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Review Paper

Examining the Pandemic Process from the Educational Perspective: What Are Scientific Studies Telling Us?

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ABSTRACT

Due to Covid-19 pandemic, one of the biggest crises occurred in the field of education. The number of students whose educational activities were interrupted because of the pandemic is an indicator of the effects of the pandemic on education. However, when the studies in the literature are examined, they mostly focus on the field of health. Studies in the field of education are relatively limited and the studies or data are unstructured. As a matter of fact, it is important to structure the data in the world created by data; to understand how the process works, to discover opportunities and the patterns that make up the world, to predict what will happen in new situations. In this context, the purpose of this study is to determine which issues are examined in the field of education in Turkey and around the world in the Covid-19 pandemic. In accordance with this purpose, analyzes were made using text mining techniques on text-based data. As a result of the research, in the international literature, more in-depth and theoretical research is included in the context of education, while in the national literature, situation determination and superficial distance education studies have been carried out.

INTRODUCTION

Covid-19 has been announced as a pandemic that affects the whole world as from March 2020 (Bender, 2020; Toquero, 2020; World Health Organization [WHO], 2020a, 2020b). The Covid-19 pandemic and related crises have affected many fields. Since March 2020, the impact of the pandemic is getting deeper each passing day (Reimers, 2020). According to the United Nations (2020), the Covid-19 pandemic is more than a health crisis, it is a crisis that affects all areas including economic, humanistic, security and human rights. At the same time, this crisis has found out the gaps within and between nations. This will require rethinking and designing all the past traditions, habits, and structures of societies. Bozkurt et al. (2020) stated that the pandemic process creates an uncertain period of time. Again, Bozkurt et al. (2020) highlighted the need for fast reflexes to survive in this period and the importance of understanding and considering this uncertainty better.

Responses to the pandemic are expected to be primarily in the field of health. Indeed, the Covid-19 pandemic is above all a public health issue (WHO, 2020a; Wong & Kohler, 2020). To prevent or treat Covid-19 infections; discovering a vaccine or drugs and taking approaches to the wide offering of such drugs will depend on their actions. However, until vaccination or drug therapy is highly successful, lessening the effect of the pandemic, slowing the spread of infection through measures such as social distancing will depend on the actions of individuals, public health agencies and government officials (Reimers & Schleicher, 2020). These interventions differ from country to country. Depending on the cultural structures, the adoption of individual and governmental measures such as social distance rules, social isolation attitudes, collective activity attitudes, closing borders, closing schools, methods of isolating other individuals may change by the entire or most of the population. As a matter of fact, the possibility of success in combating the pandemic increases the situation of adopting these measures on an individual and government basis. For example, Reimers and Schleicher (2020) has linked the success in slowing the pace of the outbreak, as shown in China, Japan, Korea and Singapore, to the timely and effective leadership of political leaders and the reactions of understanding and disciplined citizens. In this context, it is believed that educational institutions have a critical role in the adoption of measures in the struggle against pandemic by all or most of the population. Raising the awareness of students and their parents through schools will provide an opportunity for the community to act collectively on measures. The mission of education to raise awareness of the society on pandemic measures during the pandemic period cannot be realized due to pandemic conditions.

The pandemic has had a profound effect on education due to reasons (Yildiz Durak et al., 2022) such as the closure of schools, the inability of many students to access online courses, inequality of opportunity in education, and the emergence of digital divides with disadvantaged groups (Sezgin & Fırat, 2020). Emergency remote teaching and new teaching ideas are emerging to alleviate the severity of these effects and in response to the new situation (Atman Uslu & Yildiz Durak, 2022; Vezne, Yildiz Durak, & Atman Uslu, 2022). Countries and schools of all levels are testing all possible ways of delivering the most appropriate education in pandemic conditions within their local capabilities. In doing so, countries have faced unprecedented challenges (Daniel, 2020;

Vezne, Yildiz Durak, & Atman Uslu, 2022). As a matter of fact, with the closure of schools, the education of nearly 90% of the total student population in the world has been interrupted. Even after March 2020, 191 countries chose to close their educational institutions (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020). According to UNESCO (2020) data, as of 15 December 2020, the total number of learning affected by this situation in Turkey is approximately 25 million.

