as rotten fruits and vegetables, glass, cans, clothes, paper in the preliminary meeting about the factors that pollute the environment; It was reported that they mentioned these variables in the last interview. Again in this study, the researchers revealed that environmental activities designed as games also improve children's awareness of what can be done to protect the environment. It has been determined that children mostly give answers such as not throwing garbage on the ground, throwing the garbage in the garbage can, and warning those who throw garbage on the ground, as stated in the findings of the current study, about protecting the environment. They revealed that after the play-based environmental activities, the children's answers to this issue also diversified, and the awareness about using the recycling bin increased (Akbayrak & Kuru Turaşlı, 2017). In another study, it was revealed that preschool children mostly associate environmental problems with behavioral pollution (people's attitudes and behaviors such as throwing garbage on the ground, polluting the environment), water pollution, and air pollution (Özkul, 2018). The findings of this study are similar to the current research findings in that the majority of children in this period associate environmental problem with pollution, and when pollution is mentioned, water pollution is often portrayed. Studies on the environment and environmental problems at the primary and secondary school levels have also revealed similar findings with the current research. Erten (2003) reported in his study that primary school students see garbage as a big problem for the environment. In another study, Yılmaz, Bedur, and Uysal (2016) revealed that primary school 5th-grade children mostly gave the answer "garbage" to the question of what environmental problems they see in the environment they live in. In a study by Gülhan and Yurdatapan (2014) in which they investigated the effects of inquiry-based activities on primary school students' attitudes and behaviors related to the environment; It was revealed that the children in both the experimental and control groups gave answers in the pretest and posttest about what can be done to prevent environmental pollution, mostly not to throw garbage on the ground and to warn those who throw garbage. It was determined that after the inquiry-based environmental activities, they detailed the answers in the experimental group and the use of recycling was added to the answers given by the children.

Conclusion and Recommendations

It is seen that the perceptions of children about environmental problems in the preschool period are mostly limited to pollution. Considering that children's perceptions of recycling and the protection of natural resources are insufficient, it is thought that teachers and parents giving more space to activities and games related to protecting the environment (living creatures and natural resources) in the daily flow may contribute to the development/enrichment of children's perceptions on this subject. . Studies show that play-based environmental activities improve students' environmental awareness, that children participate more willingly and enjoy these activities more (Polys et al., 2017; Turgut & Yılmaz, 2010). Therefore, it is suggested that especially game-based activities should be included frequently in environmental education to be given to children.

Environmental education in the preschool period; is based on two main points, the first of which is to ensure the interaction of the child with the environment and the other to support the healthy development of the child (Wilson (1996). Therefore, the environmental education to be given to the child in this period should primarily ensure the interaction of the child with the outside world. Researches show that environmental education programs in the open-air increase children's environmental awareness (Fishman, 2005; Jean, 2010) In this sense, outdoor environmental activities can be a good alternative in terms of enabling children to gain positive experiences about their environment.

Recently, various projects have been carried out to improve children's understanding of a particular dimension of the environment in Turkey. For example, the cartoon named “Water Ambassadors” broadcast on TRT Child; It is a cartoon prepared within the scope of the "Water Ambassadors Education and Awareness Raising Technical Assistance Project", which is a European Union Project, and in parts of this cartoon, it is tried to give the main idea of how important it is to protect water to children. In the soil education project titled “We Know the Land with Tipitop and His Friends” supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK), preschool children were educated and it was determined that the understanding of the children on this subject improved significantly (Gülay et al., 2010). It is recommended to disseminate such projects.

As mentioned in the introduction, academic studies are mostly related to upper-age children, and studies conducted in the pre-school period are quite limited. It is recommended to increase environmental studies to be conducted with preschool children. Studies reveal that the effects of the education programs followed in pre-school institutions and the models based on the program on children's attitudes and awareness about the environment creates significant differences. For example, Alparslan (2019) examined the effect of preschool education institutions that adopted the Montessori method, ecological-based approach, and the Ministry of National Education (MoNE) mainstream (state schools) education model on the environmental awareness and attitudes of 54-66 month-old (4-5-year-old) children. The researcher reported that the ecologically centered attitudes of the children educated in ecological-based schools are more positive and environmental awareness is higher than the children in other schools. In his study, the researcher stated that the attitudes and awareness of the children attending the school that implement the MoNE program are lower than the preschool education institutions that apply the Montessori method and ecological-based approach. The researcher reported that the significant difference between the children studying in ecological-based schools and the children studying in schools that implement the Montessori model and the MoNE program may be due to the fact that the Montessori method is not fully understood in our country and the lack of teachers and programs in the environmental practices in MoNE’s schools. On the other hand, studies examining the national preschool curriculum in the context of environmental gains reveal that the achievements are limited and the curriculum should be improved in this sense (Erdaş-Kartal and Ada, 2018; Erdogan et al., 2012; Gülay & Ekici, 2010). It is suggested that the findings of these studies investigating the effects of preschool education programs and their contents in the context of environmental education, as well as our current study, which reveals which subjects children have more limited perceptions about the environment, should be taken into account in preschool education program studies.

Scientific Ethics Declaration

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

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Author(s) Information

Eda Erdas Kartal
Kastamonu University
Faculty of Education, Kastamonu, Turkey
Contact e-mail: *erdaseda@gmail.com*
ORCID iD:0000-0002-1568-827X

Ezgi Ada
Kastamonu University
Vocational High School, Kastamonu, Turkey
ORCID iD: 0000-0002-6167-0273

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The Effects of a Professional Development Program on the Classroom Practices of Physics Teachers

Ozlem Oktay, Ali Eryilmaz

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Abstract

The purpose of the study is to examine the effects of a long-term professional development (PD) program on the classroom practices of physics teachers. Changes in teachers' practices were investigated across four dimensions: content, teaching strategy, materials/technology, and assessment. The present study used qualitative research methodology, including a case study research. Data were collected from seven participating teachers and their 9th grade students. The PD model framework has four main components: analysis, planning, implementation, and evaluation. A teacher survey, an observation form, a student group-interview protocol, treatment-fidelity and treatment-verification opinion forms were developed as measuring instruments. Thematic coding was used in every dimension. The data were evaluated using a frequency analysis and displayed in tables. The results showed that the PD program had a positive effect on teachers' classroom practices. The more the teachers participated in each dimension of the PD program, the greater the level of positive change observed in the teachers' lesson applications. When the results were examined in relation to teaching strategies, materials/technologies, and assessment techniques used for various purposes, there was a clear increase in the number, variety, and quality of strategies, materials, and technologies used in these dimensions.

Introduction

Teachers constitute a core component of education. They play a key role in preparing students for life and helping them become capable adults. They are responsible for implementing the school curriculum and control the creation of effective student-learning environments through the use of suitable teaching strategies, technologies, materials and assessment techniques that improve content understanding.

As teachers must be lifelong learners, professional development (PD) is a strong mechanism for improving their skills and advancing their careers. In addition, they must be qualified in terms of both content and pedagogical knowledge. To improve education, special attention should be paid to the quality of teachers. Some PD studies have asserted that PD is a crucial way of positively changing and improving teachers' classroom practices (Heller et al., 2012; Smith, 2015).

In general terms, the PD process increases a person's capacity to develop new knowledge and skills. It supports participants in a long-term and continuous way (Holmes et al., 2011). In the current context, PD is particularly important for science teachers because it enables them to apply learner-centered instruction effectively. This type of instruction focuses on what learners should know and do in the learning environment.

The literature identifies some important characteristics of effective PD programs. The common core features of PD proposed by Desimone et al. (2002), namely, content-based features, coherence, duration, active learning, and collective participation, have been confirmed by other studies (Darling-Hammond & Richardson, 2009; Desimone & Garet, 2015; Luft & Hewson, 2014; Penuel et al., 2007).

The scope of this research includes effective PD models, their characteristics, and possible outcomes in terms of teacher practices. Although there is a consensus that PD programs share some key characteristics, few studies have attempted to show how these characteristics are combined or how they affect teachers' practices, using long-term, systematic data collection procedures. Most research has been carried out during traditional short-term opportunities, such as seminars or workshops, which are not effective in enhancing the development of teachers (Clarke & Hollingsworth, 2002). The literature includes scant research on content-specific PD programs or pedagogical approaches in specific disciplines. There is clearly a need for more research to examine

the changes made in real classroom situations by teachers who have participated in PD programs (Eylon et al. 2008; Wiener et al., 2018).

The Significance of the Present Study

Teachers are expected to develop effective classroom practices within the scope of this study. This model identifies the needs of teachers before the PD program is carried out. During the PD, teachers expand their content knowledge, use of materials/technologies, teaching strategies, and assessment techniques. One drawback is the duration (timespan) and contact time of PD programs. We have designed a long-term sustained program to ensure that teachers are aware of what is happening and have enough time to prepare their lessons. More research is needed on teachers' experiences to indicate PD research quality. Very few studies have followed the practice of teachers who have just participated in PD programs (Jackson, 2014). The present research combines qualitative designs with multiple data collection techniques. Manzaro and Toth (2013) have argued that data related to teaching practices should come from different sources. This study has therefore a range of different data-collection tools, including a needs-based survey, an observation form and interview protocol.

The present study discovers and explores actual classroom practices before and after the PD program. Goe (2007)'s broad definition states that practice refers to teachers' actions in the classroom with their students. Practice must be observable in class; it can be different in specific disciplines. The in-service classroom practices of physics teachers were assessed using systematic observation data prior to the PD program and again during the following fall term, after the PD program. Group interviews with students were also used to provide evidence of the teachers' behavioral changes in their classrooms. An effective PD model framework was developed, incorporating teachers who worked together on a voluntary basis in both face-to-face settings (workshops) and non-face-to-face interactions. This model incorporates effective 12 core PD characteristics into a single research design and investigates teacher practices before and after the PD program.

Main Question: What is the effect of the PD program on the in-service classroom practices of physics teachers?

SubQ1: To what extent are common topics emphasized by in-service physics teachers in physics classes before and after the PD program?

SubQ2: What and how frequently and effectively are teaching strategies used by in-service physics teachers in physics classes before and after the PD program?

SubQ3: What and how frequently and effectively are instructional materials/technologies used by in-service physics teachers in physics classes before and after the PD program?

SubQ4: What, for what purpose, and how frequently and effectively are assessment techniques used by in-service physics teachers in physics classes before and after the PD program?

Method

Research Methodology

The present study employed qualitative approaches and multiple data-collection methods. This study included case-study research methodology. The case study involved a systematic process of searching for and collecting events, and analyzing data to explain why particular events happened (Gerring, 2005). The entire group of teachers who participated in the PD program is treated as a single case in this study.

Participating Teachers

Seven teachers, referred to as TA, TB, TC, TD, TE, TF and TG for the sake of research convenience, participated in this study. Table 1 presents their demographic details and professional experiences, drawn from the TSNOP survey.

Table 1. Teachers' demographics and their professional experiences

Teachers	[1]Gender	Faculty graduated	Degree	Years of teaching	Type of school	[2]Previous PD experiences
TA	F	Education	MSc	18	Sport	• 4 times, 15 days, related to curriculum knowledge, passive participation • 4 times, 25 days, related to curriculum knowledge, active participation
TB	F	Education	BS	26	Anatolian	• 4 times, 4 days, related to curriculum knowledge, assessment, passive participation • 1 times, 15 days, related to basic computer, active participation
TC	M	Education	BS	24	Anatolian	• 1 times, 20 days, related to basic computer, active participation
TD	F	Education	MSc student	19	Vocational	• 2 times, 18 days, related to curriculum knowledge, passive participation • 4 times, 28 days, related to curriculum knowledge, assessment, active participation
TE	F	Science	BS	23	Anatolian	• 1 times, 15 days, related to curriculum knowledge, passive participation • 5 times, 39 days, related to curriculum knowledge, material development, active participation
TF	F	Education	PhD	11	Vocational	• 2 times, 9 days, related to curriculum knowledge, passive participation
TG	F	Science	BS	24	Vocational	• 3 times, 129 days, related to curriculum knowledge, basic computer, passive participation

1= F: female, M: male
2= The total number and duration of trainings so far, PD content, and the role of participant, respectively in the previous PD experiences section.

Measuring Instruments

Survey of teachers in the NOP-unit PD program (TSNOP). The TSNOP survey has 10 pages, divided into four parts. The first part covers the participants' demographic information. The second part includes questions about the teachers' professional experiences. Teachers are also asked to propose possible solutions to problems. They answer more specific questions about how training can be organized (e.g., type, context, PD roles, timing, etc.) in the third part.

Observation Form (OF)

It consists of two main parts. Part I evaluates the way in which teachers deliver content, their teaching strategies, and materials/technology; their classrooms are assessed through the implementation of this unit. Changes in practice were assessed for variety, number, and quality, as a result of the PD program. Part II covered general course-related elements that could be observed (e.g., physical situations within the context).

Table 2. General and common topics

General topics	Common topics (specific topics)
Science of physics and its purpose	O1: What is physics? O2: The aim of science of physics (why I need to know physics?)
Application fields of physics and its relation with other disciplines	O3: Physics practice areas, sub-areas O4: Physics' relation with other disciplines (chemistry, biology, etc.)
The relationship between physics and technology	O5: The relationship between physics and technology
Role of observation in emergence and development of scientific knowledge	O6: Role of observation in emergence and development of scientific knowledge O7:Qualitative-quantitative observation relationship
The emergence and development of knowledge and scientific methods	O8: The emergence and development of knowledge and scientific methods (law, theory, imagination and creativity)
Role of experiment in emergence and development of scientific knowledge	O9: Role of experiment in emergence and development of scientific knowledge (differences between hypothesis, theory, law)
Role of mathematics in emergence and development of scientific knowledge	O10: Role of mathematics in emergence and development of scientific knowledge
The use of mathematics and modeling in physics	O11: The use of mathematics and modeling in physics
Measurement of some basic quantities in physics and use of error and unit system in measurement	O12:Measurement of some basic quantities in physics and unit system O13: Error in measurement and its sources
Describing units of some basic quantities in physics in SI unit system	O14: Describing units of some basic quantities in physics in SI unit system

Student Group-Interview Protocol (SGIP)

The interview protocol had two parts. The first involved the dimensions of the PD content and its implementation in classes of teachers; the second part consisted of general questions about attitudes toward the unit and ways of improving lessons.

Treatment Fidelity Expert Opinion Form (TFEOF)

To ascertain treatment fidelity, a form was developed and sent to experts (university members, PD professionals, and teacher-education researchers). A detailed explanation followed each PD characteristic. The experts were asked two questions with three potential responses ("yes," "no" and "partially"). The questions were as follows: "Could the given title be a characteristic of the PD program?" And "Is the given characteristic, along with its explanation, integrated into the PD program?."

Treatment Verification Opinion Form (TVOF)

The treatment fidelity opinion form was modified to create a treatment verification form for the PD program. Using a treatment-verification format, seven teachers and researchers verified the same PD characteristics after the PD program finished. They were asked, "Did you do the things that I wrote about in the 'What I did' section of the TVOF form?" One question had three optional responses ("yes," "no" and "partially"), allowing participants to approve the characteristics on the form.

Qualitative Data Analysis

Frequencies were calculated and tables were created to display the data. To code the observation data more accurately, a coding-manual observation form was developed. Lists of major criteria were created, along with a set of rules for each dimension. To increase coding reliability, criteria were established for scoring the quality of the three dimensions (teaching strategy, materials/technology, and assessment). As a new curriculum was implemented developed during the second fall term, the NOP content was modified for use as ISOP unit content. A total of 60 and 64 classroom hours were observed during the NOP and ISOP units, respectively. The same coding-manual observation form was used for both terms, to compare common topics covered in both units. A common topic is a common objective, included in both physics curricula. Fifteen common topics were used to compare teacher changes caused by the PD program in four dimensions; they were labelled with the letter "O" in the study (see Table 2).

After coding the observation form during the first fall term, we randomly selected a sample piece of data from a teachers' class data and examined the same piece of data nearly a month later. We calculated the agreement rate between these two linked pieces of data and found a 97% agreement. We then compared the results of the two terms to reveal changes in practice. The interviews (SGIP) were tape-recorded and then transcribed, question by question. We prepared a coding scheme, sorting out categories and sub-categories. We used a thematic approach (Miles & Huberman, 1994) to analyze the coded transcripts.

Procedure

We explained teacher development in each of the five phases (see in Figure 1.)

Figure 1. Design process of the PD program

Phase 1 includes all preparations for the PD program. The TSNOP, SGIP, literature review, and first fall-term observations provided the main sources of meaningful data, used to structure and develop content for the PD program. Workshop I was held during Phase 2. This workshop had both theoretical and practical features. Teachers attended 20 hours of face-to-face training: five sessions of four hours each (every other afternoon on a regular basis) over the course of two weeks. At the end of Workshop I, the common parts of both units were shared by eight teachers for Workshop II. They were responsible for teaching content and the use of teaching strategies and materials/technology. The remaining three teachers wanted to prepare tests for formative, diagnostic, placement, and summative purposes.

