



## Thematic content analysis of science lesson videos uploaded to YouTube platform in the Covid-19 era

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### Highlights

- Along with emergency distance education, many videos started to be shared on social networking places.
- As a result of the content analysis of the science lesson videos uploaded to the YouTube platform, the 8<sup>th</sup> grade videos were found the most.
- It was determined that the highest number of videos were uploaded during the periods when distance education was continued.
- It was seen that the most videos were uploaded by teachers working in private schools.

### Abstract

Students started to continue their education from online platforms when they could not receive face-to-face education due to Covid-19. So, various instructional videos have been shared on the YouTube platform by the teachers and education researchers. The study aimed to analyze the videos shared in the field of science education on the YouTube platform during the Covid-19 period. For this purpose, the keywords (“science lesson” and “secondary school science lesson”) were searched in the YouTube search engine and the videos taken by the teachers and shared during the pandemic period were examined. Thematic content analysis method was used in the research. The videos were analyzed according to the parameters of the shared date, the location of the teacher who shot the video, the grade level, the subject area, the method of the video, their suitability for the learning outcome and the compatibility of the content information with scientific knowledge. The following issues were revealed in the findings: Between 23 March and 15 May 2020, when distance education continued, there was a large number of video sharing. The number of videos in which no information was given that the teachers who shot videos worked in any institution was higher than the others. There were many videos shot for 8<sup>th</sup> graders. It was concluded that the videos were generally shot on living things and the subject area of life, the question-solving method was mostly used in the videos, and the experiment/activity was rarely included in the videos. It has been concluded that there are a large number of videos that are suitable for the relevant acquisition and that the content information is suitable for scientific knowledge. Necessary suggestions were expressed in line with the results obtained.

**Article Info:** Research Article

**Keywords:** *Distance education, Science education, Thematic content analysis, YouTube*

### Introduction

With the onset of the global epidemic, Covid-19 has affected many areas around the world, and one of the areas that has been affected on a large scale is education. One of the measures taken in most countries is the rapid closure of educational institutions at all levels, from pre-school to higher education. (Bakiođlu &

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Çevik, 2020; Dikmen & Bahçeci, 2020). An average of 25 million students in Turkey were affected by the closure of educational institutions and the suspension of traditional education (Bozkurt, 2020). This number has reached 1.6 billion students worldwide (World Bank, 2020). As a result of the pandemic, all levels in the countries have moved away from the traditional education environment, and alternative solutions have been sought so that the education process can continue. With the closure of schools in our country, the Ministry of National Education started to provide education through EBA TV at primary and secondary education levels (Sirer, 2020). In the Covid-19 period, where traditional face-to-face education, which requires students and teachers to be at the same time and place, could not be realized, distance education, which does not seek these conditions and is flexible, individual and independent, was implemented (Lamanauskas & Makarskaitė-Petkevičienė, 2021; Sercemeli & Kurnaz, 2020). Teachers and students will be able to communicate by e-mail, computer or telephone conference. Distance education has been preferred because it can be easily applied during the Covid-19 process and will ensure the continuity of education (Demir & Özdaş, 2020). Numerous studies have been conducted to discuss the advantages and disadvantages of distance education. It is stated that the benefits of distance education are that students and teachers can participate in educational activities from anywhere, and this saves time and reduces the cost of education (Benzer & Akkaya, 2021; Moore & Kearsley, 2011). The limitations of distance education are listed as the inability of every student to have equal access to distance education and the inability to get enough efficiency from the lessons as a result of not providing active communication (Bostan Sariođlan, Şen & Altaş, 2021; Can, 2020; Çağlar, 2010). Distance education, which is widely used in the Covid-19 period, has also caused learning losses in students (Donnelly & Patrinos, 2021; Timmons et al., 2021; Zhdanov et al., 2022). It can be said that the reasons for these learning losses are that students stay away from school and that they lack teacher supervision (Kaffenberger, 2021).

## 2. Literature

### 2.1. Distance Learning

Education is the whole of the sequential processes that are in change, active, starting with birth and continuing until the end of life. Distance education, which was previously used in the pandemic process, but not so widely (Durak & Çankaya, 2018), has been widely used at all levels of education with the pandemic. Distance education is a programmed arrangement that requires educators and students to practice teaching methods in different environments and to use many technologies. Auxiliary tools for distance education are video, audio, computer and web technologies (Demir, 2014). Distance education is a planned and systematic type of education carried out on various platforms, supported by developing technology, where students and teachers are not physically in the same environment. Student, teacher and communication method are three important elements in distance education (Sağlam, 2022). The communication method establishes the bond between the student and the teacher, and this bond develops with the development of technology. Distance education, which can be used in primary, secondary, high school and university, has also started to be used at the graduate level and has spread to all levels of education (Kahraman, 2020).

### 2.2. Emergency Distance Education

Emergency distance education is an application to be applied in a situation that will prevent education. And after the announcement of Covid-19, different practices were implemented as schools were closed in many countries in accordance with social distance rules in order to reduce the spread of the epidemic (Madan et al., 2021; Kerkez & Soy, 2022). The education applied in this period was named differently such as online education, education from home, distance education, emergency distance education (Sağlam 2022). Although it is mostly described as distance education, Dolu (2021) states that this situation is Emergency Distance Education. Although the concepts of distance education and emergency distance education are confused with each other, Bozkurt (2020) has listed distinctions to distinguish these concepts:

- While distance education is an option, emergency distance education is a necessity.
- While distance education is the work of producing solutions for permanent learning for lifelong learning, emergency distance education is the work of producing a temporary solution to the crisis situation at that time.
- While distance education is a planned, programmed, systematic practice, emergency distance education is an intervention practice for education in an emergency.

### 2.3. Hybrid Education

Hybrid is used to bring together two different phenomena and to use them together to achieve a better result. Hybrid education, on the other hand, is the type of education in which half of the course is done by face-to-face and half of it is done by distance education (Koç Akran, 2021). Hybrid education is a mixed education that includes both the advantages of distance education and the advantages of face-to-face education (Korucu & Kabak, 2020). Hybrid education is a type of education that combines in-class interaction and participation with technology-based distance education (Yaman, 2021). Hybrid education is the education created by combining educational knowledge transfer tools and methods and combining online education and face-to-face education (Çağlar, 2010). Hybrid education provides the opportunity to complete the deficiencies of these two education combined with the other education. It also provides the opportunity to benefit from the advantages of both types of education. Studies have shown that students have high perceptions of using online platforms to support hybrid education (Haji, 2022). Therefore, this type of education has been used in many universities and successful results have been obtained. Therefore, the number of universities using hybrid education is increasing (Usta & Mahiroğlu, 2007).

