

Investigation of High School Students' Opinions About Science Courses During Distance Education

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Abstract

This research aims to determine the opinions of high school students about the Physics and Chemistry courses during the distance education due to the Covid-19 pandemic. 88 students who study in two public schools in Bursa were included in the research by determining through purposive sampling. In the research, we used a special case research design, one of the qualitative research methods, and semi-structured documents containing six open-ended questions we created as a data collection tool. When evaluating the data obtained using content analysis, we found that most participants stated they had difficulties in the problem-solving process in physics and chemistry and could not conduct an experiment. In addition, students talked about the advantages of taking these courses with distance education, such as listening comfortably in a quiet home environment, getting individual education, time to review the lesson, discipline, health, and economy. They also mentioned the disadvantages as not being able to focus on the lesson, not understanding the courses, experiencing internet and technical problems, and not socializing.

Keywords: distance education, science courses, physics courses, chemistry courses, high school students.

1. Introduction

In the historical process, people have faced various problems and disasters and have sought ways to cope with them and have been successful in most of them. The pandemic problem we experience today is one of them, and it has affected all of our lives, especially education, health, and economic issues. In this process, educational institutions at all levels closed at different times and switched to distance education. UNESCO stated that the closure of schools in 188 countries due to the pandemic has affected more than 1.5 billion students and 63 million educators (UNESCO, 2020). In this unexpected situation, many educational institutions and educators faced educational problems because they were unprepared and tried to develop solutions to these problems. For instance, UNESCO has founded an international partnership named the Global Education Coalition.

Distance Learning is an interdisciplinary field that tries to eliminate the boundaries between learners, teachers, and learning resources and uses existing technologies with a pragmatist approach to achieve this (Bozkurt, 2017). Distance Learning is associated with the concepts such as virtual learning, e-learning, internet-based learning, web-based learning, and online learning (Aydın, Karasu & Ülger, 2021).

- High school students experience technological, learning-teaching and family-related problems in the chemistry and physics courses taken through distance education.
- High school students state the existence of environment, teaching, health, discipline and economic advantages in the physics and chemistry courses they take with distance education.
- It is seen that chemistry and physics courses taken through distance education have disadvantages such as teaching, technical impossibility, not being able to socialize and economic conditions.
- Most of the high school students stated that the chemistry and physics courses taken through distance education are not effective in learning.
- High school students stated that they could not learn the subjects efficiently because a sufficient number of problems were not solved in distance education and laboratory experiments were not carried out in these courses.
- In addition, it was determined that there was not enough communication with the teachers in the lessons which were taught through distance education and the subjects that were not understood fully by the students were not asked to the teachers.

Sezgin (2021) defined emergency distance education as the process of comparing learning activities to face-to-face education by using distance access technologies. In this process, students attend classes in virtual classrooms at times scheduled by their school or institution to attend classes or learning activities, attend lectures at predetermined times, and watch lectures online instead of in class. The Turkish Higher Education Quality Council (2020) evaluated the method applied in this process as “Emergency Distance Education.” It defined it as the temporary transfer of face-to-face education to the technology environment in a crisis (URL1). The characteristic of emergency distance education is that it is an unplanned application, and you have no choice but to use any offline and/or online resource you may have at your disposal (Bond et al., 2021). According to Wang et al. (2020), it is an alternative and temporary teaching method developed in response to a particular crisis and is therefore decidedly different from typical distance education.

In this process, many Universities and K-12 schools used various online applications to the courses as if they were face-to-face (Zan & Zan, 2020). However, some problems reduced the effectiveness of the education-teaching process due to the transition to distance education. These problems include the context of students, teachers, and families. For example, not every home may have an internet infrastructure, computer, or mobile phone. There may be many students in the family, economic and social differences, and digital skills deficiencies. For this reason, it is a prerequisite to fully meet the infrastructure requirements for students to benefit from distance education at the maximum level (Doğrukök et al., 2021). According to Onyema et al. (2020), school closures have increased pressure on students, teachers, and parents, especially those with limited digital skills and resources for continuing education. In addition, to the fact that parents struggle to provide for the house, it also imposes the obligation to fulfill the duty of supervision in ensuring that their children learn from home. This process has caused teachers to experience various problems and burden them with many tasks. For instance, according to Telli and Altun (2021), the fact that the teacher, the only source of knowledge in face-to-face education, could not become a “guidance and facilitator” in the online learning environment prevented the students from taking their learning responsibilities and actively participating in the course. On the other hand, Telli and Altun (2021) have also stated that since the live video-course times are intended to be applied as in the face-to-face classroom environment and are often too long, there may be a decrease in focus and motivation of the students. For this reason, the motivation of many teachers may also be negatively affected. Also, the pedagogy available and used for face-to-face learning may not be suitable for online learning. While various pedagogies are designed for online and distance learning, teachers experiencing technological challenges may still need appropriate professional development and training (Pokhrel & Chhetri, 2021).