Phase 3 involved remote or virtual (not face-to-face) interactions between the two workshops. Teachers prepared teaching presentations during the summer. They interacted with colleagues and researchers via social networks and phone calls. Shortly before the start of the school term, they were given an opportunity to participate in teaching practice in Workshop II. This phase lasted for approximately two months and the virtual/remote interactions had an ongoing structure.

In Phase 4, the teachers lectured in Workshop II as if they were in an actual class. Workshop II was divided into three sessions, which included practical applications. Each session lasted for four hours. The workshop was spread out across three consecutive days, with afternoon meetings. Participating in-service physics teachers designed one-hour lessons for the next semester. They integrated available materials with suitable teaching strategies and shared their teaching practices with colleagues.

The teachers prepared for their classes after receiving feedback from Workshop II in Phase 5. They communicated with each other and us through remote or virtual interactions before the start of classes. The feedback results were distributed to teachers individually. Having been asked to modify and finalize the last version of their products, they uploaded their presentations onto a social platform and shared them with others before classes began. The remote and virtual interactions lasted for the whole of that time. In the same way, one researcher made post-classroom observations during the ISOP unit. Students in the observed classes were interviewed. The research sequence was the same as the sequence during the first fall term. The teachers filled out a treatment-verification form to ensure PD treatment. The total contact time was 42 hours, consisting of 32 hours of face-to-face interactions and 10 hours of non-face-to-face interactions. Figure 2 presents the PD model framework, which shows the pathway of the program.

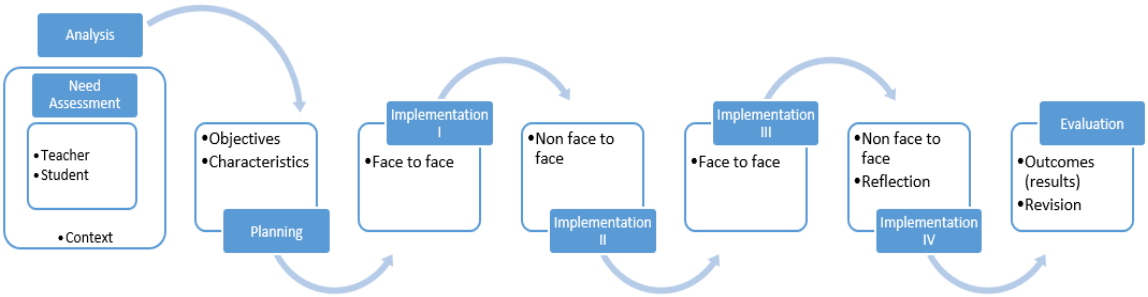

Figure 2. Professional development model framework

Results

Level of Teachers' Participation in the Professional Development Program

Table 3. Distribution rates of face-to-face and non-face-to-face interaction in the PD program

	Face-to-face interaction* (%)	Non-face-to-face interaction** (%)	Rate
Content	77	23	3
Teaching strategy	71	29	2
Material/technology	82	18	4
Assessment	90	10	9

*= [av. time for face-to-face / (av. time for face-to-face + av. time for non-face-to-face)] *100
**= [av. time for non-face-to-face / (av. time for face-to-face + av. time for non-face-to-face)] *100
(For instance; Average time passed in face-to-face interaction for content dimension is 8.7x60=522 minutes. This time is 160 minutes for non face-to-face interaction. Therefore, when calculating the percent of face-to-face interaction = [522/(522 + 160)]*100 formula was used and 77% was found).

Table 4. Core characteristics immersed in the PD program

	PD characteristics +: 1 point	Face-to-face interactions	None-face-to-face interactions
C1	Needs, demands		
1	Consider to the needs of teachers	+	+
2	Consider to the needs of students	+	+
C2	Awareness		
3	Convince teacher to change	+	+
C3	Support		
4	Support from MONE	+	+
5	Support from academicians/teachers a. Workshops, b. Materials/sources, c. Easy access to them	+++	+ (b.)
6	Support from schools a. Easy attendance to the program b. Easy implementation for researcher	++	++
C4	Motivation/incentive		
7	Giving a certificate as an incentive	+	+
8	Providing opportunity to see and compare the students' success related to the PD content	+	-
C5	Feedback		
9	Feedback from researcher	+	+
10	Feedback from teachers	+	+
11	Self-feedback	+	-
C6	Opportunity		
12	The opportunity to practice	+	-
C7	Planned and flexible program		
13	Planned and flexible program	+	+
14	Planned and flexible teacher application	+	-
C8	Duration		
15	Long term PD	+	+
16	Having an ongoing structure	+	+
17	Giving workshop nearly to the class implementation	+	+
C9	Content specific PD		
18	Getting to the core of ISOP unit	+	+
19	Aligning with the curriculum	+	+
C10	Active learning		
20	Effective/productive working	+	+
21	Reflective thinking/discussion	+	+
22	Mostly pursued by teacher	+	+
C11	Collaboration /Interaction		
23	a. Exchange of ideas, b. Group learning	++	+ (a.)
C12	Effective communication/Building learning community		
	Before workshop 1		
24*	Teacher to teacher communication	-	-
25	Teacher to instructor communication	+	+
	During workshop I		
26	Teacher to teacher communication	+	+
27	Teacher to instructor communication	+	+
	After workshop I / Before workshop II		
28	Teacher to teacher communication	+	+
29	Teacher to instructor communication	+	+
	During workshop II		
30	Teacher to teacher communication	+	+
31	Teacher to instructor communication	+	+
	After workshop II		
32	Teacher to teacher communication	-	+
33	Teacher to instructor communication	-	+

* The characteristics was unable to provide during the PD program.

The impact of the program on the practice of teachers was measured using the participation rate. A total of 32 hours of workshop time (Workshop I + Workshop II) was divided into four dimensions: 11 hours spent on content, 7 hours spent on teaching strategy, 7 hours spent on materials/technology, and 7 hours spent on assessment. We calculated the total participation time for each participant; as an example, TA participated during 9 out of 11 hours (82%). The average participation rates for face-to-face training in each dimension ranged between 77% and 80%. Non-face-to-face interactions (measured using the average results of seven teachers) were notable for their wide range, from a minimum of 35 minutes spent in the assessment dimension to a maximum of 160 minutes spent in the content dimension. Table 3 presents the percentage rates of training in each dimension, comparing face-to-face and remote/virtual interactions.

In the training sessions, the teachers discussed teaching strategy through face-to-face interactions as at least twice as often as through non-face-to-face interactions and nine times more often in the assessment dimension. According to the researchers' treatment-verification results, the ratio of face-to-face to non-face-to-face interactions was 1.2 (92/78); 33 items related to the 12 core PD characteristics (see Table 4.) were scored for this calculation.

Table 5. Teachers' weighted participation rate in each dimension

Content Dimension	Teacher	Face-to-face interaction (minute)	Face-to-face % [(1)]	Non-face-to-face interaction (minute)	Non-face- to-face % [(2)]	Total weighted participation rate
Content	TB	660	100	148	71	94
	TD	600	91	182	87	90
	TA	540	82	157	75	80
	TE	480	73	209	100	79
	TF	480	73	200	96	78
	TC	480	73	89	43	66
	TG	420	64	132	63	64
Teaching strategy	TB	420	100	142	82	95
	TD	360	86	173	100	90
	TE	360	86	125	72	82
	TF	300	71	168	97	79
	TG	360	86	96	55	77
	TA	240	57	168	97	69
	TC	240	57	80	46	54
Material/ technology	TB	420	100	87	75	96
	TD	360	86	94	81	85
	TF	360	86	56	48	79
	TA	300	71	116	100	76
	TG	360	86	28	24	75
	TE	300	71	64	55	69
	TC	240	57	78	67	59
Assessment	TB	420	100	22	35	94
	TD	360	86	46	73	85
	TF	360	86	7	11	79
	TA	300	71	63	100	74
	TE	300	71	52	83	72
	TG	300	71	8	13	66
	TC	240	57	47	75	59

[(1)] = (face-to-face interaction (min.) *100)/ interaction time (min.) in each dimension
[(2)] = (non-face-to-face interaction (min.) *100)/ max interaction (min.) in each dimension

Total weighted interaction rate formulas:
Content = (([(1)] *3.6+[(2)] *1))/(3.6+1)
Teaching strategy= (([(1)] *2.4+[(2)] *1))/(2.4+1)
Material/technology= (([(1)] *4.8+[(2)] *1))/(4.8+1)
Assessment= (([(1)] *10.8+[(2)] *1))/(10.8+1)

The face-to-face interaction section obtained a result of 34 out of 37 points (92%), whereas the non-face-to-face interaction section obtained a result of 29 (78%) points. Consequently, The PD program included 32 out of 33 characteristics (all except Characteristic 24). The 97% rate of agreement between teachers and researchers indicates that applied PD is a type of PD that is planned before the PD program. To understand the change of teacher practice in each dimension, based on the time teachers spent participating in the PD program, a weighted participation rate was calculated (see Table 5).

For example, the weighted participation rate of TB in the content dimension was calculated as follows: TB participated 100% in 660 minutes of face-to-face interaction lessons in Workshop I and Workshop II. As there is no upper limit for non-face-to-face interaction, the highest number of minutes reached by any teacher was accepted as the maximum. According to this, in comparison to TE, TB's percentage participation rate was approximately 71% of the maximum level of interaction ([148*100]/209), given a maximum of 209 minutes in this dimension. When calculating the total weighted participation rate, we used the formulas at the bottom of Table 4 for each dimension. Applying the content-dimension formula to TB produced the following result:

Content = (((1) *3.6+(2) *1))/(3.6+1)
(for (1), and (2) = see the explanations at the bottom of Table 4)
Content = ((100 *3.6+71*1))/(3.6+1) = 94 is obtained.

The 3.6 coefficient in this formula is achieved by multiplying the face-to-face interactions in each dimension by the non-face-to-face interaction rate (see at Table 3) and face-to-face interactions by the non-face-to-face interaction rate. This coefficient is calculated as 3 x 1.2 = 3.6 for content dimension.

The Results of the Teacher Practice Sessions

If participating teachers reached approximately 80% (the cut-off point) in the PD program weighted participation rates, we assumed that the program had affected them. The weighted participation rate for each teacher group classified those with 80% or more in the upper group and those with less than 80% in the lower group.

Findings of the SubQ1

TB, TD, TA, TE, TF were in the upper group, while TC and TG were in lower group, based on the weighted participation rates of each teacher in the program (Table 4). The change in the number of common topics before and after the PD program illustrates the difference between the two years of teacher practice sessions. As an example, TB completely delivered 7 common topics before the PD program and 15 common topics after the PD program.

When all of the teachers who participated in the PD program were considered, the number who delivered the full set of 15 common topics increased from an average of 4.4 to 10.3 (Table 6). This figure increased from 5.2 to 12.4 in the upper group of teachers, who obtained participation rates of 80% or above in the PD program. As can be seen from the table, the number of common topics they reached was quite close to 15. Some teachers (TB, TD) even delivered all of the common topics after the PD program. Consistently, alongside the increase in the number of common topics completely delivered, there was a decrease in the number of partially or wrongly delivered common topics among teachers in the upper group, after the program. None of the teachers failed to deliver any common topics after the PD program.

Most teachers completely delivered the common topics O1, O3, and O15 before the program. All teachers completely met the same target after the program. No teachers delivered the common topics O8, O9, or O12 before the PD program; this number slightly improved after the PD. As O8 and O9 contained misconceptions, these items increased; there were no other changes to the expected level. The common topic O12 included measuring some basic quantities and unit systems in physics. Some students described O12 as a difficult topic in the group interviews across both years.

Common topics other than O8, O9, O11, and O12 (and to some extent O10) were delivered completely by a quite a few teachers before the program. This number slightly increased after the program. There was some development on these common topics after the PD program. In addition, the total number of teachers who partially delivered O8, O9, O11, and O12 decreased by year, remaining the same as O10.

When we compare the number of partially delivered common topics with the number of completely delivered common topics, a positive change can be seen after the PD program. However, in all cases, scientific methods, hypotheses, theories, laws, and modelling concepts continued to cause trouble for teachers. When we consider the wrongly delivered common topics in the same way, the first items that catch our attention are O8 and O9. Errors decreased in O8 after the PD program; the same teacher (TC) continued to deliver O9 incorrectly. By contrast, O4 and O14, which were delivered incorrectly more often before the PD program, were delivered almost completely correctly after the PD program. In inter-class observations of teachers, O2 and O13 were taught by only one teacher before the program; strikingly, six teachers taught these subjects after the program.

Table 6. Common topics delivered for each teacher classified according to weighted participation

Common topics	Completely delivered		Partially delivered		Wrongly delivered		More delivered than aimed at the curriculum		None delivered		The common topics were stated		The common topics were associated with daily life	
Teacher	1	2	1	2	1	2	1	2	1	2	1	2	1	2
TB	7	15	5	0	3	0	3	0	0	0	4	14	5	7
TD	5	15	9	0	2	0	2	0	1	0	6	12	6	8
TA	6	12	9	2	2	1	3	0	0	0	7	13	5	9
TE	5	10	9	5	3	0	3	0	0	0	3	10	7	9
TF	3	10	8	4	5	2	2	0	2	0	0	13	3	7
Average	5.2	12.4	8.0	2.2	3.0	0.6	2.6	0.0	0.6	0.0	4.0	12.4	5.2	8.0
Difference	7.2		-5.6		-2.4		-2.6		-0.6		8.4		2.8	
TC	3	5	8	8	2	3	3	1	2	0	1	7	2	5
TG	2	5	7	10	3	0	2	0	3	0	0	9	4	5
Average	2.5	5.0	7.5	9.0	2.5	1.5	2.5	0.5	2.5	0.0	0.5	8.0	3.0	5.0
Difference	2.5		2.5		-1.0		-2.0		-2.5		7.5		2.0	
Total average	4.4	10.3	7.9	4.1	2.9	0.9	2.6	0.1	1.1	0.0	3.0	11.1	4.6	6.1
Difference	5.9		-3.8		-2.0		-2.5		-1.1		8.1		1.5	

(1:before the PD program; 2:after the PD program)

Findings of the SubQ2

When we consider the participation-level section of Table 4, it is clear that all of the teachers, other than TA and TC, have rates above the weighted participation limit in this dimension. The use of teaching strategies is evaluated in different columns (as R and NR), in accordance with the teachers' position on requiring students to participate in lessons (R: requiring student participation; NR: not requiring student participation).

Table 7. The frequency of the use of teaching strategies and their qualities according to years

	Number of times used				Quality			
Teacher	1 R	2 R	1 NR	2 NR	1 R	2 R	1 NR	2 NR
TB	15	49	10	11	79.9	96.9	87.5	97.2
TD	20	43	14	16	92.2	97.5	81.4	89.0
TE	15	34	10	13	70.2	90.8	64.6	83.9
TF	7	33	11	10	82.4	89.6	66.0	76.9
TG	7	30	11	9	60.1	87.6	50.0	75.7
Average:	12.8	37.8	11.2	11.8	77.0	92.5	69.9	84.5
Difference:	25.0		0.6		15.5		14.6	
TA	13	24	18	13	82.9	96.5	78.4	82.5
TC	2	10	14	11	25.0	77.8	46.9	57.9
Average:	7.5	17	16	12	54.0	87.2	62.7	70.2
Difference:	9.5		-4.0		33.2		7.6	
Total average:	11.3	31.9	12.6	11.9	70.4	91.0	67.8	80.4
Difference:	20.6		-0.7		20.6		12.6	

R-requiring student participation
NR-not requiring student participation
1:before the PD program
2:after the PD program

Table 7 reveals an obvious increase in the use of teaching strategies in both groups after the PD program. This increase is associated with strategies that require student participation. Quality also improved with an increased use of teaching strategies. For strategies that did not require student participation (NR), the number of uses remained almost stable among upper-group teachers and decreased slightly among lower-group teachers. Before the PD program, the quality of strategies requiring student participation was 77.0 points for the upper group and 54.0 points for the lower group, on average. These points increased to 92.5 for the upper group and 87.2 for the lower group, after the PD program. The quality increases associated with the use of strategies requiring student participation were 15.5 points in the upper group and 33.2 points in lower group.

However, even in the case of these teaching strategies, quality increased after the PD program. As a consequence of the PD program, the number of strategies requiring student participation increased from 11.3 to 31.9 in total. Quality rose from 70.4 to 91.0. The use of strategies not requiring student participation decreased from 12.6 to 11.9 after the PD program. At the same time, quality increased from 67.8 to 80.4 among the seven teachers after the program.

Findings of the SubQ3

When we consider the level of teacher participation in Table 4, it is clear that TB, TD, and TF had higher than average rankings for participation in this dimension. Both under and above the weighted participation rate, the groups of teachers increased their use of materials approximately three times after the PD program. The quality of use also increased. On average, teachers used materials/technology 7.9 times and achieved a quality rating of 63.7 before the PD program. The quality figured changed by 24.1, reaching 86.4 after the PD program.

Before the PD program, the upper group had an average rating of 75.5 for material-use quality, while the lower group had a rating of 54.8. These rates increased to 89.7 for the upper group and 84.0 for the lower group of teachers after the PD program. The quality increases associated with the use of materials/technology were 14.2 points in the upper group and 29.2 points in lower group after the PD program. After the PD program, the most frequently used materials were videos (used in the PD program), boards, and lab equipment. The MoNE lesson book and other source books began to be used in a more qualified way to teach more common topics, both inside and outside class.