### 2.4. Conducted Studies

First of all, the studies on hybrid education related to students are mentioned. Akgündüz and Akınoğlu (2016) aimed to compare students' attitudes and self-management skills in science education between blended learning, social media supported learning and traditional face-to-face learning models in their study. When the blended learning group was compared with the traditional face-to-face education group, it was seen that science attitude and self-management skills increased significantly. It was observed that the social media supported learning group had a positive effect on science attitude and self-management skills, but it was stated that this change did not make a significant difference compared to the control group. Aydıncı and Zorluoğlu (2022), in their study, aimed to investigate the thoughts of high school students about Covid-19, face-to-face education and distance education. As a result of the study, it was found that while women had more negative thoughts about Covid-19 than men, women and men had positive thoughts about face-to-face education. As a result of their study, they concluded that women think more positively about distance education. Dursun, Çavuş Güngören and Aksüt (2021) aimed to examine students' views on the use of social media tools in science education during the pandemic process. As a result of the research, it was determined that the students mostly used social media tools as a source of information, half of the participants spent more than one hour for this and they preferred EBA and YouTube platforms the most. It has been determined that social media is mostly used for narration and reinforcement of the subject. It was determined that the students stated that they care about communicating with their teacher through social media and that they find their teacher sufficient in using social media tools.

Aslan and Güner (2022) aimed to investigate the experiences and thoughts of science teachers about online learning. It was concluded that science teachers found themselves insufficient in terms of digital literacy level, while teachers whose students participated in the lesson developed a positive attitude, while teachers whose students did not participate in the lesson developed a negative attitude. Teachers stated that when they try to improve themselves at the level of technology and digital literacy, the lesson they teach is also positively affected by this, but the lack of parental interest, eye contact with the student and lack of healthy communication create problems in their lessons. In another study, Bakioğlu and Çevik (2020), in their

study, investigated the experiences of science teachers related to distance education during the Covid-19 period. They stated that teachers did not know the concept of pandemic before the Covid-19 process. During the distance education carried out during the Covid-19 process, problems such as internet connection, eye contact and communication with students, students not attending classes as much as in face-to-face education and pressure from the school administration were determined. In addition, it was concluded that the teachers were worried about the changes in the course materials, teaching methods and techniques used with the transition to distance education, and the inability to conduct experiments / activities, so they felt inadequate to fully gain the students the achievements. However, it was also concluded that teachers were able to improve themselves in this period. Bakırcı, Dođdu and Artun (2021), in their study, aimed to investigate the problems faced by science teachers during their distance education experiences during the Covid-19 process. The teachers stated that the distance education carried out during the Covid-19 period had a positive effect on their professional development, and they learned to use the computer and digital platforms better. It has been concluded that the motivation of the students in the distance education process is low and they participate less in the lesson. In their study, Bostan Sariođlan, Altaş and Şen (2020) aimed to examine the opinions of teachers about conducting experiments in science education in distance education. They stated that the necessary materials for experimentation were lacking, the interest of the students was low, and the students were insufficient in actively participating in learning by doing. In addition, they stated that the students approached the experiments with prominent visuality more curiously. Since experiments are of great importance for science lessons, they suggested developing models for experiments in distance education.

Benzer and Akkaya (2021), in their study, determined the views of pre-service teachers and graduate / doctorate students studying in the field of science education during the pandemic period on distance education. In the research, it was concluded that they found distance education positive in terms of time and space, but they found it negative because the practice could not be included. They also stated that distance education would be beneficial in theoretical courses.

Ayaz (2021), in his study, aims to evaluate the process of conducting primary school science course by teachers and parents in the distance education process during the Covid-19 pandemic period. It was observed that all participants included in the study followed EBA. However, it has been concluded that some teachers did the sharing with their students by using different online platforms (Zoom, WhatsApp, YouTube, etc.). Alqahtani (2020), in his study, aimed to examine the attitudes and perceptions of Saudi families towards the use of social media in family communication. The findings of the study, which was conducted with 818 participants, show that the purpose of families to use social media includes networking, education and getting news. It has been determined that parents and young people use the YouTube platform for educational purposes. Chen (2010) stated in his study that education should be removed from the traditional classroom environment. He stated that learning environments have also developed with the developing technology, and workshops that can be established from social media and internet networks will contribute to education. Srinivasacharlu (2020), in his study, stated that the new generation of students grew up with the digital environment and that educators should bring education together with the digital environment. It has been concluded that YouTube, which is an important digital platform, is not only an entertainment environment but also a good teaching environment. Therefore, they concluded that using the YouTube platform in the classroom with good planning provides efficiency for the teacher and the student. Whitlock (2017), in his study, aimed to investigate the effect of the virtual learning system on biology students who were preparing for university. They concluded that the virtual learning system improves students' self-monitoring habits, enables students to make decisions, and ensures equality by developing each student at their own pace, and facilitates access to higher-level science courses. Pattier (2021), in his study, investigated the effect of educational science channels on this platform with the increase in the use of the YouTube platform, and the success factors and variables used by educators in this field. In the results

obtained, it is stated that the educational science channels on the YouTube platform have a high and positive effect on learning.

### *2.5. The Aim and Significance of the Study*

The aim of this study is to comprehensively examine the studies shared in the field of science education on the YouTube platform during the Covid-19 period. The inability of educators and students to go to schools during the Covid-19 period has led to the inability of face-to-face education. In order for the education to continue, the education was moved to online platforms and the students were tried to be reached. In order to reach the education that has been moved to online platforms, students have started to spend more time with tools such as computers, tablets and phones. One of the platforms where students spend a lot of time in this period is YouTube (Dursun et al., 2021). Founded in 2005, YouTube is a video sharing site. YouTube platform has become the most popular video sharing platform in the world in a short time also in 2019, one billion hours of video are watched every day (İlhan & Grgl Aydođu, 2019). This platform is a website that can be used by people of all ages in terms of ease of use. When watching videos on the Internet, the first priority is given to the YouTube platform in terms of content variety (music, education, movies, funny videos, etc.) and accessibility (watching videos without being a member) (Arklan & Kartal, 2018). This platform is a place where every student can access easily and free of charge without being a member. And it is a platform where everyone can upload the content they want and everyone can access this content. Since the video to be uploaded can be uploaded without going through a certain control mechanism, the results are unpredictable. Mistakes made in these videos may cause misinformation, confusion or misconceptions in students. Every concept learned is a preparation for the new concept to be learned. Incomplete or incorrect learning of concepts creates problems that are difficult to solve in the future (Boyras et al., 2016; Ivowi, 1984). This is a difficult situation to solve for students and educators. One of the most important issues in science education is to identify the misconceptions of students and to eliminate the sources of these misconceptions (Topalsan & Bayram, 2019; Wartono et al., 2018). One of the sources of these misconceptions encountered in students is the internet (Acar Sesen & Ince, 2010). It is important to analyze the content of the course videos on the YouTube platform, where everyone can share videos without going through a certain filter and all students can easily access these videos. Otherwise, YouTube video contents may cause misunderstandings in students and may also be a source for misconceptions. Examining the content of the videos in the field of science education shared on the YouTube platform, which students who want to continue their education during the pandemic period can easily access and the evaluation of the content that the students have reached is the aim of this study.

## **3. Methodology**

### *3.1. Research Model/Design*

Thematic content analysis method was used in order to examine the videos shared in the field of science education on the YouTube platform during the Covid-19 period in this research. Thematic content analysis aims to synthesize and interpret the studies on a subject through themes (alık & Szbilir, 2014). The reason for using thematic content analysis in the research is to determine the similarities and differences of the videos reached with certain criteria and to try to examine them in depth with the same and different dimensions. Thus, thematic content analysis constitutes a wide and useful resource for researchers and those interested in the subject in terms of qualitatively synthesizing the same and similar aspects of the studies in a determined subject area and reaching more studies (alık et al., 2009; alık & Szbilir, 2014).