Considering the number of students whose educational activities were interrupted due to the epidemic, it is better understood how large the effects of the pandemic on education. In spite of this, when the studies in the literature are examined, it is seen that most of them are focused on the field of health, and the studies in the field of education are limited. On the other hand, studies and data on Covid-19 in the field of education are unstructured. As a matter of fact, it is important to structure the data in the world created by data; to understand how the process works, to discover opportunities and the patterns that make up the world, to predict what will happen in new situations (Bardak & Sözen, 2018). At this point, data mining science and text mining, which is a component of it, is needed to understand the current situation regarding Covid-19 in the field of education. Data mining is to extract useful information from large quantities of data that are in a continuous flow at the intersection of various disciplines and graphically reveal them (Azzalini & Scarpa, 2012). Text mining, on the other hand, can be used for classification of texts, clustering, seeing the topic from texts, production of granular taxonomy for document, sentimental analysis in texts, document summarization and entity relationship modeling with respect to the essence of the text. In this context, text mining can offer us the opportunity to identify new normal world conditions that need to be created to create a sustainable learning ecology, together with the inferences to be made from the crisis period in the field of education, caused by the Covid-19 epidemic.

During the global crisis, it is important to create a theoretical framework that can be used to guide the efforts to improve educational activities and to evaluate the existing data in this context. Hence, it is inevitable that these crisis processes will have reflections on the general education paradigm in the long run. Academic studies are a powerful tool that can be used to detect these reflections. In this sense, to provide a broader perspective on Covid-19 from an educational perspective, this study provides a text mining-based literature analysis on educational research. The purpose of this study is to examine the existing text-based data sets obtained from scientific studies on Covid-19 to present pandemic trends in education. Studying these trends is valuable not only to improve our ability to deal with crises during the current pandemic, but also to improve our readiness to deal with future pandemics and to build the new world order.

Purpose of the study

The purpose of this study is to determine which issues are examined in the field of education in Turkey and around the world in the Covid-19 pandemic. In accordance with this purpose, analyzes were made using text mining techniques on text-based data. Within this context of the purpose of the study, its objectives are as follows:

- To analyze the statistical distribution of articles published in the Covid-19 period with a broad-spectrum literature review.
- To reveal, classify and compare the themes and trends of the articles published in the period of Covid-19 in Turkey and worldwide.

THEORETICAL AND CONCEPTUAL FRAMEWORK

The Emergence and Progress of Covid-19 Pandemic: The Situation in Turkey and in the World

The Covid-19, which was claimed to have emerged in Wuhan, China's Hubei province for the first time in December 2019, was first defined as an epidemic by the Chinese local government, then as an international epidemic and a pandemic by WHO (Cucinotta & Vanelli, 2020). Covid-19 was named by WHO as a new type of coronavirus (2019-nCoV) on January 12, 2020, and this new virus SARS-CoV-2 on February 11, 2020.

The Covid-19 pandemic spread to many countries in a short time, especially to Asian countries, after China. In Turkey, the first case was detected on 11.03.2020. On 12.03.2020, it was decided to temporarily close schools and to restrict collective events, travel and transportation. As of 04.02.2021, WHO (2021) stated that the cumulative total number of cases worldwide was 103,631,793 and the number of deaths was 2,251,613 (See Figure 1). Considering the numerical values in Turkey, the cumulative total number of cases was 1,522,138, the number who died was 22,981 (See Figure 2).