Findings of the SubQ4

When we look at Table 4, it is clear that TB, TD, and TF are above the line for their participation criteria. The number of formative assessments by upper-level teachers in particular and the significant increase in quality of use are noticeable. According to the observation data, when the seven teachers used tools to carry out a formative assessment, it was generally to answer questions. Formative assessment use was 2.1 before the program, increasing to an average of 5.3 after the program. Quality increased from 58.0 to 78.9. It is clear that the use of summative assessments increased after the PD program. However, the summative assessment use of most teachers did not change. The teachers mainly used summative assessments when giving assignments (investigation).

The observation results show that no teachers used diagnostic assessments before the PD program; only one teacher (TB) used them after the program. The quality of implementation was very high (100%). This particular teacher spent more time participating in the PD program than any other. No teachers used placement tests before the PD program; afterwards, they were used successfully, especially by upper-group teachers.

Results of the Student Group Interviews

O1, O2, O3, O12 and O14 show that there was a 50% or higher change in student opinions in every teacher's observed classes. This post-PD change was obviously positive. In other words, the percentage of students who thought that common topics were not being taught properly after the PD was lower than the number who thought this before the PD. In subject O9, however, there was no significant change in student opinions. Although there was a remarkable decrease in the number of upper-group students who thought that teachers were not teaching common topics well, O9 was considered problematic during both years by students whose teachers were in both the lower and upper groups. Some students explained why they found it difficult to learn

some subjects in the unit. A common problem mentioned by students with various teachers in both years was the fast and superficial introduction of scalar and vector quantities.

Discussion and Conclusions

Major Findings and Discussion

The present study created a PD-model framework and examined its effectiveness by assessing teachers' classroom practices. The impact of the PD program, which was implemented as planned, was associated with participation rates. Teacher changes that occurred in four dimensions -content, teaching strategy, materials/technology, and assessment- were investigated. The present study supports earlier studies in confirming the positive impact of a PD program on teacher practices (Dolfing et al., 2021; Heller et al., 2012; Johnson, 2011; Pieters et al., 2019; Pop et al., 2010; Zavala et al., 2007). The present study provides detailed evidence-based results showing the direct effect of PD on teachers' classroom practices. This development model had a positive effect on class teaching in four selected dimensions.

A Discussion of Related Results in Four Dimensions

The more teachers participated in the PD program in each dimension, the more their teaching changed in a positive direction in that dimension. This study shows the importance of obtaining more results by extending interaction times. Teachers who participated in the study were divided into lower and upper groups, in reference to a participation rate of approximately 80% (participation values changed sharply).

Observation results showed that all teachers experienced a positive change in their delivery of common topics after the PD program. Teachers with higher participation rates also experienced a larger increase in the number of common topics they were able to fully deliver. Overall, fewer common topics were partially or incorrectly delivered. No teachers failed to deliver any topics correctly. Teachers emphasized daily life more frequently after the PD program. The failure to deliver common topics, a problem seen during the first observations, was discussed during the PD program; it was presented more clearly during the second observations. In the subjects that students did not feel they had learned properly (according to group interviews), there were clear improvements after the PD program.

The common topics O8, O9, and O11 were widely misunderstood; teachers began to present these more often and more correctly after the PD program; however, the rate did not increase as much as it did in other subjects. Misconceptions can be very difficult to change; extra time and the use of alternative techniques are needed to fix this problem (Singer et al., 2012). The results of the present study show that PD programs, which aim to eliminate misconceptions, need to allocate more time to this problem. The results of this study were compatible with previous NOS research findings, showing that NOS understandings are inconsistent and fragmented. For example, many teachers, who once believed science has a weak structure that can change, now believe that scientific theories can be turned into laws over time (Schwartz et al., 2004). Some students mentioned that they did not learn about hypotheses, theories about O9, or the relationships and differences between them after the PD program. Misconceptions about O11 and O5 and changes to O7 were fairly common. Some NOS concepts (modelling, hypotheses, laws, and theories) were missing after the PD program.

When we examined the observation results in relation to teaching strategies, it was clear that number, variety, and quality of teaching strategies increased after the PD program. One goal of this dimension was to apply more student-centered methods which play dominant role for student learning (NRC, 2015). Teaching methods requiring student participation were used by all teachers in the upper and lower groups. In group interviews carried out after the PD program, students mentioned talking about the various methods used in classes and participating in lessons actively (the exception to this rule were TC's students, who had the lowest levels of involvement in the program). There was no decrease or significant change in the number of teaching strategies (including teacher-centered strategies) that required less student participation.

An examination of the observation results relating to materials/technology revealed an increase in number, variety, and quality after the program. This increase was supported by student group interviews. Students interviewed before the PD program said that they didn't use any materials/technology in lessons; those interviewed after the PD program said that they used various materials/technology more often. The PD program also targeted the appropriate and effective use of books inside and outside class. To enforce this dimension, the

teachers were given materials that could be used directly in this unit; they discussed the selected materials among themselves. It is clear that this method is useful. When the teachers were given concrete materials directly and shown how to use them in lessons, they preferred to use those materials more often in their own lessons.

When the teachers assessed common topics, they tended to use summative-purpose assessments, in the form of traditional written exams. This was true for all teachers in the upper and lower groups, before the PD program. Placement and diagnostic assessments, less well-known forms of assessment, were never used before the PD program. After the program, TB, who participated more energetically in the program than any other teacher, used these two assessment methods in the most effective way after the PD program. In general, this program increased the teachers' awareness of these types of assessment, which are used for a range of different purposes. Formative assessments increased and were used in a better way after the program. In interviews, the students said that their teachers gave them more feedback and tested what they had learned more often after the PD program.

Although each dimension was given nearly the same level of importance in face-to-face interactions, the teachers paid less attention to the assessment dimension in non-face-to-face interactions. Seven teachers spent 35 minutes on average on the assessment dimension in non-face-to-face communications. By contrast, they spent 160 minutes on content, 136 minutes on teaching strategy, and 75 minutes on materials/technology. To motivate them, some documents and questions about assessment were uploaded to the social media group; even though discussion environments were created, the teachers remained less interested in this area. Teachers communicated more about teaching strategies and the use of materials in their non-face-to-face interactions. The teachers may have seen content, teaching strategies, and material as closely related topics that should be considered as a group. They may have seen assessment as a separate task needing extra attention.

Implications

The present study proves that teachers who achieve a high participation rate in a professional development program achieve more positive results during in-class teaching. We therefore advise future researchers to consider the participation rate in PD programs and take steps to increase the number of hours that teachers spend participating in the program. Teachers who participated for many hours in this study improved their delivery of common topics, use of teaching strategies, and use of materials/technology. It was observed that the teachers had deficiencies in the assessment domain, due to past experiences. These findings suggest that teachers need more knowledge and practice in class assessment during pre-service and in-service training. Similarly, it can be useful to consider learning theories at the professional-development stage. Researchers are advised to include questions about the content of programs, as well as general questions, in need-assessment surveys.

The model developed for this study was created by integrating 12 professional-development characteristics into the program at different levels. As Luft and Hewson (2014) have suggested (and the research results show), studies should integrate components and examine their effects, rather than measuring only one PD characteristic. In PD programs, models that focus on teachers are more effective than lectures by people deemed to be "experts" in the field. Still, educators can be invited to offer support, in accordance with teacher needs. PD programs run by experts should include mutual communication, rather than single-direction lecturing (Wheeler et al., 2015).

Recommendations

This study has explained the development process using five phases. In the literature, these development processes are not explored in detail (Stolk, de Jong, Bulte, & Pilot, 2011). The same study could be used to test a larger or different sample; it could also be applied to different disciplines.

The PD program was unable to provide a teacher-teacher communication environment before the training began. This type of communication could be achieved by including a longer period of time before the program. Preliminary preparation can familiarize teachers with the PD programs. This approach should be tried and tested in future PD programs. Future programs should include teachers as are active participants and involve them in practical applications. PD for teachers can be increased through face-to-face and non-face-to-face interactions (via computer networks and telephone calls). Hybrid learning environments can thus be used for PD programs, providing teachers with a supportive system for learning (Elster, 2010).

Scientific Ethics Declaration

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

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Authors Information

Ozlem Oktay
Ataturk University
Kazim Karabekir Education Faculty
Department of Mathematics and Science Education
25240 Erzurum, Turkey
Contact e-mail: *oktayozlm@gmail.com*
ORCID iD: 0000-0002-0207-1211

Ali Eryılmaz
Middle East Technical University
Faculty of Education
Department of Mathematics and Science Education
ORCID iD: 0000-0003-2161-6018

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

Serpil Deli, Ozlem Koray, Emine Kahraman

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Abstract

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

Introduction

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

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

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

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

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

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

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

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

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

The Study

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

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

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

Method

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

Study Group

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

Data Collection

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

Data Collection Tool

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

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

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

Data Analysis

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

Findings

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

Findings and Comments Related to the First Sub-Problem

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

Findings Related to the "Learning and Teaching Processes" Theme

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

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

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

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

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

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

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

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

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

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

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

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

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

Findings Related to the "Technical and Structural Situation" Theme

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

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

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

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

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

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

Findings Related to the "Assessment-Evaluation" Theme

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

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

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

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

Findings and Comments Related to the Second Sub-Problem

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

Findings Related to the "Learning and Teaching Processes" Theme

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

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

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

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

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

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

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

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

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

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

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

Findings Related to the "Technical and Structural Situation" Theme

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

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

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

Findings Related to the "Assessment-Evaluation" Theme

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

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

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

Findings and Comments Related to the Third Sub-Problem

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

Findings Related to the "Learning and Teaching Processes" Theme

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

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

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

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

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

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

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

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

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

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

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

Findings Related to the "Assessment-Evaluation" Theme

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

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

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

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

Results and Discussion

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Recommendations

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

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

Scientific Ethics Declaration

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

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Author(s) Information

Serpil Deli
Sırnak / Silopi - Cardakli Secondary School
Sırnak, Turkey
ORCID iD: https://orcid.org/0000-0001-8082-2781

Ozlem Koray
Zonguldak Bulent Ecevit University
Ereğli Faculty of Education
Mathematics and Sciences Department
Contact e-mail: ocankoray@gmail.com
ORCID iD: https://orcid.org/0000-0003-1804-0871

Emine Kahraman
Zonguldak Bulent Ecevit University
Ereğli Faculty of Education
Mathematics and Sciences Department
ORCID iD: https://orcid.org/0000-0002-0721-9545

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A Study on Digital Game Addictions of Adolescents in the Covid-19 Pandemic

Vahit Ciris, Turan Baskonus, Tezcan Kartal, Adem Tasdemir

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Abstract

The concept of digital game addiction has become an important issue that needs to be studied, depending on the increase in the time spent on the internet today, where technology and internet usage times are increasing rapidly. In this context, this study aimed to understand the antecedents of high school students' online game addiction risks. The survey method was used in the study. Within the scope of the research, 559 high school students randomly selected from this population formed the sample of the study. The "Game Addiction Scale for Adolescents," adapted into Turkish by Ilgaz (2015), was used as a data collection tool in the study. The results showed that digital game addictions of high school students were formed at the highest level in the dimensions of mood modifications, tolerance, and salience, respectively. The lowest averages were in the withdrawal and conflict dimensions. These findings show that high school students experience many emotional states in the game at a high level. Besides, while digital game addiction of male students was higher, it was determined that games played via computer caused more digital addiction. While digital game addictions of high school students do not change according to their grade level and academic achievement, their digital game addictions change according to family income level, playing time, and parental education level.

Introduction

Technological developments, changing needs, and sometimes necessities can cause our daily habits to change and a new lifestyle to be formed. Especially during the covid-19 pandemic, a closed life and the formation of an online communication process have brought technological developments and the internet to the important focus of our lives. As a matter of fact, studies conducted in the last ten years show that individuals' technology and internet usage times in daily life have increased rapidly, and the internet has become an important part of our lives (Derbyshire et al., 2013; Young & De Abreu, 2011). The internet is an important tool for individuals to reach rich information content and communicate with others from all over the world (Young & De Abreu, 2011). The emergence of smartphones and easy access to the internet has also significantly increased access to personal technologies (Schmitt & Livingston, 2015). Despite all these developments, this ease of access and social networking process has raised concerns for many individuals, especially adolescents. Especially one of these concerns is internet addiction (Young, 2009). Many applications accessed over the Internet can be addictive to adults and children, and an average adult can spend seven hours a day on the Internet. Due to the increase in the time spent on the Internet, the concept of digital game addiction has become one of the important issues to be studied, especially during the Covid-19 pandemic, and research on its effects on children has become a subject of interest. Especially adolescents show great interest in these games, which are suitable for almost all ages, and the time spent playing games is increasing day by day (Gentile, 2009). When the literature is examined, it is seen that digital game addiction has become a more serious problem with each passing day, and the research on this subject is increasing day by day. In general, the primary purpose of research is to understand addiction, to reveal its causes and consequences (Bhagat et al., 2020).

According to Greenfield (2011), the most addictive aspect of the internet is computer games. Computer games are considered a popular type of activity loved by adolescents to relieve the stress of work or activities made during leisure times (Griffiths, 2005). In addition, changing socioeconomic conditions enable children to access various games more easily (Charoenwanit & Sumneangsanor, 2014). Although these content areas are not limited to the internet, it is known that the addictive potential of the content increases when they are accessed over the internet. Currently, almost every young person can easily access various technological developments, especially in online games, and online game addiction is increasing in adolescents (Rehbein et al., 2015). Adolescents are in the age group sensitive to online game addiction due to features related to the developmental

period (e.g., communication difficulties in interpersonal relationships and the need for self-actualization) (Lafrenière, Vallerand, Donahue, & Lavigne, 2009). The aspects of online gaming addiction that interrupt other daily activities and negatively affect life are among the sensitive issues, especially for adolescents (APA, 2013). According to Young (2009), someone's inability to control the use of online games has many effects on physical and psychological harm to its users. On the one hand, adolescents may find it easier to establish close relationships with others in an imaginary world of games than to communicate directly with them. Therefore, Interactions in the game world can represent a way to solve real interpersonal problems. On the other hand, it can allow adolescents to gain respect and esteem from other players with their gaming skills, thereby satisfying their self-actualization needs. Due to the increase in the time adolescents spend with internet games, it harms the social, occupational, family, school, and psychological functioning of the individual (Gentile et al., 2011; Kuss, 2013). There is limited literature on the risk factors associated with gaming addiction in adolescents. There is not much detailed information other than male dominance depending on gender (Chou & Tsai, 2007; Gentile, 2009; Irles & Gomis, 2016; Padilla-Walker et al., 2010). Therefore, this exploratory study aimed to expand knowledge on potential risk factors for gaming addiction among adolescents.

Online Game Addiction in Adolescents

Technological developments are very rapid in the digital age. Today's adolescents have easy access to technology and are a generation that develops and changes with technology (Oblinger & Oblinger, 2005). One of the technological development products adolescents prefer in the digital age is digital games (Novrialdy & Atyarizal, 2019). Games offer endless and constantly changing experiences, often in a social context, and new games and innovative technologies are constantly entering the consumer market. Many of the new games feature more immersive, socially integrated, and monetized functions than their predecessors (Kuss et al., 2017). However, while gaming provides many benefits, there is a growing recognition that unrestricted screen time can cause harm, especially in young people, and that for some vulnerable people, gaming can be quite time-consuming and addictive (King & Delfabbro, 2020). Games are one of the most comprehensive entertainment activities, regardless of culture, age, and gender, especially since the development of the internet. Computer games that could have been played offline in the past are now compatible with online environments (Bağcı & Albayrak Özer, 2021). Online games are associated with needs such as a sense of achievement, social visibility, and escape (Kuss et al., 2017; Kuss et al., 2012; Wan & Chiou, 2006). When combined with excessive playing times, this situation can lead to a decrease in quality of life (Fuster et al., 2016) and even addiction (Lui et al., 2011; Xu et al., 2012).

The American Psychiatric Association (APA) has defined addiction as "continuing to make maladaptive choices even in the face of a clearly stated different choice" (APA, 2013). Internet addiction is defined as 1) overuse, often associated with a loss of sense of time or neglect of basic impulses; 2) withdrawal with feelings of anger, tension, and/or depression when the computer is not accessible; 3) tolerance with the need for better computer equipment, more software, or more hours of use; and 4) negative reactions with arguments, lying, poor achievement, social isolation, and fatigue (Block, 2008). Lemmens et al. (2012) state that digital game addiction should be examined in the context of seven criteria. These are;

- "salience," making the game the focus of the individual's life,
- "tolerance," the increasing time spent in the game,
- "mood modification," the orientation of the individual to the game to get rid of his troubles,
- "withdrawal," situations such as sudden irritability and irritability during the game,
- "relapse" excessive desire to play and a tendency to play repeatedly,
- "conflict" experiencing conflicts with those around them and displaying negative behaviors such as lying, and
- "problems," having problems in daily life due to excessive gaming.