The positive and negative effects of distance education applications worldwide have come before many subjects as a research subject since the beginning of the pandemic. Almost every country has carried out studies involving teachers, students, and all stakeholders to evaluate the different dimensions of this process. These studies evaluating the process also aim to take precautions against such problems in the future and to make the necessary arrangements without delay. Some studies are conducted with high school and secondary school students in the literature. To illustrate, in their study conducted on biology with high school students, Arık et al. (2021) determined the views on student-teacher communication in the distance education process, the suitability of distance education for biology, and the change of duties and responsibilities in this process. Moreover, in the study, students made suggestions such as more question solutions, detailed explanations, lesson hours, and time adjustments to experience the distance education process effectively and efficiently. In the study, examining the views of teachers, students, and parents on distance education, Başaran et al. (2020) determined some problems with distance education such as limited interaction, the inability of students to actively participate in the lesson, not being suitable for individual differences, problems in entering the lesson due to technical problems, etc. In their study with high school students, Doğrukök et al. (2021) investigated their opinions about distance education and found that the presentation of student-centered and rich course content in distance education increased the communication between student-student and student-teacher. In the study with high school students, Demirçelik, Mert and Yıldırım (2021) concluded that the students experienced problems in distance education, their psychology affected them negatively, and the students could not adapt to distance education sufficiently. In their study with secondary school students, Pınar and Dönel Akgül (2020) concluded that the students found distance education useful, and the courses in distance education enabled them to review and reinforce the science subjects. However, being unable to experiment was a significant shortcoming for them. Bostan Sarıoğlu et al. (2021), in their study with secondary school students, found that the most common answer among students' expectations from distance education is to increase experimental practices, and they felt face-to-face experimentation more effective than distance education.

There are almost no studies on science, especially physics and chemistry, held with high school students in the literature. We aim to determine the opinions of high school students studying at high school about Physics and Chemistry during the distance education process due to the Covid-19 pandemic to fill this gap.

The main problem of the study: What are the opinions of high school students about Physics and Chemistry during the distance education process?

Within the scope of the research, answers to the following sub-problems were sought:

- (1) What are the opinions of high school students about the problems encountered in the online physics and chemistry courses during the distance education process?
- (2) What are the opinions of high school students about the advantages and disadvantages of online physics and chemistry courses?
- (3) What are the opinions of high school students about the effect of online physics and chemistry courses on learning?
- (4) What are the opinions of high school students about the effect of solving problems and doing experiments in online physics and chemistry courses on learning?

2. Method

The special case research design, one of the qualitative research methods, was used in the study. A case study is a qualitative research method in which the researcher examines one or

more situations in-depth and determines the themes related to these situations (Creswell et al., 2007). A holistic single case study was preferred to investigate the problems faced by high school students regarding the physics and chemistry courses through distance education during the Covid-19 process, its effect on learning, its advantages and disadvantages, problem-solving, and experimentation.

2.1 Study group

The study was conducted with 88 students taking physics and chemistry courses at two public high schools in Bursa in the fall semester of the 2020-2021 academic year. Sixty-three of the students were girls, and 25 were boys. The criterion sampling method, one of the purposive sampling methods, was used to determine high school students. The purpose of the criterion sampling method is to create observation units from people, events, objects, or situations with certain qualities in research (Büyüköztürk et al., 2019). For this purpose, the study's criterion was determined as that the students were taking physics and chemistry courses.

2.2 Data collection tools

We used a semi-structured opinion form with six open-ended questions we created as a data collection tool in the study. While preparing the form, the instructors' opinions were consulted, and the final form was created according to the feedback. Research questions were sent via Google forms, and 88 students who voluntarily participated in the study answered them. While question 1 in the form was asked to determine the problems caused by distance education in physics and chemistry, questions 2 and 3 were asked to learn the advantages and disadvantages of conducting these courses in distance education. Also, questions 4 and 5 were asked to identify the effect of online courses on learning, and question 6 was to evaluate the effect of problem-solving and experimentation with distance education on learning. The questions in the form sent to the students are as follows:

- (1) Have you encountered any problems related to physics and chemistry courses in online education, and if so, what are these problems?
- (2) What do you think are the advantages of online education?
- (3) What do you think are the disadvantages of online education?
- (4) How does distance education affect you to learn the subjects effectively for chemistry?
- (5) How does distance education affect you to learn subjects effectively for physics?
- (6) Have you experienced any positive and negative effects of distance education on problem-solving and experimentation in physics and chemistry courses, and if so, can you tell us about them?