### *3.2. Data Collection Process*

In order to reach the data to be examined within the scope of the research, firstly, the keywords "science" and "secondary school science" were searched on the YouTube platform. As a result of the search, filters were applied according to the time range and 400 videos shared between 16 March 2020 and 18 November 2021 were found. Due to the fact that the first decision about education after the Corona Virus was seen in

Turkey for the first time was the closure of schools as of 16 March 2020, the videos shared since this date have started to be reviewed and videos shared until 18 November 2021, when the data collection process was terminated, were included in the review. However, as some videos were found twice as a result of searching for the keywords "science" and "secondary school science", these videos were included in the study only once. Videos that were not shot by a teacher, which is another criterion, were not included in the study. As a result, 297 videos matching the search criteria were found in the research.

### 3.3. Data Analysis

For the purpose of the research, 297 videos that make up the data analysis unit were examined under seven different review criteria agreed with the second researcher. These review criteria are the release date of the videos, who shot them, grade level, subject area, method of the video, suitability for the learning outcome, and compliance of the content information with scientific knowledge. The criteria for reviewing the videos are explained in detail in Table 1.

**Table 1.**

Analysis criteria of videos

	Analysis criteria
First criteria	Video upload dates
Second criteria	Duty of the teacher who shoots the video
Third criteria	Video's grade level
Fourth criteria	Subject area of the video
Fifth criteria	Teaching method used in the video
Sixth criteria	Suitability of the video for the selected acquisition
Seventh criteria	Video's content information is compatible with scientific knowledge

While examining the videos in terms of their release date, the changes in education in Turkey were considered as a basis. Each change is designated as a date range and videos are placed in these ranges according to the release date. The first case of the Covid-19 outbreak in Turkey was on March 11, 2020. The first death due to the epidemic in the country occurred on March 15, 2020, and immediately after that, schools were closed as of March 16. Schools were completely closed due to Covid-19 seen in our country between the dates of March 16, 2020 - March 22, 2020. Between the dates of 23 March 2020 – 15 May 2020, EBA TV broadcasts and distance education were carried out together. Distance education continued on 16 May 2020 and 18 June 2020. 19 June 2020 - 30 August 2020 was the summer vacation period. Distance education continued between the dates of 31 August 2020 - 11 October 2020. 12 October 2020 - 12 November 2020 hybrid training was conducted, in other words, while secondary schools teach science and other basic courses through face-to-face education, some of their courses are completed through distance education. Distance education was conducted between 13 November 2020 and 23 February 2021. Hybrid training was carried out on March 1, 2021 - May 17, 2021. Provinces were divided into risk groups and face-to-face education and distance education were carried out together according to the risk situation. Distance education was carried out between 18 May 2021 and 17 June 2021. 18 June 2021 - 5 September 2021 was the summer vacation period. Face-to-face training dates were September 6, 2021 - November 18, 2021. The videos were placed in these intervals according to their publication dates, and a comparison was made about the date ranges where more videos were published.

The second analysis criterion is the place of duty of the teacher who shoots the video. Videos that were understood not to have been created by a teacher at the beginning of the research were not included in the research. While examining, the criteria of who shot the video were coded as a teacher working under the *Ministry of National Education*, a teacher working in a private institution, a non-working teacher, a teacher candidate and a teacher whose place of duty was not specified.

The third analysis criterion is the video's grade level. In this study, which was carried out at the secondary school level, class levels are also important. The videos examined were divided into five categories: *fifth grade*, *sixth grade*, *seventh grade*, *eighth grade*, and (for videos where grade level is not specified but secondary school level) *'grade level is not specified'*.

The fourth analysis criterion is the subject area of the video. Since there are subject areas of Earth and Universe, Living Things and Life, Matter and Nature, Physical Events, Engineering Applications and Entrepreneurship Skills in the Science curriculum (2018), the videos were analyzed according to these subject areas. Due to the fact that some videos contain more than one subject area, the mixed category has been opened and the information about which subject areas they contain is written under it.

The fifth analysis criterion is the teaching method used in the video. According to the method used in the videos, it is divided into four categories, including *lecture*, *question solving*, *experiment/activity*, or *mixed category*, which is a category that includes more than one method.

The sixth analysis criterion is the suitability of the video for the selected acquisition. In the research videos, the videos that fully meet the acquisition desired to be given to the students are defined as 'the relevant acquisition is certain'. Videos that meet the relevant acquisition in a part of the video, but make mistakes while giving examples or making analogies have been included in the category of 'meeting some of the acquisition but not meeting some of the acquisition and the acquisition is not certain'. For the videos that could not be understood about the acquisition related to the video, the 'independent category of acquisition was created and these videos were added to this category. Thus, the research videos were divided into three categories according to their relationship with the relevant acquisition: *videos with certain acquisition*, *videos with unknown acquisition*, and *videos independent of the acquisition*.

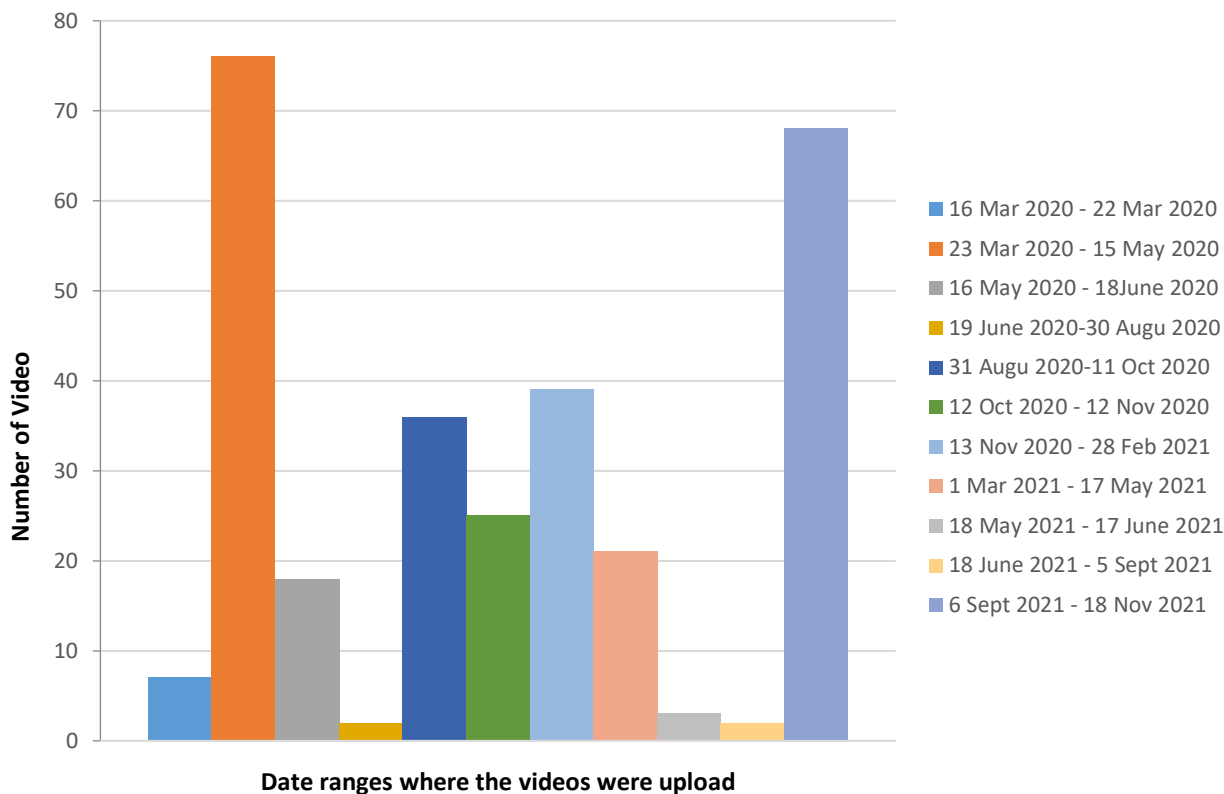
The seventh analysis criterion is to investigate whether the video's content information is compatible with scientific knowledge. In the research videos, the content information of the videos that are fully compatible with the scientific knowledge of the narration, analogy, examples given or the information described in the question solution throughout the video is defined in accordance with scientific knowledge. The videos in which some of the information described in the videos match the scientific information, but there are mistakes made in any part of the lecture, giving examples or solving the questions are defined as the videos whose content information is partially compatible with the scientific information. The videos that may pose such a problem have been collected in the category of partially suitable for scientific knowledge. As a result, when the content information of the videos examined in the research is considered in terms of compliance with scientific knowledge, the videos are divided into two categories as *appropriate* and *partially appropriate*.