In particular, there are psychological and utilitarian gains behind the decisions of individuals to continue using technologies (Kim, 2009). In this respect, users may develop distorted beliefs about technology use. Young (2010) states that online games are one of the most addictive activities. Addiction is characterized by the loss of control over online gaming (van Rooij et al., 2011), the increased priority of online gaming over other interests and daily activities (Griffiths et al., 2004; Choi & Kim, 2004) and escaping from the realities of life (Hussain & Griffiths, 2009) and continuing to play online despite negative consequences (Saunders et al., 2017).

Games can have positive aspects such as reducing stress and fatigue improving visual and attention skills (Green & Bavelier, 2003; Griffiths 2005). However, the increasing popularity of online games, along with the

increasing number of reported online gaming addiction cases, lead to some negative effects such as ignoring family responsibilities, neglecting work, health problems and committing crimes (Hsu et al., 2009; King et al., 2018). Griffiths et al. (2004) revealed that young gamers spend more time on online games than adult gamers and form stronger bonds. This shows that young people may be addicted to online games. Online games attract millions of players worldwide who spend a few hours a day. Such games can make users addicted, similar to substance abuse (Kuss et al., 2012). Online gaming addiction is becoming more and more widespread and is increasingly worrisome. In addition, the American Psychiatric Association (2013) explains that online game addiction is the constant and repetitive use of online games, which often leads to disruption of daily life. Young (2009) states that addiction to online games can have enormous consequences for the player. Gaming addicts willingly give up sleep, food, and real human contact to spend more time in the virtual world. Players are constantly alerted in the ever-changing virtual environment. The "just a few more minutes" approach can turn into hours as the game addict aims for the next challenge (Sherry et al., 2006). Game addicts need to play for a long time to gain superiority in the game. Teenagers who are addicted to online games have difficulty forming social relationships with their peers or other individuals. This is because young people spend too much time playing online games, thus reducing their opportunities for building relationships (Young, 2009).

Playing online games can also be done to avoid problems, but it is not a wise choice. Because continuing to avoid problems will not solve the problems (Grizzard et al., 2014). In the study conducted by Chung et al. (2019), approximately 6% of adolescents were categorized as a severely dependent group. Comparisons between groups showed that the addicted group started using the internet earlier than others. They have been reported to have higher levels of depression and aggression, as well as lower family cohesion and higher accessibility to computer cafes, and exposure to internet gaming advertising. It has also been observed that environmental factors have a greater effect on adolescents than family or school-related factors. Wan and Chiou (2006) conducted a qualitative study on why adolescents in Taiwan are addicted to internet games. Most interviewees stated that life without online games was"dark" and"boring."The interviewees stated that playing online games is just a "feeling of relaxation," "leisure time activities," "getting away from the present," "escaping from reality," "relaxing," "feeling like you are still working." In addition, adolescents stated that they see online gaming as the focal point of their lives. Yang and Tung (2007) reported that Taiwanese high school students, who are characterized by shyness, addiction, depression, and low self-esteem, have a higher tendency to become addicted to online games. In the study conducted by Ekinci et al. (2017) with high school students, it was seen that male students' digital game addiction was higher than female students. In addition, it was determined that the digital game addiction level of students who do not do sports is higher than those who do sports. It was concluded that students who have difficulty making use of their spare time also have high levels of digital game addiction. In the study conducted by Gentile et al. (2011), it was reported that depression, anxiety, social phobias, and low school performance are among the consequences of problematic gaming. In particular, most youth (84%) who were initially identified as problem players were still found to be problem players two years later. It has been observed that problematic games can often persist without intervention. In their research, Toker and Baturay (2016) found that socioeconomic status, smoking, playing online games, computer games, and maternal employment increase game addiction; and gender (female) and maternal education level decreased game addiction. They also revealed that game addiction significantly reduced GPA and self-esteem.

Online gaming addiction in adolescents affects various aspects of life such as psychological, health, academic, social, and financial (Billieux et al., 2008; Griffiths et al., 2012; King & Delfabbro, 2018; Lemmens et al., 2011; Novrialdy et al., 2019; Weinstein, 2010). Online gaming is an emotionally tiring and time-consuming activity. In order to create more time for the computer, game addicts avoid sleep, diet, exercise, hobbies, and socialization (Young, 2004; Dworak et al., 2007), family responsibilities, work, and health problems (Batthyány et al., 2009; Hsu et al., 2009; Young, 2009). They may experience some health problems such as back pain, eye strain, and repetitive stress because they do not take the time to get enough rest and nutrition they need (Young, 2009). The dangers that may arise due to addiction to online games include indifference to other activities (Oggins & Sammis, 2012), feeling restless when not playing games (Jannah et al., 2015), loss of control over time, decreased academic achievement, weakening of social relationships, financial and health problems. (Ghuman & Griffiths, 2012). In addition, it can cause many negative physical and psychological harms, such as social isolation, suicide, insomnia, hypertension, and death (Bruner & Bruner, 2006). In addition, a student's use of personal computers, smartphones, and video games is associated with negative psychosocial behaviors that affect student learning (Jeong & Kim, 2011; Heyoung et al., 2014; Schmitt & Livingston, 2015). A lack of understanding of the risks of online gaming addiction can keep adolescents stuck in online gaming addiction (Jeong & Kim, 2011; Novrialdy et al., 2019). According to Papec et al. (2015), one of the most important obstacles to the use of time is digital game addiction. Therefore, online gaming addiction has recently become a topic of increasing research interest. Less understanding of the risks of online gaming addiction may lead individuals to become trapped in online gaming addiction. Future studies can be conducted with more precise

measurements on the identified potential risk factors (Lam et al., 2009). This study aims to understand the antecedents of high school students' online game addiction risks. By understanding the antecedents of this condition, better prevention, screening, and intervention techniques can be developed. This also represents a gap that is intended to contribute to the literature. In this context, answers to the following questions were sought in the study.

1. What is the digital addiction level of high school students?
2. Does the digital addiction levels of high school students
   a. vary according to gender characteristics?
   b. vary by grade level?
   c. vary according to family income status?
   d. vary according to academic grade point averages?
   e. vary according to mother's educational status?
   f. vary according to father's educational status?
   g. vary according to the time spent in the game?

Method

The survey method, one of the quantitative research methods, was used in the research. The survey method aims to determine the group's specific characteristics to be researched through a restricted population and to test the hypotheses about the nature of the relationships within this group. In survey studies that aim to describe a past or present situation as it is, a large number of people can be reached, especially in a short time, and the views of the participants can be described by researching on large samples (Fraenkel et al., 2011; Creswell, 2012). Within the scope of this research, high school students were considered a limited population, and their digital addiction levels as a phenomenon were tried to be described in terms of some independent variables. In this process, the personal opinions of high school students were taken through face-to-face applications. This process aims to increase the reliability of the obtained data.

Study Group

The target population of the research is high school students in secondary education institutions affiliated with the Ministry of National Education. The limited population of the research consists of students studying in public high schools in a province located in Central Anatolia in the 2019-2020 academic year. Within the scope of the research, 559 high school students randomly selected from this population formed the sample of the study.

Before determining the study sample, the sample group size was calculated using the Power analysis G Power statistical software (Faul et al. 2007). In this context, the digital game addiction scale was evaluated as the primary outcome parameter, and the target sample size was calculated as 495 was for the effect size (.2), Alpha (.05), and Power (.95) values obtained in previous studies. In addition, to generalize to a population of approximately 5000 people, it is sufficient to reach 357 people with at least .05 significance level and .05 deviation (URL-1). In this direction, 559 high school students in the study sample are sufficient for generalization to the restricted population.

During the data collection process, a total of 636 measurement tools were delivered to high school students, and the opinions of 559 students who were suitable for data entry were included in the scope of the study. The survey response rate was calculated as 87.8%. In order to make a healthy comment, the return rate of the survey is 70-80% (Büyüköztürk et al., 2017). In this context, it can be said that the data obtained within the scope of the study are suitable for making a healthy interpretation. Information about the students included in the study is given in Table 1.

While 237 (42.4%) of the high school students in the study group were female, 322 (57.6%) were male. In addition, 45.1% of the students are in 9th grade, 27.5% are in 10th grade, 18.4% are in 11th grade, and 8.9% are in 12th-grade. While the family income level of approximately 50% of the students in the study group is between 2501-5000 TL, their parents' education level is at the highest rate at the high school level. 241 (43.1%) of the students play for 1-2 hours, 147 (26.3%) of them play daily for 3-4 hours. In addition, the majority of students use mobile phones (n=446; 79.8%) as a means of playing games.

Table 1. Demographic information of high school students in the study group

Independent variables		f	%	Independent variables		f	%
Gender	Female	237	42.4	Educational status of the mothers	Primary	151	27.0
	Male	322	57.6		Secondary	166	29.7
Grade Levels	9. grade	252	45.1		High School	168	30.1
	10. grade	154	27.5		University	74	13.2
	11. grade	103	18.4	Educational status of the fathers	Primary	80	14.3
	12. grade	50	8.9		Secondary	126	22.5
Family income	0-2500 TL	168	30.1		High School	200	35.8
	2501-5000 TL	282	50.4		University	153	27.4
	5001-7500 TL	69	12.3	Time spent in game	1 hour and less	23	4.1
	7500 - + TL	40	7.2		1-2 hours	241	43.1
Academic grade point average	25-54	56	10.0		3-4 hours	147	26.3
	55-69	168	30.1		5-6 hours	83	14.8
	70-84	176	31.5		7 hours and more	65	11.6
	85-100	159	28.4				
Gaming tools	Mobile phone	446	79.8				
	Computer	113	20.2				

Data Collection Tools

"Personal Information Form (PIF)" developed by the researchers and "Game Addiction Scale for Adolescents" adapted into Turkish by Ilgaz (2015) were used as data collection tools in the research. The aim of PIF is to collect data on independent variables (gender, class level, income status, etc.) that are considered to be a factor in students' digital addiction, which is considered as the dependent variable within the scope of the study (Young, 2009; Jeong & Kim, 2011; Irles & Gomis, 2016; Toker & Baturay, 2016; Ekinci et al., 2017; King & Delfabbro, 2018; Novrialdy et al., 2019; Chung et al., 2019). In addition, the "Game Addiction Scale for Adolescents," which was originally developed by Lemmens et al. (2009) and adapted into Turkish by Ilgaz (2015), was used to determine digital game addictions of high school students. It is one of the most cited and widely used scales. This scale is also common in representation compared to other scales.

The scale consists of 21 items and seven factors. The 7 factors and reliability coefficients in the scale are as follows: 1. factor: Salience, α=.78; 2nd factor: durability factor, α=.79; 3rd factor: mood modification factor, α=.66; 4th factor: withdrawal factor, α=.74; 5th factor: relapse factor, α=.85; 6th factor: conflict factor, α=.83; 7th factor: problems factor, α=.62. The Cronbach Alpha internal consistency coefficient for the overall scale was calculated as .92. There are three items in each factor. The scoring of the scale is in a 5-point Likert type, and the scorings are "Never (1), Rarely (2), Sometimes (3), Often (4) and Very Often (5)". The internal reliability coefficient of the scale used in the research was recalculated and calculated as .87. These results show that the measurement tool will give reliable results within the scope of the study (Kalaycı, 2010).

In addition, the scores obtained by high school students in the Game Addiction Scale were recalculated by taking into account the Likert interval used by Hazar and Hazar (2017) in determining their digital game addiction levels. The digital game addiction ranges used in the study are as follows: "1-21: Normal group, 22-42: Low-risk group, 43-63: Risky group, 64-84: Addicted group, 85-105:Highly addicted group", and they are converted to discontinuous data format.

Analysis of Data

Both descriptive and relational analyses were used together to analyze the data. Frequency (f), percentage (%), standard deviation (SD) values were used to determine the digital addiction levels of high school students within the scope of descriptive analysis. Before examining the digital addiction levels of high school students according to their demographic information, it was examined whether the data showed a normal distribution.

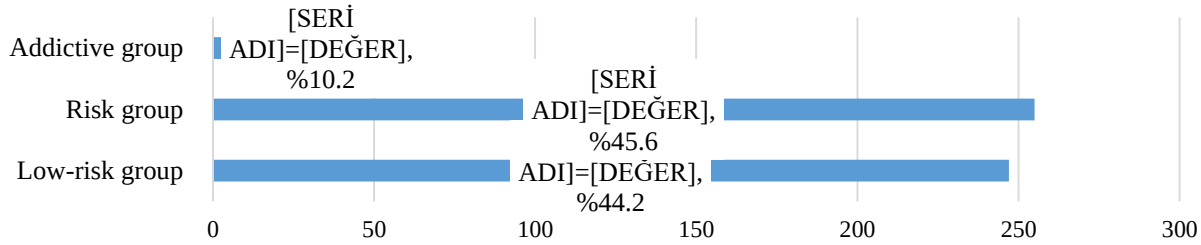
Table 2. The findings of normal distribution

		Values
Mean		2.2062
Median		2.1429
Mod		2.00
Skewness		.396
Kurtosis		-.628
Kolmogorov-Smirnov	Statistic	.077
	p	.000

When the normal distribution data on digital addiction of high school students in Table 2 are examined, it is seen that the mean, mode, and median values are not close to each other. In addition, the skewness value of the data is ,396, while the kurtosis value is -.628. Kolmogorov-Smirnov value is statistically significant ($p<.05$). The normal distribution is symmetrical, and it is the distribution whose mean-mode-median values are equal to each other. In addition, the insignificance of the Kolmogorov-Smirnov test for studies with a sample size of more than 50 is interpreted as a normal distribution (Kalaycı, 2010). These findings obtained in Table 2 can be interpreted as the data set does not show a normal distribution. In line with all these data obtained, the Mann-Whitney U test was used while examining the digital addiction levels of high school students according to two-pore variables such as gender and game-playing tool. The Kruskal Wallis test was used to examine digital game addictions of students according to more than two porous variables such as grade level and family income level. The z value was used to calculate the effect size (r) for significant differences. If N= the total number of samples, the effect size value can be calculated using the formula $r=z/\sqrt{N}$ (Pallant, 2020). According to Cohen (1988) criteria, it was interpreted as .1=small, .3=medium, .5=large effect size values.

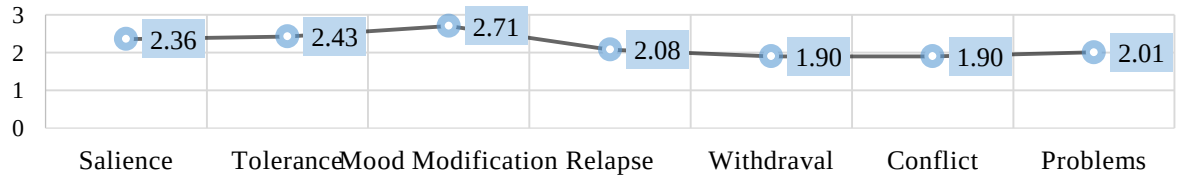
Results

Digital game addictions and distributions of high school students are given in graphic 1.



Graphic 1. Digital game addiction levels of high school students

The scores of the high school students in the study sample from the digital game addiction scale were collected under five groups (normal, addicted, low-risk, risky, high-risk) and transformed into a categorical one. According to the data obtained, it was determined that high school students were highest in the risk group (255, 45.6%), low-risk group (247, 44.2%), and addictive group (57, 10.2%), respectively. In addition, it was determined that there were no students in the normal group and at the very risky level.



Graphic 2. Digital game addiction levels of high school students in sub-dimensions

When digital game addictions of high school students were examined in the context of the sub-dimensions that make up the game addiction scale for adolescents, the highest level was observed in the dimensions of mood modification ($\bar{x}$ =2.71), tolerance ($\bar{x}$ =2.43), and salience ($\bar{x}$ =2.36), respectively. The lowest averages were in the withdrawal ($\bar{x}$ =1.9) and conflict ($\bar{x}$ =1.9) dimensions. These findings show that high school students experience many mood states in the game at a high level. They apply to the game to get rid of their troubles, the time spent playing the game is starting to increase, and the gameplay has become an important focus in the lives of the students. In addition, it can be said that high school students rarely experience conflicts with other people

around them due to unpleasant situations such as sudden irritability and anger during the game and excessive playing.

Table 3. Findings related to digital game addiction levels of high school students by gender

	Gender	N	MS	SS	U	Z	p	Effect size (r)
Salience	Female	237	245.18	58108.50	29905.5	-4.403	.000	.186
	Male	322	305.63	98411.50				
Tolerance	Female	237	264.02	62573.50	34370.5	-2.019	.044	.085
	Male	322	291.76	93946.50				
Mood Modification	Female	237	263.48	62445.50	34242.5	-2.085	.037	.088
	Male	322	292.16	94074.50				
Relapse	Female	237	249.02	59017.00	30814.0	-3.925	.000	.166
	Male	322	302.80	97503.00				
Withdraval	Female	237	255.97	60665.50	32462.5	-3.085	.002	.130
	Male	322	297.68	95854.50				
Conflict	Female	237	275.57	65311.00	37108.0	-.563	.573	-
	Male	322	283.26	91209.00				
Problems	Female	237	271.75	64405.50	36202.5	-1.046	.296	-
	Male	322	286.07	92114.50				

In Table 3, when the digital addiction levels of high school students are examined according to their gender characteristics, it is generally seen that males' digital addiction is higher in each dimension. However, the difference in means between groups in (U=29905.5, p=.000, r=.186), tolerance (U=34370.5, p=044, r=.085), change in status (U=34242.5, p=.037, r=.088), relapse (U=30814, p=.000, r=.166) and withdrawal (U=32462.5, p=002, r=.130) dimensions was significant in favor of male students, whereas the means between groups were not statistically significant in conflict (U=37108, p=.573) and problems (U=36202.5, p=.296) dimensions. Significant differences have small effect sizes. These findings obtained shows that the game became the focal point in male student's lives, the time spent playing the game started to increase gradually, they experienced the game as fun, they could experience sudden moodiness and irritability during the game, and they could not control their desire to play excessively and started playing games again and again.