2.3 Data analysis

We applied content analysis to the data obtained with the written forms answered by the students individually in the computer environment. We are both experts in the field of science education. First of all, one of us independently determined the codes, categories, and themes that emerged from the students' statements participating in the study, and then the other of us examined these codes, categories, and themes. Later, we determined 82% consistency between the two views and discussed the situations found to be different, and evaluated again. Finally, we reached a consensus and gave these codes, categories, and themes the final shape. After that, we

determined the frequencies for each code, brought similar data together within the framework of categories and themes, and reported them in tables.

2.4 Validity, reliability and ethics of the research

We followed scientific, ethical, and citation rules in this study's writing process, didn't make any falsification on the collected data, and didn't send this study to any other academic media for evaluation. Within the scope of research ethics, we informed the students participating in the research about the purpose of the study with a directive and asked the volunteer students to answer the forms. We coded the students as S1, S2, etc., to ensure impartiality in the analysis process and protect the students' privacy.

3. Results

Findings of the first sub-problem: The findings of the opinions of high school students about the problems encountered in the online physics and chemistry courses during the distance education process are presented in Table 1.

Table 1. Problems encountered in the teaching of physics and chemistry courses in the distance education process

<i>Codes</i>	<i>f</i>	<i>Categories</i>	<i>Theme</i>
Having trouble accessing the internet	30	Technological problems	Education problems
Teachers' technical infrastructure problems	7		
Students' technical infrastructure problems	4		
Not being able to enter Eba and being kicked out of the system	4		
Inability of the teacher to use technology effectively	3		
Note-taking issues	3	Learning teaching Problems	
Short course times	3		
Difficulty understanding numerical lessons	12		
Inability to teach oneself	2		
Economic situation of the family	9	Family problems caused	
Number of students in the family	3		
Inability to listen to the lecture due to the environment at home	2		

As can be seen from Table 1, three categories emerged from the students' answers regarding the problems encountered by the high school students in the physics and chemistry courses during the distance education process. While 62 of the students stated that they encountered various problems during these courses through distance education, 26 did not state any problems. Problems expressed by the students were (1) technological problems (f=48), (2) learning-teaching problems (f=20), (3) family-related problems (f=14) in order of frequency. Since many of the candidates stated more than one problem, the sum of the frequencies exceeded the number of participants. The results showed that most students encountered problems in these courses during the distance education process.

Some opinions stated by the students in the written forms regarding the categories belonging to the first sub-problem are as follows.

The students' opinions in the category of the technical problems:

S2: "Sometimes, there are freezes due to the internet, and I miss some parts of the lesson."

S9: "Sometimes our internet does not work, sometimes it makes me log out of class or does not enter the class."

S27: "Because of the internet connection, the voices of the teachers are sometimes interrupted."

S29: "Sometimes the lectures become unproductive because of the connection problem of the teachers and their lack of technological knowledge (for example, screen sharing, etc.)."

The students' opinions in the category of teaching-learning problems:

S38: "There were times when I could not write down the notes properly."

S44: "We didn't even have time to ask our teacher questions because our time was limited and our subjects were heavy."

S53: "We don't understand; some teachers teach very quickly compared to face-to-face training."

S55: "I had problems in understanding at first because the subjects were difficult, then I tried to solve this problem by reviewing it myself."

S84: "I have a focusing problem."

The students' opinions in the category of family-related problems:

S34: "It is difficult to attend live classes when you have three students at home and only one phone for this."

S22: "My computer was not suitable for me to follow lessons."

S37: "Since we are a large family, it is difficult to find a quiet place at home."

Findings of the second sub-problem: The findings obtained by evaluating the research questions numbered 2 and 3 regarding the second sub-problem, "What are the opinions of high school students about the advantages and disadvantages of the online physics and chemistry courses?" are shown in Table 2.