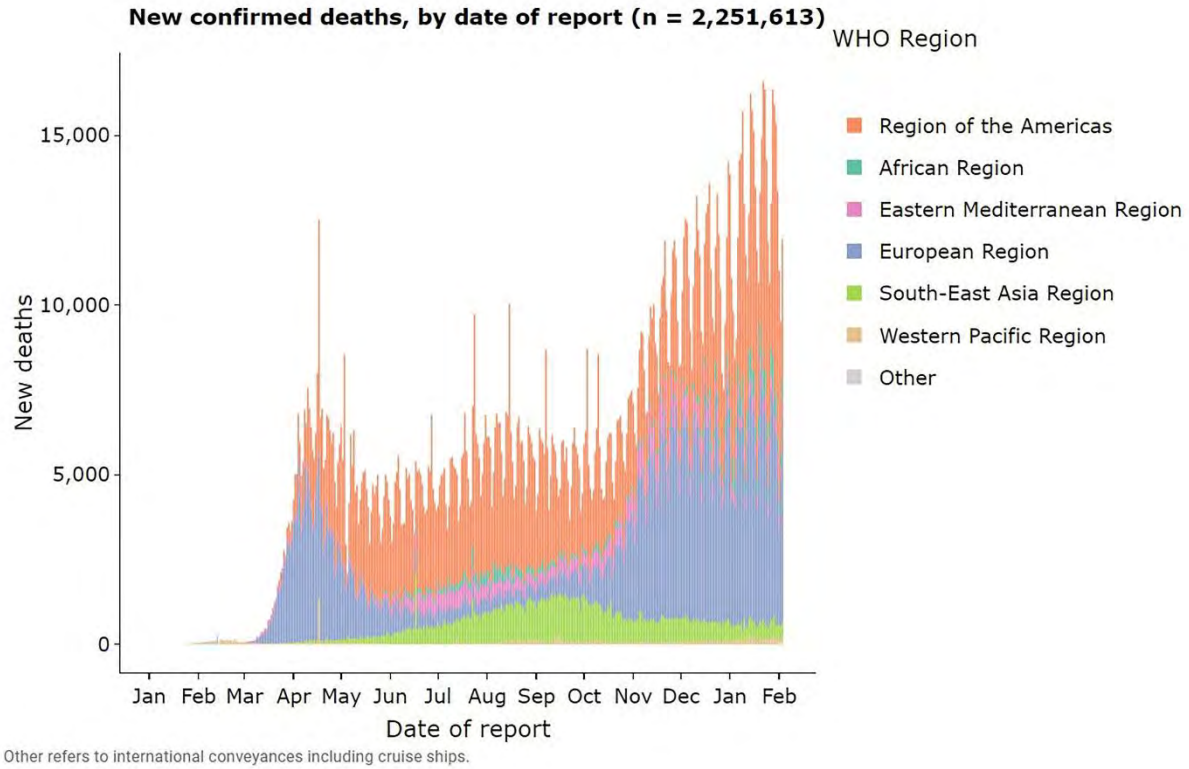

Figure 1. The Situation of Covid-19 in the World (13.01.2020)
Source: WHO (2021) https://worldhealthorg.shinyapps.io/covid/

According to Figure 2, Covid-19 measures against the pandemic in Turkey have been associated with the field of health education firstly, and then social and cultural activities. The decisions, measures and the implementation of these decisions are in parallel with other countries in the world. The process of the pandemic has moved downwards from time to time since March 2020 with the measures. However, the pandemic data could not be completely reset. At this point, it is a question that should be discussed whether the decisions taken by governments have a social response, and this question has been discussed in the theoretical context in other parts of the article.