Table 4. Findings related to digital game addiction levels of high school students by game playing tools

	Game Playing Tool	N	MS	SS	U	Z	p	Effect Size (r)
Salience	Mobile Phone	446	269.80	120329.50	20648.5	-2.988	.003	.126
	Computer	113	320.27	36190.50				
Tolerance	Mobile Phone	446	268.20	119618.50	19937.5	-3.452	.001	.146
	Computer	113	326.56	36901.50				
Mood Modification	Mobile Phone	446	266.78	118985.50	19304.5	-3.864	.000	.163
	Computer	113	332.16	37534.50				
Relapse	Mobile Phone	446	273.21	121852.50	22171.5	-1.992	.046	.084
	Computer	113	306.79	34667.50				
Withdraval	Mobile Phone	446	272.08	121346.50	21665.5	-2.356	.018	.099
	Computer	113	311.27	35173.50				
Conflict	Mobile Phone	446	272.41	121493.50	21812.5	-2.237	.025	.094
	Computer	113	309.97	35026.50				
Problems	Mobile Phone	446	270.99	120860.00	21179.0	-2.647	.008	.111
	Computer	113	315.58	35660.00				

When digital addiction is examined in terms of gaming tools, it has been determined that students who play games with computers are generally more addicted than students who play mobile phones. The difference between the mean rank in each dimension differs in favor of the students playing games with the computer. These findings show that especially games played via computer cause more digital addiction. It can be said that students who play games with the computer focus on the game more, the time spent on the game is getting more and more, the game becomes more fun, and they embrace playing games more, the unwanted psychological and physiological situations increase during the game, they experience conflict with the individuals around them, and they started to have problems in areas of responsibility such as school as a result of excessive gaming behavior.

Table 5. Findings related to digital game addiction levels of high school students by grade levels

	Grade Levels	N	MS	χ^2	df	p
Salience	[1]9.grade	252	279.98	1.765	3	.623
	[2]10.grade	154	285.48			
	[3]11.grade	103	285.22			
	[4]12.grade	50	252.44			
Tolerance	[1]9.grade	252	275.20	.423	3	.935
	[2]10.grade	154	283.50			
	[3]11.grade	103	283.44			
	[4]12.grade	50	286.32			
Mood Modification	[1]9.grade	252	282.17	2.620	3	.454
	[2]10.grade	154	264.15			
	[3]11.grade	103	296.06			
	[4]12.grade	50	284.81			
Relapse	[1]9.grade	252	284.71	.642	3	.887
	[2]10.grade	154	274.48			
	[3]11.grade	103	281.94			
	[4]12.grade	50	269.25			
Withdraval	[1]9.grade	252	282.38	.529	3	.913
	[2]10.grade	154	277.42			
	[3]11.grade	103	284.45			
	[4]12.grade	50	266.81			
Conflict	[1]9.grade	252	279.73	3.802	3	.284
	[2]10.grade	154	263.32			
	[3]11.grade	103	302.39			
	[4]12.grade	50	286.63			
Problems	[1]9.grade	252	277.05	,769	3	,857
	[2]10.grade	154	280.28			
	[3]11.grade	103	277.86			
	[4]12.grade	50	298.44			

Table 6. Findings related to digital game addiction levels of high school students by family income

	Family income	N	MS	χ^2	df	p	The source of the difference, Effect Size (r)
Salience	[1]0-2500 TL	168	260.13	8.116	3	.044	3>1, r=.189
	[2]2501-5000 TL	282	281.18				
	[3]5001-7500 TL	69	325.32				
	[4]7500 and above TL	40	276.95				
Tolerance	[1]0-2500 TL	168	262.61	10.252	3	.017	3>1, r=.188
	[2]2501-5000 TL	282	273.89				
	[3]5001-7500 TL	69	327.72				
	[4]7500 and above TL	40	313.81				
Mood Modification	[1]0-2500 TL	168	263.49	7.614	3	.055	
	[2]2501-5000 TL	282	275.76				
	[3]5001-7500 TL	69	314.02				
	[4]7500 and above TL	40	320.55				
Relapse	[1]0-2500 TL	168	267.15	7.124	3	.068	
	[2]2501-5000 TL	282	276.12				
	[3]5001-7500 TL	69	326.72				
	[4]7500 and above TL	40	280.68				
Withdraval	[1]0-2500 TL	168	285.01	2.725	3	.436	
	[2]2501-5000 TL	282	271.80				
	[3]5001-7500 TL	69	281.99				
	[4]7500 and above TL	40	313.38				
Conflict	[1]0-2500 TL	168	266.04	6.359	3	.095	
	[2]2501-5000 TL	282	275.61				
	[3]5001-7500 TL	69	307.36				
	[4]7500 and above TL	40	322.40				
Problems	[1]0-2500 TL	168	271.83	1.402	3	.705	

[2]2501-5000 TL	282	279.41
[3]5001-7500 TL	69	297.99
[4]7500 and above TL	40	287.46

Digital game addiction levels of high school students do not change significantly in each dimension according to their grade levels. In particular, this finding shows that students' grade levels are not a factor influencing their digital addiction. The digital addiction levels of the students in each class are equal to each other.

When Table 6 is examined, it is seen that the highest rank average of high school students' digital addiction levels according to their family income status is seen in the children of families with an income of 5001-7500 TL and 7500 TL and above, while it is seen that it occurs lowest in children with a family income of 0-2500 TL. In terms of salience and tolerance, the difference between the mean rank of the groups was in favor of the income of 5001-7500 TL families among families with an income of 5001-7500 TL and families with an income of 0-2500 TL. These significant differences have a small effect size. These findings show that the family income level is an effective variable on digital addictions, especially in the salience and tolerance dimensions of high school students, and show that children's digital addictions increase with the increase in the family's income level. It can be interpreted that play has become the most important focus in life, especially for children from families with high incomes, and the frequency of children's playing and the time spent playing games are starting to increase.

Table 7. Findings related to digital game addiction levels of high school students by academic grade point average

	Academic grade point average	N	MS	χ^2	df	p	The source of the difference, Effect Size (r)
Salience	[2]25-54	56	269.07	5.869	3	.118	
	[3]55-69	168	297.23				
	[4]70-84	176	287.78				
	[5]85-100	159	257.04				
Tolerance	[2]25-54	56	256.83	2.123	3	.547	
	[3]55-69	168	287.01				
	[4]70-84	176	287.00				
	[5]85-100	159	273.01				
Mood Modification	[2]25-54	56	280.71	.592	3	.898	
	[3]55-69	168	273.14				
	[4]70-84	176	280.19				
	[5]85-100	159	286.79				
Relapse	[2]25-54	56	276.29	4.874	3	.181	
	[3]55-69	168	297.26				
	[4]70-84	176	283.87				
	[5]85-100	159	258.79				
Withdraval	[2]25-54	56	301.44	9.331	3	025	3>4, r=.108
	[3]55-69	168	305.04				3>5, r=.157
	[4]70-84	176	270.11				
	[5]85-100	159	256.94				
Conflict	[2]25-54	56	263.42	1.624	3	.654	
	[3]55-69	168	277.34				
	[4]70-84	176	291.28				
	[5]85-100	159	276.17				
Problems	[2]25-54	56	310.87	2.380	3	.497	
	[3]55-69	168	279.08				
	[4]70-84	176	275.50				
	[5]85-100	159	275.08				

When the digital game addiction levels of high school students were examined according to their academic success grades, it was determined that the digital game addiction levels of the students did not change according to their academic success grades. However, students with an academic grade point average (GPA) of 25-54 ($\bar{x}$ =301.44, n=56) and 55-69 ($\bar{x}$ =305.04, n=168) in the withdrawal dimension have high levels of digital addiction. The means between groups were statistically significant (χ^2=9.331, p=.025, r=.108, r=.157). The significant difference was in favor of students with a grade point average of 55-69 between students with a grade point

average of 55-69 and students with a grade point average of 70-84 and 85-100. These significant differences have a small effect size. Although the findings show that the students' academic GPA does not affect their digital addiction in general, it is seen that students with a low GPA in the withdrawal sub-dimension have digital game addiction. This shows that students with low-grade point averages exhibit unpleasant situations such as sudden irritability and anger during the game.

Table 8. Findings related to digital game addiction levels of high school students by time spent in gaming

	Time spent in the game	N	MS	χ^2	df	p	The source of the difference
Salience	[1] 1 hour and less	23	160.87	52.051	4	.000	3,4,5>2,1
	[2] 1-2 hours	241	242.82				2>1
	[3] 3-4 hours	147	293.01				4>3
	[4] 5-6 hours	83	352.48				
	[5] 7 hours and more	65	338.03				
Tolerance	[1] 1 hour and less	23	204.72	31.938	4	.000	3,4,5>2,1
	[2] 1-2 hours	241	246.86				
	[3] 3-4 hours	147	293.77				
	[4] 5-6 hours	83	332.13				
	[5] 7 hours and more	65	331.82				
Mood Modification	[1] 1 hour and less	23	225.78	10.684	4	.030	3,4,5>2,1
	[2] 1-2 hours	241	261.68				
	[3] 3-4 hours	147	293.85				
	[4] 5-6 hours	83	297.17				
	[5] 7 hours and more	65	313.86				
Relapse	[1] 1 hour and less	23	191.96	32.757	4	.000	3,4,5>2,1
	[2] 1-2 hours	241	247.46				
	[3] 3-4 hours	147	297.38				
	[4] 5-6 hours	83	330.90				
	[5] 7 hours and more	65	327.50				
Withdraval	[1] 1 hour and less	23	240.65	31.626	4	.000	3,4,5>2,1
	[2] 1-2 hours	241	245.28				4,5>3
	[3] 3-4 hours	147	287.39				
	[4] 5-6 hours	83	331.75				
	[5] 7 hours and more	65	339.85				
Conflict	[1] 1 hour and less	23	240.50	27.475	4	.000	3,4,5>2,1
	[2] 1-2 hours	241	248.65				5>3
	[3] 3-4 hours	147	285.42				
	[4] 5-6 hours	83	320.45				
	[5] 7 hours and more	65	346.31				
Sorunlar (Problems)	[1] 1 hour and less	23	230.43	19.813	4	.001	4,5>2,1
	[2] 1-2 hours	241	258.68				4,5>3
	[3] 3-4 hours	147	275.78				
	[4] 5-6 hours	83	317.16				
	[5] 7 hours and more	65	338.67				

It is seen that the digital game addiction levels of high school students generally occur in children who play games for more than 7 hours and 5-6 hours a day at the highest level in each dimension. The mean difference between the groups, on the other hand, is significant in favor of students who play games for more than 7 hours and 5-6 hours in general. These findings show that their digital game addictions also increase, especially with the increase in the duration of the students' playing games.

In Table 9, it is seen that the highest digital addiction averages according to the educational status of the mothers generally occur in the children of mothers who are high school and university graduates. It was determined that there was a significant difference, especially in the dimensions of mood modification (χ^2=9.739, p=.021) and relapse (χ^2=13.993, p=003). This finding shows that the mother's education level is a factor in the digital game addiction of their children, and as the education level of the mother increases, the digital game addiction of the children increases. In addition, it can be said that high school and university graduate mothers' children see the game as a means of entertainment to get rid of their problems, and they cannot control the excessive playing behavior and turn to the behavior of playing games again.

Table 9. Findings related to digital game addiction levels of high school students by mother's educational status

	Mother's education status	N	MS	χ^2	df	p	The source of the difference, Effect Size (r)
Salience	[1] Primary	151	263.72	3.015	3	.389	
	[2] Secondary	166	287.33				
	[3] High school	168	278.76				
	[4] University	74	299.58				
Tolerance	[1] Primary	151	259.87	4.728	3	.193	
	[2] Secondary	166	276.15				
	[3] High school	168	297.25				
	[4] University	74	290.55				
Mood Modification	[1] Primary	151	252.92	9.739	3	.021	3>1, r=.133
	[2] Secondary	166	273.34				4>1, r=.181
	[3] High school	168	295.17				
	[4] University	74	315.76				
Relapse	[1] Primary	151	241.89	13.993	3	.003	2>1, r=.136
	[2] Secondary	166	285.60				3>1, r=.207
	[3] High school	168	308.26				
	[4] University	74	281.05				
Withdrawal	[1] Primary	151	257.54	4.212	3	.240	
	[2] Secondary	166	287.18				
	[3] High school	168	289.89				
	[4] University	74	287.28				
Conflict	[1] Primary	151	260.11	4.888	3	.180	
	[2] Secondary	166	275.63				
	[3] High school	168	298.07				
	[4] University	74	289.36				
Problems	[1] Primary	151	269.70	4.802	3	.187	
	[2] Secondary	166	264.98				
	[3] High school	168	295.02				
	[4] University	74	300.63				

Table 10. Findings related to digital game addiction levels of high school students by father educational status

	Father's education status	N	MS	χ^2	df	p	The source of the difference, Effect Size (r)
Salience	[1] Primary	80	266.09	1.182	3	.757	
	[2] Secondary	126	274.30				
	[3] High school	200	283.47				
	[4] University	153	287.43				
Tolerance	[1] Primary	80	276.96	1.305	3	.728	
	[2] Secondary	126	267.83				
	[3] High school	200	281.66				
	[4] University	153	289.45				
Mood Modification	[1] Primary	80	258.09	13.668	3	.003	4>1, r=.134
	[2] Secondary	126	241.70				4>2, r=.191
	[3] High school	200	294.76				3>2, r=.161
	[4] University	153	303.71				
Relapse	[1] Primary	80	255.96	2.145	3	.543	
	[2] Secondary	126	282.04				
	[3] High school	200	283.84				
	[4] University	153	285.87				
Withdrawal	[1] Primary	80	296.92	1.894	3	.595	
	[2] Secondary	126	267.13				
	[3] High school	200	278.09				
	[4] University	153	284.25				
Conflict	[1] Primary	80	284.21	.210	3	.976	
	[2] Secondary	126	274.66				
	[3] High school	200	280.91				
	[4] University	153	281.00				

Problems	[1] Primary	80	285.83	2.079	3	.556
	[2] Secondary	126	270.16			
	[3] High school	200	273.29			
	[4] University	153	293.83			

In Table 10, when digital game addictions of high school students were examined in terms of father's education level, there was a significant difference only in the mood modification sub-dimension (χ^2=13.668, p=.003). The significant differences that occurred had a small effect size (r=.134, r=.191, r=.161). It is seen that the mean between the groups is significant between the children of fathers who are high school and university graduates and the children of fathers who are primary and secondary school graduates, in favor of the first group. This shows that with the increase in fathers' education level, their children start to see games as fun, and they turn to digital games to get rid of their troubles.

Conclusion and Discussion

High school students were gathered under three groups when digital game addictions were grouped. These are; risky group, low-risk group, and addictive group, respectively. About 10% of the students in the study group are addicted to digital games. In addition, most of the high school students (45.6%) are in the risky group. Among the students in the study sample, students in the normal group and the high-risk group were not detected. These results show that digital games have a high risk of addiction for students in high school. In the study conducted by Chung, Lee, and Lee (2019), approximately 6% of adolescents were categorized as a severely addictive group. Comparisons between groups showed that the addicted group started using the internet earlier than others.

When it is examined in the context of the subgroups that make up the scale, digital game addictions of high school students were found at the highest level in the dimensions of mood modification, tolerance, and salience. The lowest averages are in the withdrawal and conflict dimensions. These results show that high school students experience many emotional states in the game at a high level. They resort to the game to get rid of their troubles, the time spent playing the game has started to increase, and the gameplay has become an important focus in the students' lives. In particular, this situation may cause high school students to have anxiety and worry in their thoughts later on and may cause more desire to overuse games. In addition, it can be said that high school students rarely experience conflicts with other people around them due to unpleasant situations such as sudden irritability and anger during the game and excessive playing. Educations for the conscious use of technology can be brought to the fore in preventing students' online game addiction. The education designed in the middle of formal learning can provide a good cognition development for individuals to understand the dangers of online gaming addiction. Moreover, education can encourage rational thinking to reduce overuse, preventing addiction (Faggiano, Vigna-Taglianti, Versino, Zambon, Borraccino, & Lemma, 2008). As a matter of fact, the study by Kweon and Kim (2014) showed that adolescents with a high satisfactory school life are less likely to develop an online gaming addiction. He argued that school norms strong relationships with peers and teachers could be defined as protective factors against game addiction among adolescents.