### 3.4. Validity and Reliability

To be examined within the scope of the research 297 videos were included in the study. Then, themes, categories and codes were determined by two researchers and a coding form was created. The themes, categories and codes created were also examined by a different science education specialist in order to prevent data loss and margin of error, and the final version of this review was sent to the analysis units. The videos analyzed within the scope of the research were analyzed under 7 themes. For the reliability of the coding, 60 videos, which are 20.2% of the videos that constitute the data analysis unit of the research, were randomly selected and coded by a science education specialist. The coding consistency of the coding made by two researchers was calculated (Miles & Huberman, 1994). The coding consistency between the two researchers was calculated as 87%. According to Miles and Huberman (1994), in order to form a consensus and to be able to say that the study is reliable, the researchers' coding consistency should be above 70%. For coding made differently by researchers; two researchers discussed different encodings, and this value increased to 95% by consensus.

#### 4. Findings and Discussions

In this section, the findings obtained from the analysis of the videos that were first reviewed according to the upload date are presented.



**Fig. 1.** The distribution of the videos examined in the research according to the upload date.

When the column chart given in Figure 1 is examined, there is a significant increase in the videos uploaded to YouTube between 23 March 2020 and 15 May 2020, when EBA TV and distance education are carried out together. It is seen that the highest number of videos were uploaded during this period. In the past pandemics, there was no epidemic with such a large impact on human beings, and therefore educators and education stakeholders were not prepared for such an epidemic because they did not have previous experience (Sarı & Nayır, 2020), which directed teachers to online platforms in distance education (Dursun et al., 2021). It is seen that video sharing is at the lowest rate during the summer vacation periods, which are between 19 June 2020 - 30 August 2020 and 18 June 2021 - 5 September 2021. It is known that education continues as distance education between 31 August 2020 - 11 October 2020 and 13 November 2020 - 28 February 2021. When the video distribution of these time intervals is examined, it is seen that the number of shares is close to each other. When the time period between May 18, 2021 and June 17, 2021 is examined, it is seen that the number of video sharing has decreased, although education is continued with distance education. It is known that education continues as hybrid education between 12 October 2020 - 12 November 2020 and 1 March 2021 - 17 May 2021. When we look at the number of video sharing in these ranges, it is seen that these numbers show close values to each other. It has been determined that the number of video uploads has increased significantly between September 6, 2021 and November 18, 2021. After the closure of schools in countries where the epidemic was seen, educators focused on different alternative solutions and they delivered the course materials to the students through different digital media (Yünkül, 2022). The reasons why educators who are not prepared for this process share a small number of videos in the first week after the closure of schools and the number of videos increase in the following weeks are as follows:



- Educators took some time to prepare for digital platforms.
- Closing the schools which were closed in the first week as a holiday and as of March 23, the education started with the publication of the course registrations by the Ministry of National Education (MoNE).
- It is thought that it is due to the fact that the educators are worried that the school will not be able to continue, and that they look for a solution in a panic (Çoruhlu & Aydođan, 2021).

When the relationship between the start of face-to-face education at all levels on September 6, 2021 and the increase in the number of videos is examined; Kazu, Bahçeci, and Özercan İlhan (2021) concluded in their study that teachers can prefer distance education in case of necessity, but they want to prefer face-to-face education unless it is necessary. It is thought that the number of videos is high because teachers want to continue with face-to-face education and are more motivated with the use of this education method.

The findings obtained as a result of the analysis of the workplaces of the teachers who uploaded the videos examined in the research are presented in Table 2.

**Table 2.**

The distribution of the teachers who uploaded the videos used in the research, the number of views and likes

Who shot the video?	Frequency (%)	Total Number of Views (People)	Total Number of Likes (People)
Teacher working at Ministry of Education	57(19.2)	84726	2368
Teacher Working in Private Institution	84(28.3)	1103116	24016
Candidate Teacher	1(0.3)	401	48
Teacher with an Unspecified Workplace	155(52.2)	13911492	374655

As it can be seen in Table 2, it is seen that most of the videos analyzed in this study, with a ratio of 52.2%, are in the category of "no place of duty". Then, there are videos of teachers working in private institutions with a ratio of 28.3% and videos of teachers working under the MoNE with a ratio of 19.2%. It was determined that one of the examined videos was shot by the candidate teacher. When the number of views and likes is compared according to where the teachers who shot the video work, it is thought that the number of watching and the high number of likes of the teachers whose place of duty is not specified is due to the high number of videos. It has been determined that the number of videos and the number of views and likes are proportional, so the teachers whose place of duty is not specified reach a large number of students and receive their appreciation. When the teachers working in private institutions were compared with the teachers working in the MoNE, it was determined that those working in private institutions were able to reach more students by shooting a large number of videos, and they were appreciated by meeting the expectations of more students.

The findings obtained as a result of the analysis of the number of views and likes of the class levels of the videos examined in the research are presented in Table 3.

**Table 3.**

The distribution of the number of views and likes of the class levels of the videos used in the research

Class Level	Frequency (%)	Total Number of Views (People)	Total Number of Likes (People)
5	70 (23.6)	2558925	57159
6	69 (23.2)	3911863	106392
7	51 (17.2)	3430016	97431
8	102 (34.3)	5187557	149280
Not specified	5 (1.7)	11374	199

When Table 3 is examined, it is seen that 34.3% of the videos are 8<sup>th</sup> grade with 102 videos. It is seen that the most videos were shot at the 8<sup>th</sup> grade level. It is thought that the reason for the high number of videos shot for 8<sup>th</sup> grade students is that students who pass from primary to secondary education in Turkey are preparing for the LGS (High-School Entrance Exam). It is seen that 70 of them are at 5<sup>th</sup> grade level with 23.6%, 69 of them are at 6<sup>th</sup> Grade level with 23.2% and they are almost equal to each other. 51 videos at the 7<sup>th</sup> grade level constitute 17.2% of the research videos. There were 5 videos whose grade level was not specified and this is the least part of the research videos with a rate of 1.7%. Depending on the number of videos analyzed by grade level, videos shot at 8<sup>th</sup> grade reached more students and by meeting the expectations of more students, they received more likes. Although the number of videos shot for the 5<sup>th</sup> grade level is higher than the number of videos shot for the 6<sup>th</sup> and 7<sup>th</sup> grade levels, they reached fewer students and received less appreciation. The number of videos at the 6<sup>th</sup> and 7<sup>th</sup> grade level is less, but these videos have reached more students and it is seen that these videos meet the expectations of the students.