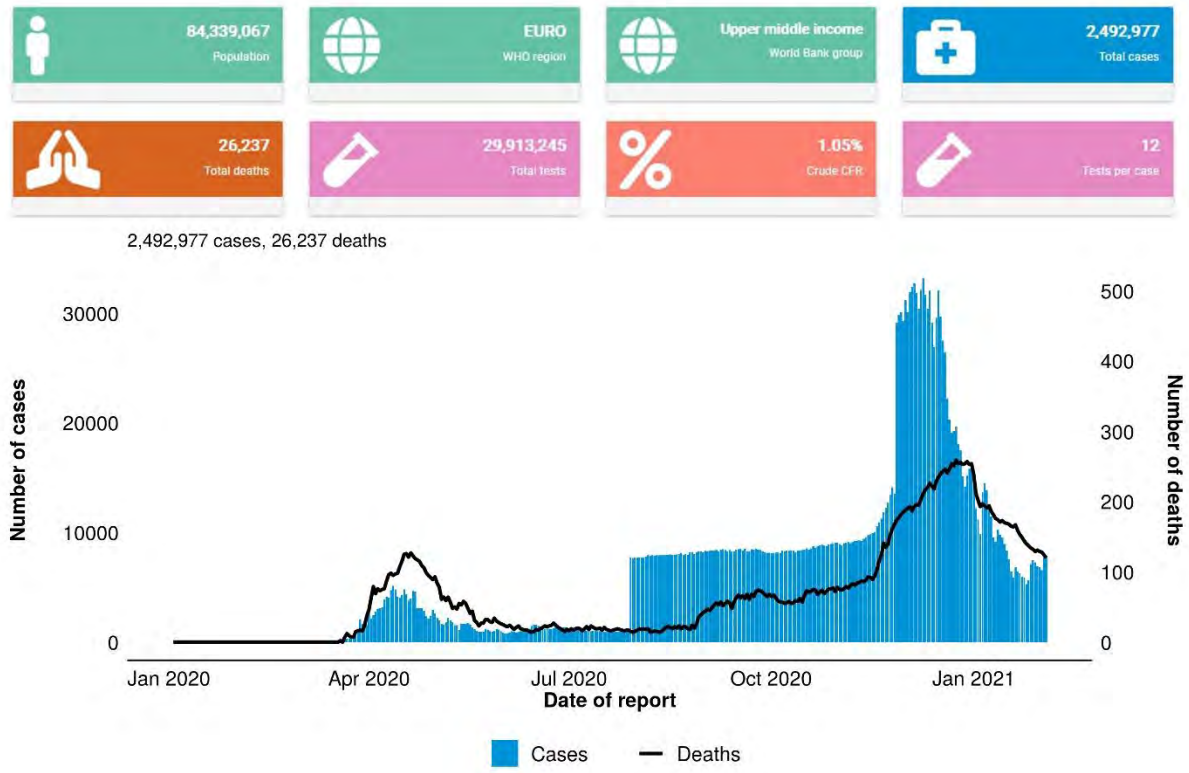

Figure 2. The Situation of Covid-19 in Turkey (13.01.2020)
Source: WHO (2021) https://worldhealthorg.shinyapps.io/covid

Responses to Covid-19 in the World and Turkey

The United Nations Development Program [UNDP] (2020a) has stated that its efforts to respond to the Covid-19 crisis should be focused on preparation, response and recovery to the Covid-19 pandemic. These goals are in the framework of preparing for the pandemic and its effects, slowing the spread of the virus, alleviating the destructive effects it may have on vulnerable groups and economies, protecting individuals from the effects of the pandemic, responding throughout the pandemic, and supporting countries to recover from the economic and social effects of the pandemic for the near future.

The Covid-19 outbreak adversely affects the global economy, which is a dynamic system with its unpredictable progress (Birinci & Bulut, 2020). Economic impacts are the case for Turkey and the countries of the world. Economic effects have caused problems in many areas such as education, gender inequalities, production, sheltering, immigrant sheltering, food supply, revenue and occupation losses, tourism, global trade, and the existing problems have deepened (UNDP, 2020b).

The pandemic has prompted governments and citizens to rethink how life should be like in a new normal. These multifaceted crises have required countries and citizens to come up with different policies and solutions to respond to the pandemic. On the other hand, effective responses to the effects of Covid-19 are subject to full and effective global cooperation (Özcan & Tomasi, 2020). However, sufficient data could not be produced and analyzed for the answers given for full and effective cooperation (Özcan & Tomasi, 2020).

Covid-19 Responses on Education in the World and Turkey

Since the beginning of the Covid-19 pandemic, schools have been closed, and measures have been taken to sustain learning in many countries (UNESCO, 2020). New regulations have been made in the implementation of education policies, primarily at the global level (TEDMEM, 2020). In order to prevent the Covid-19 outbreak, 191 countries chose to close their educational institutions after March 2020 (UNESCO, 2020). 187 of these 191 states suspended education throughout the state. Around 1.5 billion students in the world have been affected by the adverse conditions created by Covid-19 in terms of education (Drane, Vernon, & O'Shea, 2020a). 24 million students are also in danger of dropout (Amelan, 2020). While some countries completely closed schools, educational activities in the United States, Canada, Greenland, Russia and Australia were stopped for a period of time only in educational institutions regionally (UNESCO, 2020).

According to the world's Covid-19 responses in education, with the closure of schools, efforts such as using information and communication technologies effectively, urgent distance education and online learning infrastructure support, regulation of legal legislation on measurement and evaluation, support mechanisms (ready-made text message services, social networks, etc.) were established to support families and students.