In general, male students have higher levels of digital addiction than female students. It was determined that the mean of male students was higher, especially in the dimensions of salience, tolerance, mood modification, relapse, and withdrawal. Similarly, in many studies, it has been found that gender is an important factor in game addiction, and males have higher levels of addiction (Bonanno & Kommers 2005; Charlton & Danforth, 2007; Chiu, Lee, & Huang, 2004; Chou & Tsai, 2007; Ekinci, Yalçın, & Soyer, 2017; Griffiths et al., 2004; Lee, Han, Kim, & Renshaw, 2013; Walther, Morgenstern, & Hanewinkel, 2012). These results show that the game became the focal point in male students' lives, the time spent playing the game started to increase gradually, they experienced the game as fun, they could experience sudden moodiness and irritability during the game, and they could not control their desire to play excessively and started playing games again and again. According to Charlton and Danforth (2007), male adolescents are more likely to play video games excessively and are more likely to encounter negative consequences due to their gaming behaviors. In addition, males have a 2-3 times higher risk for internet addiction than females (Lee et al., 2013). In this respect, it has been found that gender is an important factor in digital addiction, and male adolescents' propensity for excessive gaming and problematic use is higher than that of adolescent females and other age groups (Irmak & Erdoğan, 2016). This is because males are more game-oriented, and females are more conversation-oriented (Mitchell, 2000). In addition, according to Winn and Heeter (2009), girls report that they spend less free time, and this free time is divided into shorter periods, which makes it difficult to allocate more time to video games. Despite these results, there are studies in the literature showing that gender is an important variable on its own, but when other variables

interact with gender and when race, age, and grade point averages are included, gender is not a significant predictor variable (Reason, 2001). Moreover, study findings show no difference between male and female students in terms of internet activities such as gaming, downloading, gambling, and shopping (Rehbein & Mößle, 2013).

According to the game-playing tools, it was determined that most high school students prefer phones. However, when the addiction levels were examined, it was determined that the students who played games with the computer were more addicted than the students who played games with the mobile phone. This shows that computer use, in particular, carries a greater risk for digital game addiction. It can be said that these results show that high school students focus more on the game with the computer, the time spent on the game is increasing, the game becomes more fun, and they are more connected to the game, the undesired psychological and physiological states increase during the game, the interaction with the individuals around them increases, they experience conflicts, and they start to have problems in areas of responsibility such as school as a result of excessive playing behavior. Similar results were obtained in the literature (Bruner & Bruner, 2006; Gentile et al., 2011; Papec et al., 2015; Young, 2004).

Digital game addiction levels of students do not change according to grade levels. This result shows that the digital addiction levels of students studying at different grade levels are equal to each other. Similarly, there are studies in the literature showing that students' digital game addictions do not change according to grade levels (Ayhan & Köseliören, 2019; Bağci & Albayrak-Özer, 2021; Koç & Uğur, 2017; Kurt, Dogan, Erdogmus, & Emiroglu, 2018). Despite these results, in the study conducted by Koç, Boduroğlu, Ekinay, and Gezici (2021), it was found that the fifth graders had higher game addiction levels than the seventh and eighth graders and the eleventh graders higher game addiction levels than the eighth graders. The study conducted by Öncel and Tekin (2015) determined that the game addiction levels of the eighth-grade students were higher than the fifth and sixth-grade students.

Family income is an important variable for high school students' digital addiction. Within the scope of the research, it was determined that the digital addiction of the students increased with the increase in the family income level. Especially the family's income level is the factor in the salience and tolerance of high school students' digital game addiction. This shows that online play has become an important focus for children from families with high incomes, and the frequency of playing games and the time spent playing games are increasing. Similarly, Toker and Baturay (2016) revealed in their research that socioeconomic status increases addiction. The source of this result can be shown as the ability of families to reach technological opportunities due to the increase in their economic level. The increase in the time that students with technological opportunities spend on the use of technology can be interpreted as a factor that offers opportunities for addiction. In addition, the weakening of the bond with the students' families who have access to technological opportunities can be interpreted as a factor supporting addiction. Because the parent-child relationship strongly affects both internet and game addiction (Parker, & Benson, 2004). A good relationship reduces the degree of addiction (Liu & Kuo, 2007).

Although high school students' digital game addiction levels do not generally change according to their academic success, digital addictions of students with an academic grade point average of 25-54 and 55-69 in the withdrawal dimension are significantly higher. This shows that students with low-grade point averages exhibit unpleasant situations such as sudden irritability and anger during the game. Similarly, many studies (Gentile, Lynch, Linder, & Walsh, 2004; Schmitt & Livingston, 2015; Young, 1996, 1998) stated that there is a negative relationship between academic achievement and the total time spent on video games. Adolescents exposed to more significant amounts of video games perform worse in school (Gentile et al., 2011). Students with low-grade point averages are more likely to show a higher degree of game addiction than those with better grades (Young, 1998). Borzekowski and Robinson (2005) and Mysirlaki and Paraskeva (2007) found no significant relationship between the time devoted to digital gaming and academic performance.

As high school students' playing time increases, their level of digital addiction also increases. In particular, the highest addiction was observed in students who played games for over 7 hours and 5-6 hours, while the lowest was in students who played games for 1 hour or less. Similarly, Lemmens et al. (2009) determined that there is a strong positive correlation between students' game addiction and the time spent on games. In their research, Toker and Baturay (2016) determined that the duration of playing games and computer games increased the addiction levels of students. Essentially, gaming time is already one of the indicators of digital gaming addiction. In general, the concepts of "excessive gaming behavior" and "addiction" can be used interchangeably in the literature (Şimşek, & Karakuş Yılmaz, 2020). However, while playing excessive games can be designed to be fun in a way that does not cause negative consequences in the life of the individual, negative effects may

occur in many areas of daily life due to excessive use of individuals with addiction (Weinstein 2010; Kuss & Griffiths, 2012; Şimşek, & Karakuş Yılmaz, 2020). In the context of this study, it was determined that especially the time spent in the game increased the levels of digital addiction in adolescents, and it could cause negative effects such as the inability to control moods such as moodiness and anger, the increasing time spent playing games, the focus on games, the inability to live in harmony with the real world, and having conflicts. In particular, this situation shows in some studies that with the increase in the time spent in the game, adolescents can choose to meet the need for superiority and socialization in the virtual world as an alternative to their deficiencies in some aspects of the real world (Blais, Craig, Pepler, & Connolly, 2008; Young, 2010). Adolescents with strong psychological needs to master the operation of a game will spend more time playing online games. The same is true for those who have a strong need to relate and escape from reality through online games (Lin, 2010). In addition, the longer the online game playing time and the higher the addiction level, the stronger the deterrents and restrictions will be (Xu et al., 2012).

Mother's education level is an influential variable on digital game addictions of high school students. Especially the children of mothers who graduated from high school and the university had the highest digital game addiction. In addition, as the education level of the mother increases, the digital game addiction of the children also increases. In particular, it was determined that there was a significant difference in mood modification and relapse dimensions. Again, the highest averages in these dimensions belong to the children of high school and university graduate mothers. According to these results, it can be said that especially high school and university graduate mothers,' children see the game as a means of entertainment to get rid of their problems, and they cannot control the excessive playing behavior and turn to the behavior of playing games again. In the nature of this result, the mother may be working due to the increase in the mother's education level. It can be indirectly concluded that the time allocated to children by working mothers is limited. The limited-time devoted to children can be interpreted as weakening family communication. Toker and Baturay (2016) emphasized in their research that maternal employment increases game addiction. In studies (Kim, 2016; Ko, Wang, Liu, Yen, Chen, & Yen, 2015; Zhu, Zhang, Yu, & Bao, 2015), the function of the family (family economy, family health; communication, love) in-game addiction was emphasized. Zhu et al. (2015) found that a low-quality parent-child relationship predicted adolescent online gaming addiction and was also linked to decreased school engagement and increased engagement with deviant peers. Despite these results, there are study findings in the literature showing that the levels of game or internet addiction in adolescents do not differ according to the education level of the mother, and there is no relationship between the education level of the mother and the violence problems arising from video games (Batıgün & Kılıç, 2011; Funk, Baldacci, Pasold and Baumgardner, 2004). However, in a limited number of studies conducted with Turkish students, a negative relationship was found between mother's education level and game addiction (Çakıcı, 2018; Göymen, 2019; Toker & Baturay, 2016). In these studies, it was found that game addiction decreased as the mother's education level increased in high school students.

In general, while the father's educational status in each dimension was not a factor in the digital game addictions of high school students, the highest averages in mood modification occurred in the children of fathers who were high school and university graduates. This shows that with the increase in fathers' education level, their children start to see games as fun, and they turn to digital games to get rid of their troubles. Similarly, although some studies emphasize that there is no significant relationship between father's education level and game addiction in high school students (Çakıcı, 2018; Göymen, 2019), studies are showing that game addiction is related to father's education level (Eni, 2017). However, studies revealing the relationship between parental education level and game addiction are limited and inconsistent.

Recommendations

A lack of knowledge and understanding of the dangers of online games can cause students to become addicted. Therefore, it is crucial that efforts are made to increase students' knowledge of the dangers of online gaming addiction, particularly by their school, teachers, and friends. School-supported education, seminars, guidance, and counseling can help students understand the dangers of online gaming addiction to avoid addiction to online games because one of the functions of guidance and counseling services in schools is to prevent students' inappropriate behavior.

By strengthening the bond of high school students with school, preventive measures can be taken to prevent game addiction. Schools have a great place in the socialization of children. Establishing stronger student-teacher relationships in schools will lead to fewer behavioral problems (Crosnoe, Johnson, & Elder, 2004). Therefore, the relationship between adolescents and their teachers can be related to the degree of adolescents' game

addiction. In addition, undesirable behaviors exhibited by students in schools will negatively affect students' learning outcomes and academic success (APA, 2013; Bruner & Bruner, 2006; Schmitt & Livingston, 2015). With this prevention strategy, problems such as sleep problems, social conflicts, academic success problems, negative moods, and social isolation can be prevented by reducing the level of play of the students (King & Delfabbro, 2018).

At school, modules on the risks of online gaming addiction can be prepared by student counselors and/or guidance services. Modules can be planned with different content for males and females, especially in the context of gender. Because in the study, it was determined that male students were more prone to addiction. These modules can raise students' awareness of technology use by providing a systematically designed set of learning experiences in a formal setting. It will be important to create this awareness, especially considering that the computer has a greater effect on creating game addiction. Another potential risk in adolescent gaming addiction is parents' education level, family income status, and attitudes towards gaming. The relationship between parents' attitudes towards playing and their adolescent children's play behaviors can be examined in future studies. In addition, parents can be made aware of addiction and technology use, especially as an important stakeholder in the education process.

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Author(s) Information

Vahit Çiriş
Kırşehir Ahi Evran University
School of Physical Education and Sports, Kırşehir, Turkey
ORCID iD: 0000-0002-3087-0942

Turan Başkonuş
Ministry of Education, Kırşehir, Turkey
ORCID iD: 0000-0001-8932-7656

Tezcan Kartal
Kırşehir Ahi Evran University
Department of Mathematics and Science Education,
Kırsehir, Turkey
ORCID iD: 0000-0001-7609-3555

Adem Taşdemir
Kırşehir Ahi Evran University
Department of Elementary Education, Kırsehir, Turkey
ORCID iD: 0000-0003-3027-3256
Contact e-mail: ademtasdemir@ahievran.edu.tr

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Development of an Anatomy Attitude Scale for Medical School Students and Analysis of Their Attitudes

Mehmet Ali Can

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Abstract

Anatomy is one of the most fundamental areas of medical sciences. When medical education is given in its "normal" course, primarily macroscopic anatomy education and other basic medical sciences form the foundation, and then the clinical medical sciences are built on top of this foundation. Due to its importance, as mentioned above, it is known to be a course feared by students newly starting their medical education. A literature search showed that there was not an "Anatomy Attitude Scale" that questions the views of medical school students in our country about anatomy. This study aims to develop a scale to reveal the attitudes of medical school students towards anatomy validly and reliably and to investigate anatomy attitudes of medical school students using this scale in a pilot administration. This study included 700 Term 2, 3, 4, 5, and 6 students studying in the School of Medicine of Çanakkale Onsekiz Mart University (ÇOMU) in the academic year 2020-2021 who agreed to take part in the study. Of these students, 345 were recruited for factor analysis and 355 for investigation of attitudes. In the study, an Anatomy Attitude Scale was developed first in line with the literature, which consisted of 14 items and 3 subfactors, "Value of Anatomy", "Hating Anatomy", and "Time Allocated to Anatomy". The results of construct validity were also verified by confirmatory factor analysis. Then, the scale was administered to 355 students. The results obtained from the data showed that the students of ÇOMU Medical School were aware of the importance of anatomy as a fundamental medical science, and the physician candidates who intended to become a specialist in any branch in the future attributed more value to Anatomy. We believe that the "Anatomy Attitude Scale" we have developed as a result of this study will help shape medical education in our country.

Introduction

The anatomy course has been a historic area in medical education. Students who have just started medical education have negative prejudices about the course which has a large place in the first years of medical education because of the dense anatomical terminology it contains when they examine the course materials related to the anatomy course and meet with students who are in the later stages of medical education. As a result, students develop anxieties and this gains importance in the formation of their thoughts about the lesson. These concerns and prejudices cause problems in the student's interest in Anatomy and in following the course in the next process, and ultimately affect the student's success in the course. Determining the views and attitudes of students about Anatomy can be a guide in preventing such possible negativities. For this reason, it will be of great importance to determine the views of the students and will be a guide for the measures to be taken.

People evaluate their world. They have a feeling of like or dislike for almost everything they encounter (Aronson et al., 2010). In short, attitude is an individual's evaluation of other individuals, objects or thoughts (Ajzen & Fishbein, 2005; Crano & Prislin, 2006). The word "attitude" originally means "being available and ready for action" and it envisions something that can be observed directly, such as a boxer fighting in the ring. However, today, although the attitude cannot be observed directly, it is the structure that prioritizes the behavior and directs the choices and decisions of the individual regarding his/her action (Hogg & Vaughan, 2014). Attitudes consist of three components: thoughts and beliefs about the related object cognitive component; affective component of emotional reactions to the object; object-oriented behaviors constitute the behavioral component (Zanna & Rempel, 1988). Looking at the literature, we see that there are studies on the methodology and quality of Anatomy education, primarily in medical schools, and these studies' attitude has only been dealt with in very small portions (Acuner et al., 1999; Arı & Şendemir, 2003; Arı et al., 2003; Çetkin et al., 2016; Özcan & Kuş, 2020; Tuygar et al., 2015; Uygur et al., 2013). Some measurement tools intended to measure

"Attitude towards Anatomy" have also been used by some education institutions outside Medical Schools where anatomy education is provided. The scales used in the studies of Lök et al. (2009) may be shown as examples of these. However, a search of the literature has shown that an "Anatomy Attitude Scale" that directly reveals the attitudes of medical school students towards anatomy and particularly one that was developed in Turkish Culture using medical school students in Turkey is not available. This lack constitutes a justification for developing a measurement tool providing valid and reliable data for investigating the attitudes of medical school students who are candidates to become physicians in Turkey. This study aims to develop a scale for medical school students to reveal their attitudes towards anatomy validly and reliably and to investigate anatomy attitudes of medical school students using this scale in a pilot administration. Anatomy education methods, educational materials to be used and approaches to students can be arranged in the light of the data to be obtained, and the anxieties and prejudices that have arisen in students can be destroyed.

Method

This cross-sectional study aims to show the validity and reliability of the scale developed and investigate students' anatomy attitudes. This study was conducted with the approval of the Clinical Trials Ethics Committee of Çanakkale Onsekiz Mart University dated 11/11/2020 and numbered 2011-KAEK-27/2020-E.2000157168.

Study Group

The literature on scale development requires conducting an exploratory factor analysis (EFA), a confirmatory factor analysis (CFA) and reliability analyses for the scale being developed. In particular, the EFA and CFA are expected to be run on the data obtained from different groups. This study was conducted with the data obtained from Term 2, 3, 4, 5 and 6 students studying in the School of Medicine of Çanakkale Onsekiz Mart University in 2020-2021. Term 1 students were not included in the study because the anatomy courses of Term 1 students are included chiefly in the fourth, fifth and sixth lesson committees given towards the end of the year. Our worry that they would not have had a sound opinion on anatomy before attending the course made us exclude Term 1 students.

Due to the COVID-19 pandemic, the ethics committee approval required the scale to be administered online. The scale was sent online to Term 2, 3, 4, 5 and 6 students. The consent information was displayed to the students first. The scale items were made visible for the students who gave their consent and the page was shut for those who did not consent. In this way, a total of 700 students participated in the study. The data file obtained was randomly divided into two parts to have a balanced distribution of terms. The first data file consisting of data from 345 students was used to perform the EFA and find the Cronbach Alpha reliability coefficient. The second data file consisting of data from 355 students was used to perform the CFA and investigate students' attitudes.