Table 2. Advantages and disadvantages of online processing of physics and chemistry courses

<i>Codes</i>	<i>f</i>	<i>Categories</i>	<i>Theme</i>
Quiet listening environment	12	Environment	Online course advantage
Listening comfortably at home	5		
Not having to go outside	6		
Flexible environment	5		
get up late in the morning	4		
Not worrying about being late for school	4		
Benefits of individual training	6	Teaching	
Having time for study	5		
Re-watching the subject	2		
Understanding the importance of school discipline	2	Discipline	
Family control	2		
Reduction in school expenses	3	Economy	
Being safe at home	12	Health	

Inability to understand lessons	20	Teaching	Online course disadvantage
Inability to focus on the lesson-distraction	9		
Inability to ask questions due to lack of time	9		
Learning disability	3		
Not memorable	2		
Lessons are ineffective	5		
Inability to take notes in class	2		
Internet and technical problems	24	Technical conditions	
Inability to socialize	4	Sociability	
Infectious diseases of crowded home environment increase	5	Health	
Differences in internet and hardware facilities	4	Economy	

As shown in Table 2, the advantages and disadvantages provided in the distance teaching of the physics and chemistry courses taken by high school students during the distance education process were evaluated in 5 categories. Twenty-four of the students stated that it was not an advantage to carry out these courses with distance education, while 3 students stated that they did not have any disadvantages. Other 61 students expressed their opinions about the situations they saw as advantages and disadvantages. Online course advantages expressed by the students were (1) environment advantage (f=36), (2) teaching advantage (f=13), (3) health benefit (f=12), (4) discipline advantage (f=4), (5) financial advantage (f=3) in order of frequency. Disadvantages expressed by the students were (1) teaching disadvantage (f=50), (2) technical impossibility (f=24), (3) health benefit (5), (4) not being able to socialize (f=4), (5) economic conditions (f=3) in order of frequency. The results show that students determined many advantages and disadvantages of the physics-chemistry courses in the distance education process.

The students' opinions in the categories belonging to the second sub-problem are as follows.

The students' opinions in the category of the media advantage:

S3: "Since there are no unnecessary conversations in the classroom environment, we can listen more comfortably."

S12: "It is very comfortable as there is no getting up late in the morning."

S49: "We can learn in an environment where we feel comfortable."

S61: "Students are quiet and can listen to the lesson comfortably without sitting in the back desks."

The students' opinions in the category of the teaching advantage:

S74: "I can understand the subjects that I do not understand by listening to the videos on the internet."

S80: "We understand the subject when we watch a video over and over again."

S5: "I learn better because we receive individual education."

S6: "We have more time at home for our studies."

The students' opinions in the category of the health benefit:

S23: "But, of course, it is better this way in terms of health."

S27: "The only advantage I think is to be able to protect our health at home and attend classes."

S42: "Being less risky in terms of the pandemic."

The students' opinions in the category of the disciplinary advantage:

S16: "We attend classes more often with the contribution of our family."

S7: "We have only understood how necessary the discipline and prohibitions at school are; I think there is no advantage other than that."

The students' opinions in the category of the economic advantage:

S26: "Staying at home during this period is a kind of avoidance of expense."

S37: "Not spending money because we don't go to school."

The students' opinions in the category of the teaching disadvantage:

S44: "Due to the lack of time, we cannot ask the teachers questions; we cannot solve the questions that we do not understand or cannot do."

S47: "There is a disconnection in the lessons. Lessons are harder to understand."

S49: "It is challenging to concentrate on the lessons."

S60: "In the virtual environment, the information that the student receives through gestures and mimics from the teacher is missing."

The students' opinions in the category of the technical disadvantage:

S56: "Many lessons are interrupted due to system errors, and they are not efficient."

S39: "In my opinion, there are disconnections in online education due to the internet connection problem in the course, and this negatively affects the course."

S65: "It is not as productive as in school; we cannot attend the class when there are some system or internet problems."

The students' opinions in the category of socialization:

S37: "Not being able to socialize and not having a teacher-student relationship makes the lesson inefficient."

The students' opinions in the category of the health benefit:

S46: "We are in front of the screen too much; our eyesight deteriorates."

S51: "Since the home environment is crowded, when a person gets sick at home, it infects everyone."

S55: "Our eyes and backs hurt from looking at the screen for hours every day. It is getting harder to get efficiency from the lessons."

The students' opinions in the category of the economic disadvantage:

S52: "Not everyone has a computer, which complicates the family's situation."

S23: "Everyone's family cannot provide enough internet connection. Those who don't have internet access can't watch the lesson."

Findings of the third sub-problem: The findings obtained by evaluating the research questions numbered 4 and 5 to determine the opinions of high school students about the effect of the online physics and chemistry courses on learning are shown in Table 3. According to the data

obtained from the research questions 4 and 5, while 74 of the students stated that the online chemistry course was ineffective, 71 said online physics online was ineffective, and 2 students had no idea. In this case, the number of students who were satisfied with the effect of online education on learning was relatively low for chemistry ($f=12$) and physics ($f=15$) courses.