When the responses are viewed in terms of the educational activities in Turkey, the first response has been faced with the closure of schools as well as education on a global level (not at TED, 2020b). Emergency distance education has been started as of March 2020 in order not to interrupt the education due to the pandemic and to minimize the learning losses. After the decision to close the schools in Turkey to establish a distance learning system for an effective digital education platform, the Ministry of National Education has used the Information Network (EBA) infrastructure (Ozer, 2020). To the cooperation with Turkey Radio and Television Corporation (TRT), EBA TV (elementary, secondary, high school) channels have been established (See https://www.eba.gov.tr/#/anasayfa). In these channels, besides the basic education of children, extracurricular educational entertainment elements and documents for parents are presented. In addition, it was aimed to include students with special needs into the system by developing content for special education. Various studies have been carried out to meet the materials, products and demands needed by vocational and technical education institutions during epidemic days (Özer, 2020b). In order to cope with the negative psychological effects caused by Covid-19, studies have been carried out by MoNE to provide a psychosocial support system consisting of helpline and guides (MoNE, 2020). In terms of health services in Turkey, as well as supplying medical equipment and struggling with pandemic (WHO, 2020b) the Ministry of Health and the Ministry of Education attempted to brief and guide primarily medical personnel, public and sector workers. Public service ads, social media accounts and expert videos were used to inform the public (Ministry of Health, 2020). In addition to these, informative presentations and videos were prepared for teachers and it was aimed to make their presentation in all schools through the Ministry of National Education in the first lesson of the academic year and to increase the widespread effect.

According to UNESCO (2020), the total number of learners affected by the disruption of education by the end of 2020 in Turkey is about 25 million. According to the TEDMEM (2020a) report, the problems that arise against the responses to Covid-19 in the field of education are in the dimensions of governance, distance education process and reopening of schools. In terms of governance, it has caused problems in an effective decision-making and implementation mechanism during the period when schools are closed. In the distance education process, access to the Internet and insufficiencies in technological facilities cause students with special needs, who are in disadvantaged groups, who have some socio economic problems, to be deprived of educational opportunities. There have been uncertainties regarding measurement and evaluation. In the process of reopening the schools, problems were experienced in terms of logistics, maintaining social distance and applying the measures related to the implementation of hygiene rules.

Evaluation of the Responses to Covid-19 in the Theoretical Context

In this study, some theoretical contexts have been examined in order to explain the answers that stand out from the pandemic period

education perspective and to harmonize individual and collective interests. In addition to medical studies and policy measures taken by governments, it was deemed important to explain the social structure, culture and behavior of individuals within these structures in order to reduce/prevent the effects of the pandemic. First of all, Kohlberg's Moral Development Theory, one of the basic theories of educational psychology, was discussed to explain individual and collective social behaviors during the pandemic period. According to this theory, moral development is divided into three levels, and three levels into different stages. At the preconventional level, according to the phase of obedience and punishment, what is right is obedience to authority, not individual behavior or thoughts. This is necessary in order not to be punished. Individuals at this stage, for example, wear masks and comply with hygiene rules only to avoid punishment. Since the rules are not obeyed in the absence of authority, it seems unlikely that societies consisting of individuals who display such behavior will individually and collectively cope with the pandemic. The other phase is the shopping phase based on mutual interest. Here, it is now moral if the results benefit the individual rather than authority. if it provides benefits to individuals. While it seems more possible to fight the pandemic at the individual level in societies in this moral phase, it may not be possible to struggle collectively. At the traditional level, the behaviors that occur must be accepted by the society in order to be accepted as correct. At this stage, the individual maintains and adheres to the rules rather than individual expectations. Individuals who perform behaviors in order to maintain the social system and maintain the continuity of social rules tend to follow a rule and perform the behavior, even if they find it wrong individually. In societies formed by individuals at this stage, pandemic struggle can be carried out collectively. According to the post-traditional level, which is the last level, laws are deemed appropriate in the general society and are necessary to protect the values of the individuals living in that society. It is thought that societies formed by individuals in this moral phase can be successful in dealing with the pandemic at the individual and collective level. According to Kohlberg's theory, social conditions can accelerate, slow down or stop the development of an individual's cognitive moral development ability (Çiftçi, 2003). Therefore, moral behaviors can be understood as culturally dependent (Kohlberg, 1981).