The distribution of the subject area and the number of views and likes of the videos examined in the research are presented in Table 4.

**Table 4.**

The distribution of the number of views and likes on the subject areas of the videos used in the research.

Subject Area	Frequency (%)	Total Number of Views (People)	Total Number of Likes (People)
Earth and Universe	67(22.6)	5616714	159747
Living Things and Life	80(27.0)	3906969	287136
Physical Events	60(20.2)	308079	7246
Matter and Nature	10(3.4)	55089	1464
Science Engineering and Entrepreneurship Applications	1(0.3)	1597	27
Earth and Universe + Living Things and Life	48(16.2)	3847403	89110
Living Things and Life + Physical Events	1(0.3)	19	3
Living Things and Life + Physical Events + Matter and Nature	9(3.0)	1961	64
Earth and Universe + Living Things and Life + Physical Events	2(0.7)	16659	534
Earth and Universe + Living things and Life + Matter and its nature + Physical Events	17(5.7)	1336656	33351
Matter and its Nature + Science and Engineering and Entrepreneurship Practices	1(0.3)	351	22
Physical Phenomena + Science and Engineering and Entrepreneurship Practices	1(0.3)	8238	130

When Table 4 is examined, the subject area of Living Things and Life, which constitutes 27.0% of the videos with 80 videos, has been the subject area with the most videos. Similarly, Balaydın and Altnok (2018) stated that studies using POE strategy in science education were mostly conducted in the field of biology in their analysis and ethics studies. It can be said that the reason for this situation is that there are many subjects and acquisition related to this subject area in the science curriculum (MoNE, 2018). After that, the subject area was the Earth and the Universe, which made up 22.6% of the research with 67 videos. 60 videos were shot in the subject area of Physical Events and it is seen that 20.2% of the videos shot are in this area. There are 10 videos in the subject area of Matter and Its Nature, and 3.0% of the research videos are in this area. There is one video in the subject area of Science Engineering and Entrepreneurship Applications, and this video constitutes 0.3% of the videos. According to the table, it is seen that the videos that are mixed in the subject area are "Earth and Universe + Creatures and Life", which constitutes 16% of the research with 48 videos. According to the table, it is seen that "Matter and Nature + Science Engineering and Entrepreneurship Applications", which has the least video, constitutes 0.3% of the research with 1 video. According to the table, it is seen that "Physical Events + Science Engineering and Entrepreneurship Practices" constitute 0.3% with 1 video. When the videos are examined according to the subject area, it has been determined that the number of views and likes of each subject area is high in terms of the number of views and likes and it has been observed that there is no difference as a single subject area and a mixed subject area and it was determined that only the category with low number of videos had low number of views and likes.

The distribution of the teaching method used in the videos examined in the research according to the number of views and likes is presented in Table 5.

**Table 5.**

The distribution of the method used in the videos used in the research according to the number of views and likes.

Teaching Method	Frequency (%)	Total Number of Views (People)	Total Number of Likes (People)
Lecture	96(32.3)	4709147	139887
Problem Solving	111(37.4)	2253443	61955
Experiment / Activity	6 (2.0)	12504	268
Lecture + Question Solving	84(28.3)	8124641	214977

When Table 5 is examined, according to the purpose of the videos, it is seen that the largest part of them is 37.4% with 111 videos, and in this part, the question solution method is used. Afterwards, lecture, which makes up 32.3% with 96 videos, appears. And then, with 84 videos, it is seen that there are videos that contain both lecture and question solving with a rate of 28.3%. Six videos, which make up the smallest part of this table, make up 2.0%, and these are videos that includes experiments/activity. When the distribution of the method used in the research videos according to the number of views and likes is examined, it is seen that the number of videos containing the question-solving method as the number of videos is high. It has been determined that the videos that combine lecture and question solving are watched by more people and these videos are liked by meeting the expectations of the students. It has been determined that the number of videos of the experiment/activity method is very low, and therefore few students have accessed the videos that contain this method.

The videos examined in the research are presented in Table 6 according to their relationship with the relevant acquisition.

**Table 6.**

The distribution of the number of views and likes of the videos used in the research according to their relationship with the acquisition.

Acquisition to Achievement	Frequency (%)	Total Number of Views (People)	Total Number of Likes (People)
With Certain Acquisition	285(95.9)	15076693	416632
With Uncertain Acquisition	2(0.6)	20236	375
Independent of Acquisition	10(3.5)	2806	80

When Table 6 is examined, it is seen that 285 videos (95.9%) are suitable for the acquisition in terms of its relationship with the learning outcome. It is seen that two videos (0.6%) are coded with an uncertain acquisition and it is seen that 10 videos (3.5%) are coded independently of the acquisition. When the videos with unknown acquisition are compared with the videos that are independent of acquisitions, it is seen that the number of videos with unknown acquisition is less, while the number of views and likes is higher.

The reasons for the videos to be included in the category of undetermined gain are as follows;

Drama was made in the video number V202. In the drama where the students represent the Sun, Earth and Moon “F.5.1.4.1.The Sun prepares a model that represents the movements of the Earth and Moon relative to each other.” acquisition has been attempted. While the movements of the Earth and the Sun are shown correctly, it is seen that the Moon never goes around the Earth. For this reason, it has been included in the category of unknown acquisition. In the video V249, “F.5.4.1.1. It makes inferences based on the data obtained from the experiments conducted to show that the substances can change state with the effect of heat.” A question regarding the acquisition has been resolved. However, it was determined that the problem solved was at a higher level than the level of the 5th grade students.

The compatibility of the content information of the videos examined in the research with scientific knowledge and the number of views and likes are given in Table 7.

**Table 7.**

The distribution of the number of views and likes of the content of the videos used in the research in accordance with scientific knowledge.

Relevance of Content	Frequency (%)	Total Number of Views (People)	Total Number of Likes (People)
Appropriate	288(96.7)	15055734	416104
Partially Appropriate	9(3.3)	44001	983

When Table 7 is examined, it is seen that the content information of the videos, which cover 96.7% of the study with 288 videos, is in accordance with scientific knowledge. It is seen that 3.3% of the study with 9 videos is partially compatible with scientific knowledge. When the content of the video is examined in terms of the number of views and likes in terms of compliance with scientific knowledge, it has been determined that the number of students who access and like the videos is also high because the number of videos in the appropriate category is high. It has been determined that the number of views and likes is high, although there are 9 videos in the category of partially suitable for scientific knowledge of the content of the video.