There are differing views in the literature about the size of the study group when developing a scale. Cattell (1978) argued that in a factor analysis, the number of participants should be three to six times the number of items and Gorsuch (1974) at least five times. Everitt (1975) stated that "the number of participants should be at least ten times the number of items. The draft "Anatomy Attitude Scale" developed had 27 items. Given this information, we ensured that the number of participants was ten times the number of items in the measurement tool or more. Some characteristics of the participants in the
group are given in Table 1.

Table 1. Some characteristics of the study group

Variable		EFA and Reliability Investigation Group		CFA and Attitude Investigation Group	
		f	%	F	%
Gender	Female	183	53	182	51.3
	Male	162	47	173	48.7
Term	Term 2	83	24.1	99	27.9
	Term 3	90	26.0	91	25.7
	Term 4	61	17.7	59	16.6
	Term 5	59	17.1	52	14.6
	Term 6	52	15.1	54	15.2
Total		345	100	355	100

Data Collecting Instrument

Preparation of the Anatomy Attitude Scale (AAS)

The data collecting instrument developed by the investigator is the "Anatomy Attitude Scale (AAS)". To develop the AAS, its draft form needed to be constructed first. The draft form of the AAS was prepared using the following procedures:

- As a result of literature searches, no scale was found in Turkey compatible with the Turkish Culture and directly measured the anatomy attitudes of medical school students. However, it was found that anatomy attitude scales were studied in different disciplines (health sciences, physical education, etc.). The items of these scales were examined.
- Literature articles and books related to anatomy attitudes, published in peer-reviewed journals, were reviewed.
- A total of 50 volunteering students, from Term 2, 3, 4, 5, and 6, ten from each, were asked to write their thought about anatomy as an e-mail composition and the expressions of attitude in the compositions were analyzed.
- Based on the previously studied scale items, literature data and opinions obtained from student compositions, 33 sample scale items were identified.
- These 33 sample scale items were sent for review to three faculty specialists working in medical school anatomy departments, a faculty member specializing in educational psychology working on attitudes, and another faculty member expertized in measurement and evaluation.
- Based on the feedback received from the specialists, 6 items were excluded from the scale. Another 5 items were modified—the 27 items remaining after this procedure were used in practice to obtain validity and reliability evidence. Anatomy Attitude Scale is given in English in Appendix-A and in Turkish in Appendix-B.

Data Analysis

Validity analyses in the development of AAS

There were not any lost data in the dataset. The dataset was tested for suitability for factor analysis. In the Kaiser Meyer Olkin (KMO) Test, any score below 0.500 is considered unacceptable. Scores between 0.501 and 0.700 are considered as moderate, 0.701 and 0.800 as good, 0.801 and 0.900 as very good, and those above 0.901 as excellent (Çokluk et al., 2010; Field, 2018; Tabachnick & Fidell, 2013). The Bartlett's Test of Sphericity analysis result is expected to turn out significant ($p<.05$) (Çokluk et al., 2010). A factor identification method was selected: The Principal Axis Factoring (PAF) method (Warner, 2008). This method is preferable to the principal components analysis if a scale is being developed for the first time and its conceptual background is not that apparent. Using the rotation method, the factors were identified and differentiated. Axis rotation was applied using the "Varimax" method (Özdamar, 2013). As reference values for the fit-indices for DFA, $0.05\leq RMSEA\leq 0.08$ can be considered as acceptable and $0\leq RMSEA\leq 0.05$ as excellent for RMSEA according to the literature, $0.05<RMR\leq 0.08$ as acceptable and $0\leq RMR\leq 0.05$ as excellent for RMR, over 0.90 as acceptable, and 0.95 and above as excellent for TLI, over 0.90 as acceptable, and 0.95 and above as excellent for CFI, and $2<X2/sd\leq 5$ as acceptable and $0\leq X2/sd\leq 2$ as excellent intervals for X2/sd (Anderson & Gerbing, 1984; Bentler, 1990; Çokluk et al., 2010; Hooper et al., 2008; Hu & Bentler, 1999; Kline, 2005; Marsh et al., 1988; Özdamar, 2013; Şimşek, 2007; Tabachnick & Fidell, 2013; Vieira, 2011).

Reliability analyses in the development of AAS

The Cronbach Alpha reliability coefficient, which shows reliability in the sense of internal consistency, was calculated to obtain AAS reliability evidence. A reliability value over 0.70 was accepted as a high-reliability level (Özdamar, 2013; Warner, 2008).

Data analysis at the stage of determining student attitudes

Descriptive statistics (percentages, frequencies, means, etc.) and comparison tests were used to investigate students' attitudes towards anatomy. Tests for normality are highly susceptible (Tabachnick & Fidell, 2013). Additionally, measurements related to dependent variables do not show a normal distribution in many studies

(especially in social sciences) (Pallant, 2016). The Central Limit Theorem postulates that if the sample is large enough (n=30+), the distribution of means in the sample will be normal regardless of the distribution of variables, and the violation of normal distribution will not lead to a big problem (Everitt & Howell, 2005; Field, 2018; Pallant, 2016; Tabachnick & Fidell, 2013). In large samples, the skewness does not deviate from the normal to a considerable extent. A positive kurtosis starts to disappear in a sample size larger than 100 and a negative kurtosis in a sample size larger than 200 (Tabachnick & Fidell, 2013). Based on this information, it was decided to perform the analyses using parametric statistical techniques.

Findings

Findings Related to AAS Development

The KMO and Bartlett's Test of Sphericity were reviewed first in EFA. The KMO and Bartlett's Sphericity values turned out to be consistent with those suggested by the literature. However, some items in which the item-total correlations and EFA factor loading values could not reach the level recommended in the literature (0.30 and above) (Büyüköztürk, 2013). These were items 1, 2, 4, 6, 7, 8, 9, 10, 13, 17, 19, 20 and 26 in the draft form. After removing these items from the scale, the KMO and Bartlett's sphericity values were reviewed again. It was found that KMO (Kaiser Meyer Olkin): 0.879 and Bartlett's Test of Sphericity value X2: 3022.334, sd: 91 and P: 0.0001. As stated under the heading Data Analysis, the KMO and Bartlett's Test results were at levels suggested by the literature. After extracting the 13 items with item-total correlations and EFA initial extraction loading values below the levels suggested by the literature, the item-total correlations and factor analysis initial extraction loading values of the remaining 14 items are given in Table 2.

Table 2. Initial extraction loading values and item-total correlations

Item No	Initial extraction Loading Value	Item-Total Correlation	Item No	Initial extraction Loading Value	Item-Total Correlation
AA3	0,828	0,336	AA18	0,801	0,398
AA5	0,635	0,679	AA21	0,706	0,373
AA11	0,549	0,595	AA22	0,598	0,319
AA12	0,866	0,395	AA23	0,727	0,364
AA14	0,696	0,606	AA24	0,620	0,684
AA15	0,843	0,787	AA25	0,566	0,595
AA16	0,747	0,367	AA27	0,595	0,618

As seen in Table 2, the EFA initial extraction loading values and item-total correlations of these 14 items turned out to be 0.30 and above. Therefore, the retained items were considered to be suitable for the scale. The scree plot for the 14 items retained as a result of the EFA and 3 factors is shown in Figure 1.

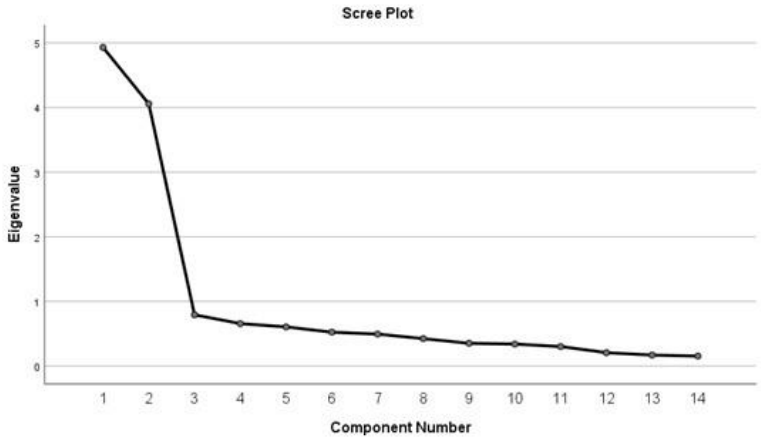

Figure 1. Scree plot of AAS items after EFA

As seen in the scree plot, there are 3 factors in the AAS. To see these 3 factors more distinctly, the "Varimax" axis rotation method was used. The subdimensions (subfactors) arising from this procedure and the level of variance explained by each dimension are shown in Table 3.

Table 3. Factors and the extent to which they explain variances after a rotation procedure

Items	Factors 1	2	3	Factor Name
AA15. Knowing the human body with the help of "anatomy" makes me feel like a physician	0.891			
AA14. Knowledge of anatomy should be reminded at the beginning of each training.	0.832			
AA27. Anatomy is the foundation of other medical courses.	0.731			Value of anatomy
AA24. Practical anatomy lessons are engaging.	0.717			
AA11. I will not call a person who does not know anatomy a physician.	0.706			
AA5. Learning anatomy makes me happy.	0.676			
AA25. I loved anatomy owing to our faculty members.	0.624			
AA12. If a list of most unnecessary courses were made, anatomy would be at the top. *		0.915		
AA3. If I were the health minister, I would remove anatomy course from the schools of medicine. *		0.880		Hating anatomy
AA18. If I were a medical education planner, I would propose anatomy only as an elective. *		0.857		
AA16. If I were in charge, I would remove information on anatomy from the "Medical Specialization Examination (MSE)". *		0.855		
AA23. I watch anatomy videos in my free time.			0.753	Allocating Time to Anatomy
AA21. I wish to do my doctorate on anatomy after I graduate			0.704	
AA22. Drawing anatomic figures makes me happy.			0.697	

* Items written in red have negative meanings and scored reversely.

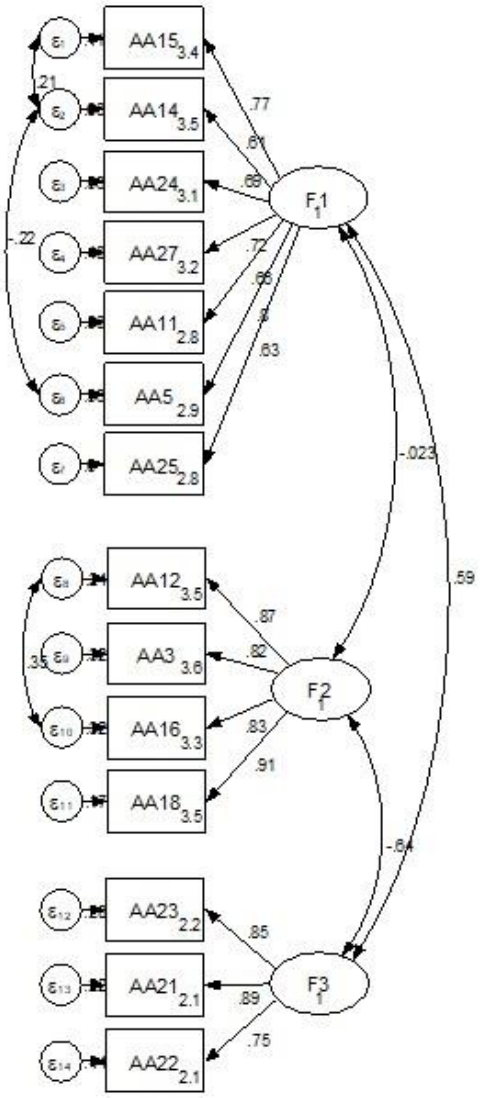

Figure 2. AAS confirmatory factor analysis diagram (standardized values)
F1: Value of Anatomy, F2: Hating Anatomy, F3: Allocating Time to Anatomy

The total variance in attitude towards anatomy explained by the 14-item and 3-subdomain AAS was 69%. Hence the scale explains 69% of the attitude towards anatomy. The factors that appeared are named in Table 3. Value of anatomy explains 29% of the variance, hating anatomy 24% and allocating time to anatomy 16%. The Cronbach Alpha reliability coefficients were calculated for the AAS and its 3 subdimensions. The reliability level for the entire scale was 0.82. The reliability level was 0.89 for the value of the anatomy subfactor, 0.92 for the hating anatomy subfactor, and 0.78 for the allocating time to the anatomy subfactor. The McDonalt ω composite reliability coefficients was determined as 0,91. This construct that appeared in the EFA needed to be tested for verification. This test can be done using CFA. The diagram obtained in the CFA is shown in Figure 2.

Fit-indices need to be identified for this diagram. These fit-indices determine whether the construct is appropriate or not. The CFA Fit-indices were X2/sd: 3.22, TLI: 0.93, CFI: 0.95 and RMSEA: 0.079. As stated under the heading Data Analysis, the CFA fit-indices were at levels suggested by the literature. Therefore, it can be said that the model created was appropriate.

Findings Related to Students' Attitudes Towards Anatomy

Students' attitudes towards anatomy were reviewed based on AAS items. Descriptive statistics (frequencies, percentages, means and standard deviations) were used for this review. The results are shown in Table 4.

Table 4. Student attitudes towards anatomy

Items	Don't agree at all		Don't agree		Partly agree		Agree		Fully agree		Mean (S. Dev.)
	f	%	f	%	f	%	f	%	f	%	
AA3. If I were the health minister, I would remove the anatomy course from the schools of medicine.	183	51.5	76	21.4	63	17.7	17	4.8	16	4.5	1,89 (1,13)
AA5. Learning anatomy makes me happy.	33	9.3	36	10.1	140	39.4	90	25.4	56	15.8	3,28 (1,13)
AA11. I won't call a person who does not know anatomy a physician.	32	9	58	16.3	138	38.9	74	20.8	53	14.9	3,16 (1,14)
AA12. If a list of most unnecessary courses were made, anatomy would be at the top.	135	38	102	28.7	80	22.5	24	6.8	14	3.9	2,10 (1,11)
AA14. Knowledge of anatomy should be reminded at the beginning of each training.	16	4.5	22	6.2	119	33.5	114	32.1	81	22.8	3,61 (1,04)
AA15. Knowing human body with the help of "anatomy" makes me feel like a physician	19	5.4	22	6.2	119	33.5	114	32.1	81	22.8	3,61 (1,07)
AA16. If I were in charge, I would remove information on anatomy from the "Medical Specialization Examination (MSE)".	112	31.5	114	32.1	83	23.4	25	7	21	5.9	2,24 (1,14)
AA18. If I were a medical education planner, I would propose anatomy only as an elective.	139	39.2	103	29	72	20.3	25	7	16	4.5	2,09 (1,13)
AA21. I wish to do my doctorate in anatomy after I graduate	109	30.7	96	27	109	30.7	28	7.9	13	3.7	2,27 (1,09)
AA22. Drawing anatomic figures makes me happy.	91	25.6	62	17.5	121	34.1	51	14.4	30	8.5	2,63 (1,24)
AA23. I watch anatomy videos in my free time.	89	25.1	95	26.8	120	33.8	32	9	19	5.4	2,43 (1,12)
AA24. Practical anatomy lessons are interesting.	28	7.9	23	6.5	130	36.6	102	28.7	72	20.3	3,47 (1,12)
AA25. I loved anatomy owing to our faculty members.	37	10.4	46	13	153	43.1	69	19.4	50	14.1	3,14 (1,14)
AA27. The foundation of other medical courses is anatomy.	21	5.9	30	8.5	163	45.9	84	23.7	57	16.1	3,35 (1,04)

The lowest mean value was in item "If I were the health minister, I would remove anatomy course from medical schools". However, considering the item has a negative meaning, it is understood that the students found the course necessary. The items with the highest mean values were "Knowledge of anatomy should be remembered at the beginning of each training" and "Knowing the human body with the help of anatomy makes me feel like a physician". These items show that the opinion on the course was positive.

Gender*Term and Anatomy Attitude

Whether there were any differences between the anatomy attitudes of students who had different genders and were studying in different terms was tested using the multivariate variance test (MANOVA). MANOVA was preferred because there were two group-forming variables (gender and term of study) and three measurement variables (value of anatomy, hating anatomy and allocating time to anatomy). No significant difference was found in any of the subfactors of anatomy attitude scale with respect to the basic effects of "gender", "term" and "gender-term interaction" ($F(3\text{-}343)=2{,}16$, $p>.05$; $F(12\text{-}1035)=1{,}11$, $p>.05$ and $F(12\text{-}1035)=0{,}73$, $p>.05$, respectively).

Reason for choosing a medical school*following medical sources outside textbooks*willingness to be a specialist in the future and anatomy attitude

The students' attitudes towards anatomy with respect to the rationale for choosing a medical school, following medical sources outside textbooks, and willingness to be a specialist in the future were analyzed using the MANOVA test. The results are shown in Table 5.