Bandura's (1977) social learning theory is a social behavior theory that proposes new behaviors can be gained by observing and imitating others. Therefore, from the perspective of educational theory, it is seen that the determinants of human behavior are behavioral factors (competence, practice, self-efficacy), environmental factors (social norms, interaction with society), cognitive factors (knowledge, expectations, and attitudes) (Bandura, 1986). This theory can be used to explain individual and collective community behaviors against Covid-19. Within the framework of this theory, individuals need to gain cognitive and behavioral competencies in order to comply with Covid-19 measures. Even if they have these competencies, environmental factors that affect their behavior must be taken into consideration. Therefore, an individual's behavior is affected by the social context.

When education learning theories such as behaviorism, cognitivism and constructivism are examined, they focus on how people learn and display behaviors related to these learning. Although these theories state that the environment and social context determine learning, the dominant factor is the individual. Based on these theories, it can be inferred that individual change can be achieved first, and then collective harmony, in the context of responses to Covid-19.

In educational theories, it is stated that the answers about the pandemic should be interpreted in a cultural context and the individual cannot be evaluated independently from the social structure, but these theories basically focus on the basic determinant of the individual's behavior. As a matter of fact, learning starts in the mind of the individual and social structure, culture, governments, rules, social role-models are factors that are effective in the display or sustainability of behaviors. When evaluated in the context of Covid-19 responses, adaptation of the individual is critical for social harmony.

Text mining

As efforts to develop medical response for Covid-19 continue, data mining for social and behavioral sciences can provide valuable information to manage the pandemic and its effects. As a matter of fact, data mining is the process that allows revealing meaningful and useful patterns of information that is hidden in large data sets that cannot be understood at first glance (Han, Kanber, & Pei, 2012). Data sets can make it possible to evaluate stored data, obtain useful patterns and templates that can have hidden, critical, strategic and political value, and this can be considered as an indication of the importance of the data mining concept. The data mining process consists of multiple stages. The first step is data selection. The second phase is the preprocessing phase and this phase is important for the success of data mining. The third stage is the reduction stage. Next is the data mining stage and the final stage is interpretation and validation.

Text mining is a component of data mining (Feldman & Dagan, 1995). Text mining is a field of application associated with data mining, statistics, artificial intelligence and machine learning, databases, library and information sciences and computational linguistics (Miner et al. 2012). While structured data is used in data mining, unstructured data is used in text mining. Text mining has a very important place today (Aydoğdu, 2020), as approximately 90% of the data in the world is unstructured (Balamurugan & Pushpa, 2015).

Text mining is generally carried out in five steps. These steps start with data selection, data cleaning, data transformation, data mining, and end with evaluation and interpretation of results. The main applications of text mining are automatic classification/clustering, information extraction/summarization, and linkage analysis/mapping (Hung, 2012).

METHOD

From the beginning of the pandemic, scientists in the academic world have moved rapidly to produce research to directly examine

policy and individual and collective behavior in response to the pandemic, and to inform stakeholders. As a result, it has been seen that there are many articles on the subject in national and international scientific journals. To review these articles, the methodology of this study includes systematic literature review as well as text mining procedures. The methodology designed in this context is visualized in Figure 3.

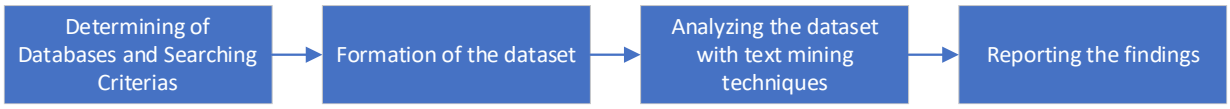

Figure 3. The Process of Research

Determining of Databases and Searching Criteria

The first choice of databases to allow works in Turkey and the world and to reflect on the comparison for the creation of data sets for text mining has been carried out. For the examination of trends in the research databases in the world and Turkey are given in Table 1.