Table 3. The effect of online processing of physics and chemistry courses on learning

<i>Codes</i>	<i>f</i> <i>(chemistry) &</i> <i>(physics)</i>	<i>Categories</i>	<i>Theme</i>
Insufficient understanding of the lessons	26 -23	From teaching induced effect	To learn negative effect
Difficulty in learning due to not being able to focus on lessons	9-7		
Difficult topics become more difficult to understand with online transfer	11-12		
Incomplete settlement of information because adequate solutions cannot be made	9-11		
Difficulty learning formulas	7-9		
The problem of not being able to ask questions that they do not understand during the lesson	7-3		
Unable to solve the question	3-4		
Not understanding the lessons due to the teachers' lack of technological knowledge	4-1	Effect from conditions	
Limitation and ineffective use of lesson times	3-3		
Ambient silence makes it easier to listen to the lesson	7-8	Ambient influence	To learn positive effect
Supporting the lessons with the help of videos increases visual learning	5-7	Visual support effect	

As shown from Table 3, we created two categories for the positive and negative effects themes regarding the opinions of high school students about the effect of online physics and chemistry courses on learning. Student opinions expressing the negativity of online education were about (1) effects arising from teaching (chemistry $f=72$; physics $f=69$) and (2) effects arising from conditions (chemistry $f=7$; physics $f=4$) in order of frequency. Student opinions expressing that it has a positive effect on learning were about (1) effect of the environment (chemistry $f=7$; physics $f=8$) and (2) visual support effect (chemistry $f=5$; physics $f=7$) in order of frequency.

Some students' opinions in the categories of the third sub-problem are as follows.

The students' opinions in the category of effect caused by teaching:

S44: "I don't think I fully understand any subject in chemistry."

S53: "Both of them are difficult to understand at school anyway, and it is not understood enough with distance education."

S68: "As we could not ask as many questions as in face-to-face education, we could not get as much efficiency as we did there."

S74: “Since physics is a complicated course and our lessons are 30 minutes, we try to learn very quickly, and therefore I get perplexed.”

S85: “The chemistry is difficult for me to grasp, and it became even more difficult when it became online this year.”

The students’ opinions in the category of effect caused by conditions:

S11: “Since the lesson times are limited and there are problems with constant attachment, I cannot ask questions, I cannot get efficiency.”

S12: “The teacher cannot explain everything s/he wants from a distance; it takes a lot of time to show or open a shape, a picture, and many more.”

Comments in the category of the environmental effect:

S19: “The subjects are listened to more comfortably because the environment is quieter.”

S61: “When it is a school, classroom environments are noisy. Also, tall people cannot listen to the lesson because they have to sit at the back desks.”

The students’ opinions in the category of the visual support effect:

S18: “I learn by watching additional videos. The images are remembered more easily.”

S74: “Especially the physics teacher makes us watch a lot of videos in the lessons, which makes learning easier.”

Findings of the fourth sub-problem: We examined the answers to the question “What are the opinions of high school students about the effect of solving problems and doing experiments in online physics and chemistry courses on learning?” and have given them in Table 4.

Table 4. Thoughts on problem solving and experimentation in the online process of physics and chemistry courses

<i>Codes</i>	<i>f</i>	Categories	Theme
Inability to ask questions they do not understand	9	Problem solving effect	Problem applications and experimentation
Not enough problem solving	12		
Failure to take notes on problem solutions	3		
Teachers' writings are not understandable	3		
Inability to establish mutual communication during problem solving	6		
Not understanding the problems being solved	5		
No test	25	Experimentation effect	
Virtual lab application in progress	2		
Experiment videos are being watched	7		

Regarding the sub-problem, 46 of the students stated that it had no effect, and 4 students did not make any other explanations even though they said they thought it had a positive effect. Additionally, 38 students made explanations by expressing that they thought negatively. As shown in Table 5, we interpreted the answers and grouped them under the categories of problem-solving effect ($f=38$) and experimenting ($f=34$). We have presented student opinions about the answers that make up these categories below.

The students' opinions in the category of problem-solving:

S14: "I think it negatively affects because we cannot always ask questions that we do not understand."

S30: "I think that I do not understand problem solutions because the opportunities are limited."

S54: "Because it is not face-to-face, I do not understand both courses properly, most importantly, when we ask the subjects we do not understand because the time is too short, there is not enough time, I think it did not have a positive effect."

S55: "Question solutions are difficult in the context of distance education... it can never replace face-to-face education. I usually see the negative effects."