It is seen that there are errors, incomplete information and carelessness in 3.3% of the videos. The reasons for the partially appropriate videos to be included in this category can be listed as follows;

In the video number V5, the question solved between the 25<sup>th</sup> and 27<sup>th</sup> minutes is explained on the figure, and the crescent is seen once and the bulging moon is seen three times in a month. In the video numbered V16, "climatology" was written where "meteorology" should be written while solving the fill-in-the-blank questions in the 9<sup>th</sup> minute. Drama was made in the video number V31. In the 10<sup>th</sup> minute, the planets were invited to the stage. One of the planets that appeared on the stage lay on the ground and covered his face with his hands, and it is not clear which planets they are. In the video number V37, images of the phases of the Moon were given in the 10<sup>th</sup> minute and the names of these phases were asked to be written. The teacher misspelled the places of the first four and the last four. In the question that was solved in the 19<sup>th</sup> minute, images of spiders, worms and snails were given. The teacher answered the question correctly, but did not give information about whether the worm and snail were reptiles or not. In the 9<sup>th</sup> minute of video number V42, the teacher said the following while explaining the properties of the Moon: "We can call the Moon a little planet." At the 12<sup>th</sup> minute, the teacher continued to refer to the Moon as "little planet". The question solved by the teacher in the 4<sup>th</sup> minute in the video number V126, "Which or which of the events given in daily life do not occur as a result of the activities of fungi?" while the teacher read the end of the question as "occurs". Instead of choosing the negative ones, the teacher chose the positive ones and marked the wrong option. In the video numbered V187, in the 2<sup>nd</sup> minute, the teacher, while describing the Torricelli experiment, made the following sentence without saying whether the glass pipe was filled with mercury or not: "Torricelli is at the seaside, closing the 1-meter glass pipe with his hand and dipping it into the mercury." Drama was made in the video number V202. Students represent the Sun, Moon, Earth. In the video, where the movements of the Earth, Sun and Moon are tried to be explained, the Moon has never been around the Earth. In the 18<sup>th</sup> minute of the video number V219, the teacher made a mistake in the matching question. The teacher paired the expression "planet with prominent rings" with Mars and the expression "planet resembling a tilted barrel" with Saturn. Such erroneous statements and answers may cause misunderstandings in students. At the same time, they can lead to the formation of cognitive structures that are difficult to change for students (Chrzanowski et al., 2018; Vosniadou, 2020). While examining the research videos, there were no videos whose content information did not comply with scientific knowledge.

## 5. Conclusion and Suggestions

This study includes a detailed examination of the videos shared in the field of science on the YouTube platform during the Covid-19 period. Examining the videos that were shared as instructional in this period, which turned to online platforms, also reached the conclusions of how online platforms should be organized. In the results obtained from this study, it was determined that more videos were uploaded during the periods when education was continued with distance education in schools, and these videos were mostly shot by teachers working in private schools, although they were at the 8<sup>th</sup> grade level. It was concluded that the teachers shared the videos the most between March 16, 2020 and March 22, 2020. In this period, after the declaration of the pandemic, it was concluded that the teachers started to look for different solutions and turned to the YouTube platform, which is one of the digital applications. It has been concluded that teachers who upload videos to the YouTube platform do not feel the need to share where they work. It was concluded that the majority of the teachers who shared these videos were working in private institutions. It is thought that this situation is realized because the expectations of the institution they work, their parents and students from the teachers working in the private institution are higher. It is thought that as a grade level, the sharing of a large number of videos for 8<sup>th</sup> grade students may have resulted from the preparation of the students for the LGS (High School Entrance Exam). It was concluded that more videos could have been taken at the 8<sup>th</sup> grade level, especially for the students who could not attend the face-to-face education, to prepare for the exam. The number of videos shot for the 7<sup>th</sup> grade level is half the number of videos shot for the 8<sup>th</sup> grade. As a result, it was concluded that it is possible for teachers to shoot more videos at the 8<sup>th</sup> grade level by focusing on the exam. In our review in terms of subject area, it was concluded that very few

videos were shot on the subject area of Matter and Its Nature. However, when we associate it with the number of acquisitions, it is concluded that this subject area has fewer acquisitions. However, it was concluded that few videos were shot for this subject area, which is very important for science. For the sciences, the importance of experiment and activity is quite big. The fact that the number of videos containing experiments is quite low shows that teachers prefer to shoot videos in which they use question solving and plain explanation instead of doing experiments and activities. Instead, the teachers shot videos for solving questions and aimed to prepare the students for the exam in these videos.

In the light of the results obtained from this study, the following suggestions were made;

The YouTube platform, where everyone can easily share content, provides an advantage in terms of ease of use. In addition to this, it is thought that the videos belonging to the people who want to share videos on YouTube should first be reviewed by the experts of the field where the videos are shared. It would be appropriate to check the content of educational videos, especially before they are uploaded to the YouTube platform, so that students do not encounter a problem that is difficult to solve. As it is known, the internet is one of the sources of the misconceptions encountered in students, but wrong content may cause misunderstandings in students. According to the results obtained from this study, more digital content can be produced for classes and topics that have less video. While more videos are encountered especially in the 8<sup>th</sup> grade level and “Living Things and Life” subject areas, it is recommended to increase the number of videos uploaded in other grade levels and subject areas. In other studies, science or for other lessons videos uploaded to different online education sites can be analyzed to have information about their content. It is thought that it will contribute to the literature if it is done at different school levels, such as this study, in which only secondary school videos are researched.

## 6. Limitations of the Study

In this study, the science lesson videos uploaded to the YouTube platform were analyzed. Although there are many digital platforms other than YouTube, this study has been limited to the videos uploaded to the most preferred YouTube platform. The study was limited to studies at the secondary school level only. Since a large number of video content is uploaded to the YouTube platform, only videos shot by teachers are included in the study in terms of scientific value. The videos shot by the students were excluded from the study. It has also been seen with numerous video content shot by students. The study was initiated from March 16, 2020, the date of the start of the pandemic, and was terminated on November 18, 2021, when the data collection process was terminated.

## References

- Acar Sesen, B., & Ince, E. (2010). Internet as a source of misconception: “Radiation and radioactivity”. *Turkish Online Journal of Educational Technology-TOJET*, 9(4), 94-100.
- Akgündüz, D., & Akinođlu, O. (2016). The effect of blended learning and social media-supported learning on the students' attitude and self-directed learning skills in science education. *Turkish Online Journal of Educational Technology-TOJET*, 15(2), 106-115.
- Alqahtani, E. (2020). *The digital family in a traditional society: Attitudes of Saudi young people and parents towards the use of social media in family communication*. Doctoral dissertation, Cardiff University.
- Arklan, Ü., & Kartal, N. Z. (2018). Y kuşađının ierik tüketicisi olarak Youtube kullanımı: Kullanım amaçları, kullanım düzeyleri ve takip edilen ierikler üzerine bir araştırma [Youtube usage by Y generation as a content consumer: Study on usage purposes, usage levels and followed contents]. *Gümüőhane Üniversitesi İletişim Fakültesi Elektronik Dergisi*, 6(2), 929-965.