Table 1. Databases and access links used in the research process

Database	Access link
TR Index Search Engine	https://trdizin.gov.tr/
Web of Science	http://webofknowledge.com

As seen in Table 1, TR Index search engine and Web of Science were used to determine the studies to be used in the text mining process during the research process. TR Index and Web of Science was chosen as the source database where qualified studies appear to represent national and international studies. Web of Science is a database that enables detailed bibliometric analysis. Results according to the criteria determined using this database can be downloaded directly as a list. On the other hand, all of the studies in TR Index were transferred one by one to an excel file by the researchers and a data file was created. The data in both search engines were accessed on January 13, 2021.

Table 2. The number of studies obtained from search engines

Search Engine	The number of studies	The number of studies matching the criteria
TR Index Search Engine	108	95
Web of Science	353	353

"COVID 19", "education" and "pandemic" were chosen as keywords to conduct research for the purpose of study in selected databases. The number of studies is given in Table 2. Using the keywords in the TR Index search engine, 108 studies were reached. Since 13 of these studies are letters to the editor or editorial articles, they were not included in the text mining process. As a result, the number of studies analyzed using TR Index search engine is 95.

By using the Web of Science search engine *TS = (COVID AND education * AND pandemic) AND (WC = Psychology, Social OR WC = Education & Educational Research OR WC = Education, Special OR WC = Social Issues)*, English articles are analyzed. There are 353 articles in the data set as a result of the search.

Formation of the data set

The title and abstract parts have been included in the data pile in order to provide clearer conclusions for the analysis of the articles findings. All data was first cleared to remove unnecessary information such as page and issue numbers, publishers and author contact information. Cleaned data were collected in separate files into the field later to compare Turkey and the world.
The language of the texts in the data set is important in the implementation of the process steps in text mining. For example, eliminating according to the stop words or stemming differs depending on the language. Therefore, English abstracts are used to extract part of the research conducted in Turkey and in the world to ensure consistency in data and avoid creating data sets for analysis of the origin of language differences.

Analysis of data with text mining techniques

In this section, techniques and methods of calculation used in analyzing data sets in line with the purpose of the research are given. The library and applications used in the analysis of data sets are also explained.

Word clouds

Word clouds are used to visualize frequently used terms in a document (Lohmann, Heimerl, Bopp, Burch, & Ertl, 2015). Word clouds are created by considering the frequency value of the terms in a data set of frequently used concepts. While creating the word

clouds, the font size is determined in proportion to the calculated frequency values. Thus, the most frequently used terms in the document can be visualized with larger fonts than less used terms. In this study, a web-based tool Word Art (https://wordart.com/) application was used to create data sets and word clouds. Word Art is one of the best applications that can be used to create word clouds (Kolesnikov, Lomachenko, Kokodey, Khitushchenko, & Mihailov, 2019), and there are different studies that create word clouds using this application (Chen, Chen, Qu, Chen, & Ding, 2018; Diakite, Dubourg, & Raoult, 2021).

Term weighting with TF-IDF algorithm

In addition to the frequency of the terms in a document, it is important to determine how many different documents the terms are in, in terms of determining the weight of the terms. At this point, the term frequency & inverse document frequency (TF-IDF) algorithm developed by Salton & Buckley (1988) is widely used for weighting terms in text mining. TF-IDF algorithm is expressed as in equation 1.

TFIDF(t, d, n) = tf(t, d) x idf(t, n) *Equation 1*

In Equation 1, t is the term whose weight will be calculated, d is the active document to be weighed, and n is the number of documents in the data set. TF-IDF value of a term is equal to the multiplication in the d. document's term frequency and the idf value of the term. The calculation method of the idf value of the t term is given in Equation 2, with the total number of documents in the data set being n.

$$idf(t,n) = log\frac{n+1}{df(t)+1} + 1 \quad \textit{Equation 2}$$

The idf value of a term is the total number of documents in the data set (n), t. df (t) containing the term is equal to the ratio of the number of documents to the logarithm function. In practice, since calculating the numerator, denominator and ultimately 0 values in this equation brings warnings such as division error to 0, calculations can be made by adding 1 to the numerator, denominator, and result value.

$$X_{norm} = \frac{X}{\sqrt{X_1^{\,2} + X_2^{\,2} + X_3^{\,2} + .. + X_n^{\,2}}} \quad \textit{Equation 3}$$

The L2 normalization method was used to normalize the tf-idf values of each term calculated for each document (Equation 3). In this normalization method, the TF-IDF value of the term is calculated by dividing by the squareroot of the sum of the squares of the TF-IDF values of all terms in the document. Finally, since the TF-IDF value of a term differs for each document, the weight value of the term was determined by considering the maximum value in the documents for each term.