The students' opinions in the category of experimenting:

S20: "We did not experience problem-solving, but of course, since the experiment can take place in the school environment, problems may arise."

S26: "Yes, we could not carry out some experiments because those materials were in the experimental laboratory of our school, so they were not things we would find."

S61: "The physics teacher showed us the experimental instrument on the image."

S65: "Experiments cannot be done in distance education, and question solutions are not as understandable as in school."

4. Discussion and conclusion

In this study, we aimed to determine the opinions of the high school students about the online physics and chemistry courses during the distance education process due to the Covid-19 pandemic. The literature discussion about the findings of the data obtained for this purpose is included in this section.

When we examined the answers given by the students to the question "What are the opinions of high school students about the problems encountered in online physics and chemistry courses during the distance education process?", three categories emerged to determine the problems encountered. As shown in Table 1, in the category of technological problems, students stated problems such as accessing the internet, technical infrastructure problems experienced by teachers and students, not entering the Educational Informatics Network (EIN), or being logged out of the system, and teachers' inability to use technology effectively. In the category of learning-teaching problems, students expressed problems such as difficulty understanding physics and chemistry courses, which are numerical courses, trouble taking notes, short course durations, and inability to focus on the lesson. In the category of family-related problems, they expressed problems such as the economic situation of the family, the number of students in the family, and the home environment not creating suitable conditions. The problems stated by the students at this stage are not specific to physics and chemistry courses but are general situations that can be encountered in all courses. Almost all studies on the subject have encountered the same problems. For example, our results coincide with the findings by Pınar and Dönel Akgül (2020), Telli (2021), Yamamoto and Altun (2020), Owusu-Fordjour, Koomson and Hanson (2020), on the decrease of educational efficiency due to the problems and deficiencies related to technical infrastructure and internet access during the distance education process. According to Kaynar et al. (2020), the problems that students' problems in entering the distance education system stem from the equipment they have. Our findings on technological problems, learning-teaching problems, and family-related problems are in line with the conclusions by Eken, Tosun and Tuzcu Eken (2020) showing that there are some adverse effects. These conclusions include the negative effects caused

by teachers without distance education experience and students who do not have distance education experience. Besides, other findings consist of the lack of motivation for listening to the lecture, taking notes, and reviewing after the lesson in students who are accustomed to the classroom environment, the lack of a study room of their own in the student's house, and the remote environment of the crowded home environment.

Related to the sub-problem "What are the opinions of high school students about the advantages and disadvantages of the online physics and chemistry courses on learning?", we evaluated the advantages of distance learning in 5 categories: environment, teaching, discipline, economy, and health. Disadvantages were expressed as the inconvenience of technical conditions, inability to socialize, health conditions, and inadequacies in economic conditions. In the environment category in the study, the students considered it an advantage to listen to lessons in a quiet home environment, wake up late in the morning, not worry about being late for school, and be flexible. In the teaching category, they stated that it was an advantage to listen to lessons individually, have time to study and watch the lecture again. Due to family control at home, they considered compulsory attendance to classes as an advantage. In addition, they emphasized that they did not go to school so that the costs were reduced and their health was safe against the danger of covid as an advantage. These findings are in line with the findings by Pinar et al. (2020). They are also in line with the findings by Balaman and Hanbay Tiryaki (2021), Karakaya, Arık, Çimen, and Yılmaz (2020) showing that distance education saves time and enables lesson review. In the category of teaching, which is seen as disadvantageous in the distance education process, the students focused on the subjects such as not being able to understand the lessons, not being able to focus, lack of time, not being able to ask questions, the ineffectiveness of the lessons and not taking notes. Apart from these, the most significant disadvantage is the internet problem and technical problems such as computer capacity, inability to connect, insufficient infrastructure, etc. A small number of students stated that they could not socialize because they did not go to school, that crowded home environment increased the risk of disease and transmission, and that economic opportunities did not provide equal opportunities. Many of these findings are supported by the findings of literature studies. For example, they are in line with the findings of inefficiency, lack of motivation, and technological infrastructure by Balaman and Hanbay Tiryaki (2021) and the findings of connection problems and low motivation by Demirçelik, Mert and Yıldırım (2021). In addition, they are also in line with the findings by Doğrukök et al. (2021), showing that some of the students felt unhappy because of not being together with their friends. According to Pokhrel and Chhetri (2021) there are economic, social, and psychological reflections in the lives of students who stay away from the usual program of the schools.