- Aslan, S., & Güner, T. (2022). Fen bilimleri öğretmenlerinin çevrimiçi öğrenme (senkron) ortamları ile ilgili deneyimlerinin incelenmesi [An investigation of science teachers' experiences with online learning (sync) environments]. *Uluslararası Türkçe Edebiyat Kültür Eğitim Dergisi*, 11(1), 398-421.
- Ayaz, E. (2021). İlkokul fen bilimleri dersinin pandemi dönemi uzaktan eğitimine ilişkin öğretmen ve ebeveyn görüşlerinin incelenmesi [Examination of teacher and parent opinions regarding distance education during the pandemic period of primary school science course]. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi [Journal of Uludag University Faculty of Education]*, 34(1), 298-342.
- Aydıncı, M., & Zorluođlu, S. L. (2022). Lise öğrencilerinin covid-19, yüz yüze eğitim ve uzaktan eğitim algıları [High school students' perceptions for covid-19, face-to-face education and distance education]. *Neşehir Hacı Bektaş Veli Üniversitesi SBE Dergisi*, 12(2), 1253-1267.
- Bakırcı, H., Dođdu, N., & Artun, H. (2021). Covid-19 pandemi dönemindeki uzaktan eğitim sürecinde fen bilgisi öğretmenlerinin mesleki kazanımlarının ve sorunlarının incelenmesi [Investigation of professional achievements and problems of science teachers in the distance education process of covid-19 pandemic period]. *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 7(2), 640-658.
- Bakiođlu, B., & Çevik, M. (2020). Covid-19 pandemisi sürecinde fen bilimleri öğretmenlerinin uzaktan eğitime ilişkin görüşleri [Science teachers' views on distance education in the covid-19 pandemic process]. *Turkish Studies*, 15(4), 109-129.
- Balaydın, H. T., & Altınok, O. (2018). Türkiye'de fen eğitiminde TGA stratejisi: Bir meta sentez [POE strategy in science education in Turkey: A meta-synthesis]. *Recep Tayyip Erdoğan Üniversitesi Sosyal Bilimler Dergisi*, 4(8), 427-444.
- Benzer, S., & Akkaya, M. M. (2021). Pandemi sürecinde fen bilimleri alanında uzaktan eğitim [Distance education in the field of science in the pandemia process]. *SBedergi*, 5(8), 19-46.
- Bostan Sariođlan, A., Şen, R., & Altaş, 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(2), 193-214.
- Bostan Sariođlan, A., Altaş, R., & Şen, R. (2020). Uzaktan eğitim sürecinde fen bilimleri dersinde deney yapmaya ilişkin öğretmen görüşlerinin araştırılması [Investigation of teachers' views about experimenting in science course during distance education]. *Milli Eğitim Dergisi*, 49(1), 371-394.
- Boyraz, D. S., Hacıođlu, Y., & Aygün, M. (2016). Argümantasyon ve kavram karmaşası: Erime ve çözünme [Argumentation and concepts confusion: Melting and dissolving]. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, 36(2), 233-267.
- Bozkurt, A. (2020). Koronavirüs (Covid-19) Pandemi süreci ve pandemi sonrası dünyada eğitime yönelik değerlendirmeler: Yeni normal ve yeni eğitim paradigması. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, 6(3), 112-142.
- Can, E. (2020). Koronavirüs (Covid-19) pandemisi ve pedagojik yansımaları: Türkiye'de açık ve uzaktan eğitim uygulamaları [Coronavirus (Covid-19) pandemic and pedagogical reflections: The applied on open and distance education applications in Turkey]. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, 6(2), 11-53.
- Chen, M. (2010). *Education nation: Six leading edges of innovation in our schools*. San Francisco: Jossey-Bass.