Table 5. Students' attitudes towards anatomy with respect to the reason for choosing a medical school, following medical sources outside textbooks, and willingness to be a specialist in the future

	Value	F	df	Error df	p
Reason for choosing school of medicine;	0.058	1.653	12.000	1005.000	0.072
Following sources related to medicine outside course presentations and lesson material proposed by the faculty member	0.003	0.336	3.000	333.000	0.799
Willingness to be a specialist in the future	0.028	3.210	3.000	333.000	0.023
Reason for choosing a school of medicine * Following sources related to medicine outside course presentations and lesson material proposed by the faculty member	0.035	0.989	12.000	1005.000	0.457
Reason for choosing school of medicine * Willingness to be a specialist in the future	0.016	0.458	12.000	1005.000	0.939
Following sources related to medicine outside course presentations and lesson material proposed by the faculty member * Willingness to be a specialist in the future	0.008	0.897	3.000	333.000	0.443
Reason for choosing a school of medicine * Following sources related to medicine outside course presentations and lesson material proposed by the faculty member * Willingness to be a specialist in the future	0.049	1.401	12.000	1005.000	0.159

The MANOVA test showed that from the basic effects, only willingness to be a specialist created a significant difference in the anatomy attitude subfactors ($F(3\text{-}333)=3.210$, $p<.05$). The other basic effects and interactions were found not to create any difference in the subfactors of the anatomy attitude scale ($p<.05$). An ANOVA test was performed to see in what subfactors of the anatomy attitude scale the willingness to be a specialist in the future created a difference. The results are shown in Table 6.

Table 6. Student attitudes towards anatomy with respect to willingness to be a specialist in the future

		N	Mean (S. Dev.)	F	p	Significant Difference
Value of Anatomy	Yes	322	23,91 (5,53)	7.398	0.007	Yes>No
	No	33	20,82 (7,04)			
Hating Anatomy	Yes	322	8,22 (4,09)	1.720	0.191	
	No	33	9,24 (4,36)			
Allocating Time to Anatomy	Yes	322	7,37 (3,06)	.173	0.678	
	No	33	6,88 (3,14)			

The test showed that the willingness to be a specialist in the future made a difference only in the "value of anatomy" subfactor of the anatomy attitude scale ($F=7{,}398$, $p<.05$) and made no significant difference in the other subfactors ($p>.05$). The value attributed to anatomy by the physician candidates who are willing to become specialists in the future (mean=23.91) was higher compared to those who do not intend to be a specialist (mean=20.82).

Discussion

Anatomy is the oldest branch known among the medical sciences, and the sources that have survived to our time mainly consist of information on and drawings of the human body. Existing sources of medical history show that ancient medical data consisted mainly of anatomical information. This should be considered normal because when medical information such as disease, cause and treatment could not be expressed definitively, the most correct information obtainable in a concrete way would be on the human body as an observable and examinable material. The process progressed in this way; information on the human body was collected first, which formed the foundation for medicine and then the changes and disorders observed in this structure were defined, the concept of disease was raised, and possible diseases were identified, and finally, treatment methods for correcting these began to be argued. Also, in today's medical education, the "normal" is being explained at the early stages of the education, emphasizing macroscopic anatomy to establish the foundation. Then, the other medical departments are built on this foundation, first as essential medicine and then as clinical medical sciences. Therefore, the role of anatomy education and the need for candidates to have sound anatomy knowledge are indispensable for the development of future physicians.

Studies have shown that student's willingness to learn is essential for effective learning. The more a person is willing to learn and has interest and love toward the subject to be learned, the more the function of learning is encompassing and perpetual. To perceive and interpret a piece of information, the student must have believed in the necessity of that information. Due to these facts, we can say that to give medical education at an adequate level. It is of utmost importance that the students adopt and embrace fundamental medical knowledge, particularly anatomy, in the first years of education. Another criterion used to shape medical education is student feedback. To this end, an attitude scale was developed in this study to assess student opinions and behaviours towards anatomy. The construct validity studies of the scale showed that the anatomy attitude scale was a valid scale consisting of 3 subfactors. The results of construct validity were also verified by the results of a confirmatory factor analysis. The reliability values of the scale ranged between .78 and .92 for the subscales. The reliability value of the entire scale was found to be .82. These results show that the reliability level of the scale is also high. It will be helpful to retest this scale for validity and reliability in different groups in studies to be conducted in the future. In this way, contribution may be provided to develop the scale further.

In this study that was conducted using the scale developed, the data obtained from Term 2, 3, 4, 5 and 6 students studying in the School of Medicine of Çanakkale Onsekiz Mart University in the academic year 2020-2021 were used. It is remarkable that the item "Knowing the human body with the help of anatomy makes me feel like a physician", which we think expresses the students' attitudes towards anatomy in a most general way, received a high score in the positive direction. This showed that the students were aware of the importance of anatomy as fundamental medical science. It is also observed that students similarly valued anatomy in the previous studies questioning the method and quality of anatomy education in medical education. In a study made by Arı et al. (2003), 47.6% of the students responded as "partly" for the role of anatomy education in making the students feel that they are in a school of medicine, and 45.5% responded as "completely" (93.1% in total). In another study made by Uygur et al. (2013), 84.8% of the students agreed with the view "anatomy education makes me feel I am in a school of medicine" (partly agree 31.6%, agree 26.6% and fully agree 26.6%), which showed the positive thoughts of students about anatomy. In the study of Arı & Şendemir (2003), 89.6% of the students stated that they did not see anatomy education as a waste of time. Similarly, in the study of Özcan & Kuş (2020) on clinical anatomy education, 62.3% of the students did not see Clinical and Cross-Sectional Anatomy lessons as a waste of time, and 89.3% stressed the importance of anatomy lessons by stating that this course was necessary for their professional life and 90.2% that these lessons will positively influence the clinical practice they will receive in the future.

Another indicator of the importance students attribute to anatomy is the item "If I were the health minister, I would remove anatomy course from medical schools", which received the lowest mean value but from which we concluded that the students believed that the course was necessary considering it had a negative meaning. For this item, a positive value of 90.6% was obtained (Don't agree at all 51.2%, Don't agree 21.4% and Partly agree 17.7%).

The items "Learning anatomy makes me happy", "I won't call a person not knowing anatomy a physician", and "The foundation of other medical courses is anatomy" also reached above 3 as a mean value, reflecting a relatively positive opinion. Supporting this, the items "If I were a medical education planner, I would propose anatomy only as an elective" and "If a list of most unnecessary courses were made, anatomy would be at the top" are significant in showing the value attributed to anatomy for being negative statements and receiving the lowest scores, and thus taking the lowest places on the list.

When we consider the high-scoring item "Knowledge of anatomy should be remembered at the beginning of each training", we conclude that students who are at later stages of medical education and attending clinical training were more aware of the importance and necessity of anatomy. As stated earlier, it is pleasing to see that students are aware of the necessity of anatomy, which is one of the fundamental elements of medical education. However, as expressed by the students, it appears that anatomy reinforcement lessons, which they believe are insufficient, should be given particularly at the beginning of clinical training within the scope of spiral integration. Additionally, the other branches of science should also be integrated into this process within the same framework.

Since the item "Practical lessons of anatomy are interesting" received a high score, we think that anatomy, more of an illustrative branch of science, attracts more attention due to educational materials used in laboratories such as cadavers, organ samples, and models. Instead of entirely abstract, theoretical lessons, practical applications, and small-group works showing the structure and neighborhood of formations in the human body as they appear in reality will make medical education more effective. The high score received by the item "I loved anatomy owing to our faculty members" shows us that faculty members' behaviors and approaches to education during courses are also critical. Although the item "If I were in charge, I would remove information on anatomy from the Medical Specialization Examination (MSE)" received an average score, we think that this was due to the necessity of very detailed information in the examination and because the students at the final years of medical education would think they have to study old subjects in detail again.

The items "I watch anatomy videos in my free time" and "Drawing anatomic figures makes me happy" also received mean scores close to 3, which seemed positive. The burden of medical education and the differences in personal learning methods may explain the relatively low score received by video watching. Since drawing anatomic figures depends on the drawing talents of persons, we did not think this item would receive a high score. However, students still draw pictures of structures in detailed or simple forms or study topics by schematizing them, depending on their learning methods.

Although the item "I wish to do my doctorate on anatomy after I graduate" seemed to have a low score with 7.9% "Agree" and 3.7% "Totally agree" responses, it received a relatively high value. This was because a large group of medical students is known to dream about receiving a specialization education in a clinical branch. It was observed in a study made by Çetkin et al. (2016) that a large majority of students had an inclination to clinical sciences in their preferences for an area of specialization, while a tiny group of them, 6.5%, wanted to prefer basic medical sciences and 1.2% anatomy. We hope that enough basic medicine and particularly anatomy specialists will graduate from the increasing number of medical schools to meet the need.

When we compared the basic effects with the attitude scale we developed, we found no significant difference in any of the subfactors of the anatomy attitude scale with respect to gender and term. Having no difference was an expected result because neither gender nor learning new subjects in later years directly relates to anatomy. The need for anatomy is clearly known in understanding the other branches studied together with anatomy during the early years of medical education, and the clinical branches later added on top of these.

When the items "the reason for choosing a medical school" and "following medical sources outside textbooks" were compared with the attitude scale, no significant difference was found in any of the subfactors of the anatomy attitude scale. When we consider the reasons for choosing a medical school, although their reasons may be different, students today choose what they will encounter and what courses they will take when they come to a medical school. As far as we can see, the issue students are aware of most is that anatomy lessons are present, and this course is challenging. We think that students receiving medical education accept this course and the fact that it is difficult and study hard to have a good command of it, and that they comprehend the importance of this course. It was also an expected result that following medical sources outside textbooks would have no relationship with the factors of the attitude scale.

It was found that the willingness to be a specialist in the future made a significant difference only in the "value of anatomy" subfactor of the anatomy attitude scale and made no significant difference in the other subfactors. Physician candidates who intend to become specialists in the future attribute more value to anatomy than those with no such ideation. This shows us that students are aware that they will need the knowledge of anatomy more during their specialization education. Students who wish to specialize in any branch will need extensive anatomy knowledge in the medical specialization examination. This shows that they consider anatomy important for these two reasons.

Conclusion

An analysis of the study data gave the following results:

- A 14-item Anatomy Attitude Scale was constructed.
- The Anatomy Attitude Scale consists of 3 subfactors, "Value of Anatomy", "Hating Anatomy," and "Allocating Time to Anatomy".
- The ÇOMU Medical School students who were administered the Anatomy Attitude Scale were aware of the importance of anatomy as a basic medical science.
- It was observed that the percentage of those who wish to receive anatomy education after Graduation increased compared to previous studies.
- Gender, term of study, reasons for choosing a medical school, and following materials outside textbooks were found not to change students' viewpoint towards anatomy.
- It was revealed that the physician candidates who intended to become a specialist in any branch in the future attributed more value to anatomy.

Scientific Ethics Declaration

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

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Author Information

Mehmet Ali ÇAN
MD., Ph.D., Assistant professor
Çanakkale Onsekiz Mart University
Faculty of Medicine, Department of Anatomy, Çanakkale, Turkey
Contact e-mail: macan@comu.edu.tr
ORCID iD: https://orcid.org/0000-0002-2385-248X

Appendix – A

Development of an Anatomy Attitude Scale for Medical School Students

Distinguished medical student,
This scale is about the necessity of the anatomy course you saw in terms 1 and 2 in medical school, the benefit it provides you, its contribution to your professional life, and your feelings towards the course. What is expected of you is to read each statement and tick the option (totally agree, agree, partially agree, disagree, strongly disagree) in response to the statement. Your name will not be mentioned on the scale. Thank you for your participation.

Gender
☐ Female ☐ Male

Term
☐ Term 2 ☐ Term 3 ☐ Term 4 ☐ Term 5 ☐ Term 6

Why did you choose medical school? (*Tick only one option*)
☐ Because my score is enough ☐ Because it's my ideal job
☐ Because my family wants ☐ Because of its good status in society
☐ Because it is a guaranteed profession that makes money

Apart from the lecture presentations and the lectures suggested by the lecturer, do you follow the resources related to medicine?
☐ Yes ☐ No

Do you want to pass the "Medical Specialization Exam" and become a specialist in the future??
☐ Yes ☐ No

(1) Strongly Disagree (2) Disagree (3) Partially Agree (4) Agree (5) Strongly Agree

Items	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
3. If I were the health minister, I would remove the anatomy course from the schools of medicine. *	(1)	(2)	(3)	(4)	(5)
5. Learning anatomy makes me happy.	(1)	(2)	(3)	(4)	(5)
11. I won't call a person who does not know anatomy a physician.	(1)	(2)	(3)	(4)	(5)
12. If a list of most unnecessary courses were made, anatomy would be at the top. *	(1)	(2)	(3)	(4)	(5)
14. Knowledge of anatomy should be reminded at the beginning of each training.	(1)	(2)	(3)	(4)	(5)
15. Knowing human body with the help of "anatomy" makes me feel like a physician	(1)	(2)	(3)	(4)	(5)
16. If I were in charge, I would remove information on anatomy from the "Medical Specialization Examination (MSE)". *	(1)	(2)	(3)	(4)	(5)
18. If I were a medical education planner, I would propose anatomy only as an elective. *	(1)	(2)	(3)	(4)	(5)
21. I wish to do my doctorate in anatomy after I graduate	(1)	(2)	(3)	(4)	(5)
22. Drawing anatomic figures makes me happy.	(1)	(2)	(3)	(4)	(5)
23. I watch anatomy videos in my free time.	(1)	(2)	(3)	(4)	(5)
24. Practical anatomy lessons are interesting.	(1)	(2)	(3)	(4)	(5)
25. I loved anatomy owing to our faculty members.	(1)	(2)	(3)	(4)	(5)
27. The foundation of other medical courses is anatomy.	(1)	(2)	(3)	(4)	(5)

* Items written in red have negative meanings and scored reversely.

Appendix – B

Tıp Fakültesi Öğrencilerinin Anatomi Dersine Yönelik Tutum Ölçeğinin Geliştirilmesi

Çok değerli tıp fakültesi öğrencisi,
Bu ölçek dönem 1 ve 2'de gördüğünüz anatomi dersinin tıp fakültesindeki gerekliliği, size sağladığı fayda, meslek hayatınıza katkısı, derse yönelik duygularınız ile ilgilidir. Sizden beklenen her bir ifadeyi okumanız ve ifadeye karşılık size uygun olan seçeneğe (tamamen katılıyorum, katılıyorum, kısmen katılıyorum, katılmıyorum, kesinlikle katılmıyorum) işaretlemenizdir. Ölçekte isminiz belirtilmeyecektir. Katılımınız için teşekkür ederiz.

Cinsiyetiniz

☐Kız ☐Erkek

Döneminiz

☐Dönem 2 ☐Dönem 3 ☐Dönem 4 ☐Dönem 5 ☐Dönem 6

Tıp fakültesini neden seçtiniz? (*Yalnızca bir seçeneği işaretleyiniz*)

☐Puanım yettiği için ☐İdealimdeki meslek olduğu için

☐Ailem çok istediği için ☐Toplumdaki statüsü iyi olduğu için

☐Para kazandıran garanti meslek olduğu için

Ders sunuları, öğretim üyesinin önerdiği ders kaynakları dışında tıp ile ilgili kaynakları takip eder misiniz?

☐Evet ☐Hayır

Gelecekte TUS kazanıp uzman olmak istiyor musunuz?

☐Evet ☐Hayır

(1) Kesinlikle Katılmıyorum (2) Katılmıyorum (3) Kısmen Katılıyorum (4) Katılıyorum (5) Kesinlikle Katılıyorum					
Maddeler (İfadeler)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
3. Sağlık bakanı olsam tıp fakültelerinden anatomi dersini kaldırırım. *	(1)	(2)	(3)	(4)	(5)
5. Anatomi öğrenmek beni mutlu ediyor.	(1)	(2)	(3)	(4)	(5)
11. Anatomi bilmeyen kişiye hekim demem.	(1)	(2)	(3)	(4)	(5)
12. En gereksiz dersler sıralaması yapılsa "Anatomi" başta gelir. *	(1)	(2)	(3)	(4)	(5)
14. Her staj başında anatomi bilgilerinin hatırlatılması gerekir.	(1)	(2)	(3)	(4)	(5)
15. "Anatomi" ile insan vücudunu tanımak bana kendimi hekim gibi hissettiriyor.	(1)	(2)	(3)	(4)	(5)
16. Yetkili olsam "Tıpta Uzmanlık Sınavından (TUS)" anatomi bilgilerini kaldırırım. *	(1)	(2)	(3)	(4)	(5)
18. Tıp eğitimi planlayıcısı olsam Anatomi'yi sadece seçmeli ders olarak önerirdim. *	(1)	(2)	(3)	(4)	(5)
21. Mezun olduğumda Anatomi doktorası yapmayı isterim.	(1)	(2)	(3)	(4)	(5)
22. Anatomik şekilleri çizmek beni mutlu eder.	(1)	(2)	(3)	(4)	(5)
23. Boş zamanlarımda anatomi videoları izlerim.	(1)	(2)	(3)	(4)	(5)
24. Anatomi pratik dersleri ilgi çekicidir.	(1)	(2)	(3)	(4)	(5)
25. Öğretim üyeleri nedeniyle Anatomiyi çok sevdim.	(1)	(2)	(3)	(4)	(5)
27. Diğer tıp derslerinin temeli Anatomidir.	(1)	(2)	(3)	(4)	(5)

*Tersten puanlanan maddeler.