We evaluated research questions 4 and 5 for the third sub-problem, on high school students' opinions about the effect of online physics and chemistry courses on learning. The number of students who were satisfied with the effect of online education on learning was relatively low for chemistry ($f=12, 13.6\%$) and physics ($f= 15, 17\%$) courses. According to the results of the content analysis of the data, we determined the adverse effects on learning physics and chemistry courses as the effect arising from the teaching and the conditions. In contrast, the environment and visual support positively affected the learning. The students who had opposing opinions about distance teaching stated that they could not understand the physics and chemistry courses enough and could not focus. These courses, which were already difficult, were getting more challenging. The knowledge was not fully established because enough problems could not be solved, they could not understand the formulas, and they had difficulty asking questions due to the lack of time. They also stated that teachers' lack of technological knowledge affected the efficiency of the course and the understanding of the courses. These findings align with the findings of Pinar and Dönel Akgül (2020) that students cannot grasp the subject well in distance education, have difficulty asking questions, and cannot get efficiency from the process due to technical problems. Regarding the positive effect of online physics and chemistry courses on learning, opinions were that the quiet home environment made it easier to listen to lectures and

the lessons supported with the help of videos increased visual learning. These findings are in line with the findings of Arik et al. (2021), about minimizing the loss of time due to home lessons in the distance education process, watching the lessons repeatedly, and a silent environment. The students stated that they had more difficulties in magnetism, optics, and electricity in the distance education process in the physics course compared to other subjects. In the chemistry, they stated that they had difficulties in balance and speed in chemical reactions and organic compounds.

Related to the sub-problem “What are the opinions of high school students about the effect of problem-solving and experimenting in the online physics and chemistry courses on learning?”, the students reported negative opinions such as not being able to solve a sufficient number of problems, not communicating with the teacher during the solution, not having enough time to take notes, and not asking the problems they did not understand. They also stated that experiments could not be done in distance education like face-to-face education. Few students stated that they watched videos and benefited from virtual laboratory applications instead of experiments. These findings are compatible with the finding of Pınar and Dönel Akgül (2020) showing that the biggest shortcoming of the students towards distance education is that they cannot do experiments and cannot immediately ask the questions they cannot solve. According to Kahraman (2020), although distance education applications provide convenience with theoretical-oriented courses, they have caused difficulties in practice-oriented courses.

As a result, considering the ongoing epidemic and possible similar situations in the future, distance education may become a part of our lives. It seems that distance education will take place in our lives to complement face-to-face education in the coming years. For this reason, it is essential to investigate the positive and negative experiences of educators and students in this process to realize future improvements. Especially considering the applied nature of science, it is also crucial to create original content for distance education for these courses. It is understood from the emergency distance education process that it is vital to establish the infrastructures for the distance education process in a planned manner immediately.

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References

- Arik, S., Karakaya, F., Çimen, O., & Yılmaz, M. (2021). Covid-19 pandemi sürecinde uygulanan uzaktan eğitim hakkında ortaöğretim öğrencilerinin görüşlerinin belirlenmesi. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, 41(2), 631-659.
- Aydın, Y., Karasu, T., & Ülger, E. (2021). Yüksek öğretiminde uzaktan eğitimin imkânı ve karşılaşılan problemler: Muş alparslan Üniversitesi İslami İlimler Fakültesi örneği. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, 9(4), 1141-1159.
- Balaman, F., & Hanbay Tiryaki, S. (2021). Corona virüs (Covid-19) nedeniyle mecburi yürütülen uzaktan eğitim hakkında öğretmen görüşleri. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 10(1), 52-84.
- Başaran, M., Doğan, E., Karaoğlu, E., & Şahih, E. (2020). Koronavirüs pandemi sürecinin getirisi olan uzaktan eğitimin etkililiği üzerine bir çalışma. *AJER-Academia Eğitim Araştırmaları Dergisi*, 5(2), 368-397.