- Chrzanowski, M. M., Grajkowski, W., Zuchowski, S., Spalik, K., & Ostrowska, E. B. (2018). Vernacular misconceptions in teaching science-types and causes. *Journal of Turkish Science Education*, 15(4), 29-54.
- Çađlar, C. (2010). *Karma eđitim sisteminin ođrenci grşleri ile deđerlendirilmesi (Sakarya niversitesi rneđi)* [The evaluation of blended learning system with students' opinions (Sakarya University sample)]. Yayınlanmamış Yksek Lisans Tezi, Sakarya niversitesi Sosyal Bilimler Enstits. (Master's thesis, Sakarya University).
- Çalık, M., Ayas, A., & Ebenezer, J. V. (2009). Analogical reasoning for understanding solution rates: Students' conceptual change and chemical explanations. *Research in Science and Technological Education*, 27(3), 283-308.
- Çalık, M., & Szbilir, M. (2014). Parameters of Content Analysis. *Education and Science*, 39(174), 33-38.
- Çoruhlu, T. Ő., & Aydođan, U. (2021). Sınıf ođretmenlerinin uzaktan eđitim srecinde karřılařtıkları problemlerin tespit edilmesi [Determining the problems faced by the primary school teachers in distance education]. *Amasya niversitesi Eđitim Fakltesi Dergisi*, 10(2), 61-79.
- Demir, E. (2014). Uzaktan eđitime genel bir bakış [Overview of distance education]. *Dumlupınar niversitesi Sosyal Bilimler Dergisi*, 39, 203-212.
- Demir, F., & zdař, F. (2020). Covid-19 srecindeki uzaktan eđitime iliřkin ođretmen grşlerinin incelenmesi [Examining teachers' opinions related to distance education in the covid-19 process]. *Milli Eđitim Dergisi*, 49(1), 273-292.
- Dikmen, S., & Bahçeci, F. (2020). Covid-19 pandemisi srecinde yksekđretim kurumlarının uzaktan eđitime ynelik stratejileri: Fırat niversitesi rneđi [Strategies of higher education institutions for distance education in the covid-19 pandemic process: Example of Fırat University]. *Turkish Journal of Educational Studies*, 7(2), 78-98.
- Dolu, G. (2021). Determination of science teaching students learning of several concepts of radioactivity subject taught with emergency remote education and students' opinions on emergency remote education. *Journal of Educational Technology & Online Learning*, 4(4), 702-725.
- Donnelly, R., & Patrinos, H. A. (2021). Learning loss during COVID-19: An early systematic review. *Prospects*, 1-9. <https://doi.org/10.1007/s11125-021-09582-6>
- Durak, G., & Cankaya, S. (2018). The current state of the art in learning spaces: A systematic review study. *International Journal of Emerging Technologies in Learning (iJET)*, 13(11), 208–224. <https://doi.org/10.3991/ijet.v13i11.9247>
- Dursun, G., Çavuş Gngren, S., & Akst, P. (2021) *Sosyal medya aralarının fen eđitiminde kullanımına iliřkin ođrenci grşleri: Covid-19 pandemisi*. 14. Ulusal Fen Bilimleri ve Matematik Eđitimi Kongresi, Burdur, Trkiye.
- Haji, S. A. (2022). Students' use of online learning platforms to support blended Learning at Cameroonian University. *Journal of Educational Technology & Online Learning*, 5(2), 422-431.
- Ivowi, U. (1984). Misconceptions in physics amongst Nigerian secondary school students. *Physics Education*, 19, 279-285.
- İlhan, E., & Grgl Aydođdu, A. (2019). Youtube kullanıcılarının kullanım motivasyonlarının incelenmesi [A research into the Youtube users' motivations for use]. *Gmřhane niversitesi İletişim Fakltesi Elektronik Dergisi*, 7(2), 1130-1153.
- Kahraman, M. E. (2020). COVID-19 salgınının uygulamalı derslere etkisi ve bu derslerin uzaktan eđitimle yrtlmesi: Temel tasarım dersi rneđi [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.
- Kaffenberger, M. (2021). Modelling the long-run learning impact of the Covid-19 learning shock: Actions to (more than) mitigate loss. *International Journal of Educational Development*, 81, 102326.
- Kazu, H., Bahçeci, F., & Özercan İlhan, M. G. (2021). Sınıf öğretmenlerinin uzaktan eğitim ve yüz yüze eğitim uygulamalarını değerlendirmeleri [Assessment of distance learning and face to face education applications by primary school teachers]. *Journal of History School*, 53, 2601-2627.
- Kerkez, F. İ., & Soy, S. (2022). Beden eğitimi öğretmenlerinin covid-19 salgını döneminde acil uzaktan eğitim deneyimleri ve ders kazanımlarını sağlamaya yönelik bireysel çözümleri [Experiences of physical education teachers in the emergency distance education and individual solutions to provide lesson gains during the covid-19 pandemic period]. *Journal of Global Sport and Education Research*, 5(1), 1-17.
- Koç Akran, S. (2021). Öğretmen adaylarının "hibrit eğitim" kavramına ilişkin algılarının belirlenmesi: Bir metafor analizi çalışması [Determining teacher candidates' perceptions on the concept of "hybrid education": A metaphor analysis study]. *International Journal of Humanities and Education*, 7(16), 432-462.
- Korucu, A. T., & Kabak, K. (2020). Türkiye'de hibrit öğrenme uygulamaları ve etkileri: Bir meta analiz çalışması [Hybrid learning practices and effects in turkey: A meta-analysis study]. *Journal of Information and Communication Technologies*, 2(2), 88-112.
- Lamanauskas, V., & Makarskaite-Petkeviciene, R. (2021). Distance lectures in university studies: Advantages, disadvantages, improvement. *Contemporary Educational Technology*, 13(3), ep309, <https://doi.org/10.30935/cedtech/10887>.
- Madan, A., Bindal, S., & Gupta, A. K. (2021). Social distancing as risk reduction strategy during COVID-19 pandemic: A study of Delhi-NCT, India. *International Journal of Disaster Risk Reduction*, 63, 102468.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis an expanded sourcebook* (2<sup>nd</sup> Ed.). California: Sage Publications.
- Ministry of National Education. [MoNE]. (2018). Fen bilimleri dersi öğretim programı (İlkokul ve ortaokul 3, 4, 5, 6, 7 ve 8. sınıflar) [Science course teaching program (Primary and middle school grades 3, 4, 5, 6, 7 and 8)]. Ankara.
- Moore, M. G., & Kearsley, G. (2011). *Distance education: A systems view of online learning* (3.Ed.). Belmont, CA: Wadsworth.
- Pattier, D. (2021). Science on Youtube: Successful edutubers. TECHNO REVIEW. *International Technology, Science and Society Review*, 10(1), 1-15. <https://doi.org/10.37467/gkarevtechno.v10.2696>.
- Sağlam, Ö. (2022). *Covid-19 pandemisi izalasyon dönemine ilişkin öğretmen, öğrenci ve veli görüşleri* [Teachers, students and parent opinions regarding the COVID-19 pandemic isolation period]. Yayınlanmamış Yüksek Lisans Tezi, Bartın Üniversitesi, Lisansüstü Eğitim Enstitüsü. (Master's thesis, Bartın University).
- Sarı, T., & Nayır, F. (2020). Pandemi dönemi eğitim: Sorunlar ve fırsatlar [Education in the pandemic period: Challenges and opportunities]. *Turkish Studies*, 15(4), 959-975. <https://dx.doi.org/10.7827/TurkishStudies.44335>.

- Sercemeli, M., & Kurnaz, E. (2020). Covid-19 pandemi d6neminde 6đrencilerin uzaktan eđitim ve uzaktan muhasebe eđitimine y6nelik bakıř ađıları 6zerine bir arařtırma [A research on students' perspectives to distance education and ditance accounting education in the covid-19 pandemia period]. *International Journal of Social Sciences Academic Researches*, 4(1), 40-53.
- Sirer, E. (2020). Eđitimin ekran 6zerinden teknolojik d6n6ř6m6nde pandemi d6nemi'nin etkisi [Transformation of education on screen]. *Uluslararası Toplum Arařtırmaları Dergisi*, 16(29), 1987-2018. <https://doi.org/10.26466/opus.777215>.
- Srinivasacharlu, A. (2020). Using YouTube in colleges of education. *Shanlax International Journal of Education*, 8(2), 21-24.
- Timmons, K., Cooper, A., Bozek, E., & Braund, H. (2021). The impacts of COVID-19 on early childhood education: Capturing the unique challenges associated with remote teaching and learning in K-2. *Early Childhood Education Journal*, 49(5), 887-901.
- Topalsan, A. K., & Bayram, H. (2019). Identifying prospective primary school teachers' ontologically categorized misconceptions on the topic of "force and motion". *Journal of Turkish Science Education*, 16(1), 85-109.
- Usta, E., & Mahirođlu, A. (2007). Harmanlanmış 6đrenme ve 6evrimi7i 6đrenme ortamlarının akademik bařarı ve doyumuna etkisi [The effects of blended learning and online learning on academic achievement and learner satisfaction]. *Ahi Evran 6niversitesi Kırřehir Eđitim Fak6ltesi Dergisi*, 9(2), 1-15.
- Vosniadou, S. (2020). *Students' misconceptions in science education*. Li-fang Zhang (Ed.) Oxford Encyclopedia of Educational Research. New York: Oxford University Press. <https://doi.org/10.1093/acrefore/9780190264093.013.965>.
- Yaman, B. (2021). Covid-19 pandemisi s6recinde T6rkiye ve 7in'de uzaktan eđitim s6re7 ve uygulamalarının incelenmesi [Examining the distance education processes and practices in Turkey and China during covid-19 pandemic]. *OPUS International Journal of Society Researches*, 17(Pandemi 6zel Sayısı), 3298-3308. <https://doi.org/10.26466/opus.857131>
- Y6nk6l, E. (2022). Always with me even from a distance: Teachers' technology usage skills before and after distance education. *Journal of Educational Technology & Online Learning*, 5(3), 636-654.
- Wartono, Batlolona J. R., & Putirulan, A. (2018). Cognitive conflict strategy and simulation practicum to overcome student misconception on light topics. *Journal of Education and Learning (EduLearn)*, 12(4), 747-757.
- Whitlock, J. A. (2017). *A virtual learning system's impact on student achievement in a secondary biology college preparatory course; an action research study*. Doctoral dissertation, University of South Carolina, College of Education.
- World Bank, (2020). The COVID-19 pandemic: Shocks to education and policy responses. May 2022 Available: <https://openknowledge.worldbank.org/bitstream/handle/10986/33696/148198.pdf>.
- Zhdanov, S. P., Baranova, K. M., Udina, N., Terpugov, A. E., Lobanova, E. V., & Zakharova, O. V. (2022). Analysis of learning losses of students during the COVID-19 pandemic. *Contemporary Educational Technology*, 14(3), ep369.