- Bond, M., Bedenlier, S., Marin, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education*. <https://doi.org/10.1186/s41239-021-00282-x>
- Bostan Sarıođlan, A., Ően, R., & Altař, R. (2021). What do secondary school students think about experimental practices in science lessons taught in distance education? *Journal of Educational Technology & Online Learning*, 4(1), 193-214.
- Bozkurt, A. (2017). Trkiye'de uzaktan eđitimin dn, bugn ve yarını. *Açık Öđretim Uygulamaları ve Arařtırmaları Dergisi* (AUAd), 3(2), 85-124.
- Bykztrk, Ő., Kılıç Çakmak, E., Akgn, . A., Karadeniz, Ő., & Demirel, Ő. (2019). *Bilimsel arařtırma yntemleri*. Ankara: Pegema Yayıncılık.
- Creswell, J. W., Hanson, W. E., Clark Plano, V. L., & Morales, A. (2007). Qualitative research designs: Selection and implementation. *The Counseling Psychologist*, 35(2), 236-264.
- Demirçelik, E., Mert, R., & Yıldırım, Z. S. (2021). Kayserideki 9. sınıf đrencilerinin uzaktan eđitime iliřkin grřlerinin belirlenmesi. Uluslararası Trk kltr cođrafyasında. *Sosyal Bilimler Dergisi (TURKSOSBİLDER)*, 6(2), 227-235.
- Dođrukk, B., Kurnaz, A., Őentrk-Barıřık, C., & Kaynar, H. (2021). Lise đrencilerinin uzaktan eđitime iliřkin algılarının farklı deđiřkenler aısından deđerlendirilmesi. *Stratejik ve Sosyal Arařtırmalar Dergisi*, 5(1), 145-169. <https://doi.org/10.18506/anemon.762996>
- Eken, ., Tosun, N., & Tuzcu Eken, D. (2020). Covid-19 salgını ile acil ve zorunlu uzaktan eđitime geiř: Genel bir deđerleme. *Milli Eđitim Dergisi*, 49(1), 113-128.
- Kahraman, M. E. (2020). The effect of COVID-19 epidemic on applied courses and the implementation of these courses by distance education: Example of basic design course. *Medeniyet Sanat Dergisi*, 6(1), 44-56.
- Karakaya, F., Arık, S., Çimen, O., & Yılmaz, M. (2020). Investigation of the views of biology teachers on distance education during the COVID-19 pandemic. *Journal of Education in Science Environment and Health*, 6(4), 246-258.
- Kaynar, H., Kurnaz, A., Dođrukk, B., & Őentrk Barıřık, C. (2020). Ortaokul đrencilerinin uzaktan eđitime iliřkin grřleri. *Turkish Studies*, 15(7), 3269-3292.
- Onyema, E. M., Eucheria, N. C., Obafemi, F. A., Sen, S., Atonye, F. G., Sharma, A., & Alsayed, A. O. (2020). Impact of coronavirus pandemic on education. *Journal of Education and Practice*, 11(13), 108-121.
- Owusu-Fordjour, C., Koomson, C. K., & Hanson, D. (2020). The impact of COVID-19 on learning: The perspective of the Ghanaian students. *European Journal of Education Studies*, 7(3), 88-101.
- Pınar, M. A., & Dnel Akgl, G. (2020). The opinions of secondary school students about giving science courses with distance education during the Covid-19 pandemic. *Journal of Current Researches on Social Sciences*, 10(2), 461-486.
- Pokhrel, S., & Chhetri, R. (2021). A literature review on impact of COVID-19 pandemic on teaching and learning. *Higher Education for the Future*, 8(1), 133-141. Retrieved from <http://www.itobiad.com/tr/pub/issue/60435/769798>.
- Sezgin, S. (2021). Acil uzaktan eđitim srecinin analizi: ne ıkan kavramlar, sorunlar ve ıkarılan dersler. *Anadolu niversitesi Sosyal Bilimler Dergisi*, 21(1), 273-296.
- Telli, S. G., & Altun, D. (2021). Coronavirs (Covid-19) pandemisi dneminde çevrimii đrenme. *niversite Arařtırmaları Dergisi*, 4(2), 90-107.
- The Turkish Higher Education Quality Council (2020). Pandemi dneminde uzaktan eđitim. Retrieved from Yksekđretim Kalite Kurulu URLı: <https://portal.yokak.gov.tr/makale/pandemi-doneminde-uzaktan-egitim/>.
- UNESCO (2020). "Global Education Coalition." UNESCO, 26 March 2020.

- Wang, G., Zhang, Y., Zhao, J., Zhanh, J., & Jianh, F. (2020). Mitigate the effects of home confinement on children during the COVID-19 outbreak. *The Lancet*, 395(10228), 21-27. [https://doi.org/10.1016/S0140-6736\(20\)30547-X](https://doi.org/10.1016/S0140-6736(20)30547-X)References
- Yamamoto, G. T., & Altun, D. (2020). Coronavirüs ve çevrimiçi (online) eğitimin önlenemeyen yükselişi. *Üniversite Araştırmaları Dergisi*, 3(1), 25-34.
- Zan, N., & Zan, B. U. (2020). Koronavirüs ile acil durumda eği- tim: Türkiye'nin farklı bölgelerinden uzaktan eğitim sis- temine dahil olan edebiyat fakültesi öğrencilerine genel bakış. *Turkish Studies*, 1367-1394.