N-gram-based text categorization

Usage frequencies of words in a document can be listed using the bag-of-words model. In order to create this model, terms in documents are individually assigned to numerical index values and the document-term matrix is created. There is term data in the documents and columns in the rows of the matrix. At the intersections of rows and columns, the frequency of occurrence of the term in the document is included. In the bag-of-words model, each word can be determined as a term by default, and in some cases, determining the word groups as terms and creating frequency values according to these terms provides more meaningful results. For example, since the words “distance” and “education” will be used frequently in a study in which the references about distance education are analyzed, these two words can be defined as a single term and analyzes can be made in this context.

In n-gram-based word classification, the value of n indicates how many word groups the terms will consist of. The value of n can be a single value, or a range can be specified to create terms as many as the number of words in this range.

Table 3. Classification of a text according to different n-gram values

Text	n	Terms
Student success distance education	1	“student”, “success”, “distance”, “education”
	2	“student success”, “success distance”, “distance education”
	1, 2	“student”, “success”, “distance”, “education”, “student success”,

	"success distance", "distance education"

In table 3, examples of terms that a text will create according to different values of n are given. As can be understood from the table, the terms consist of one word while the value of n is 1. When the value of n is 2, the words in the text are classified in groups of 2. When a range is specified for the value n, word groups are created for the values in that range. In this study, analyzes were made with the values of 1, 2, 3, 1-2, 1-3, 2-3 as n-gram parameters, and the results were examined and significant results were interpreted.

Topic modeling with Non-Negative Matrix Factorization (NMF)

NMF algorithm is widely used in fields such as astronomy, visual processing, bioinformatics, text mining, missing data assignment. The NMF algorithm (Lee & Seung, 1999) enables the decomposition of an existing V matrix as WxH matrices that do not contain negative values as close to the V matrix as possible.

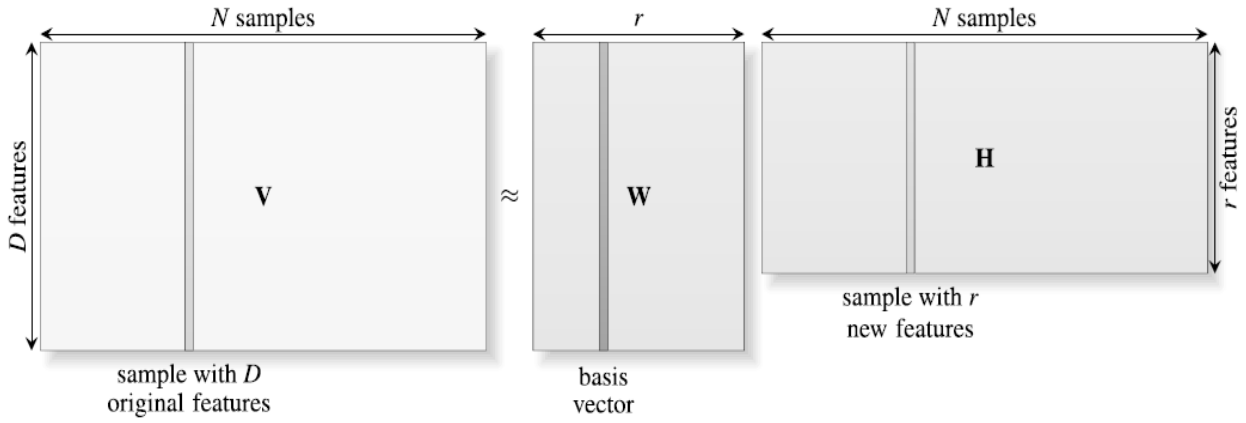

Figure 4. NMF process (Lopes & Ribeiro, 2015)

As seen in Figure 4, the matrix with D features in the NMF algorithm is reduced and the H matrix containing r features is obtained. In this study, the matrix in which theTFIDF values of the terms for each study are input was determined as the V matrix. Depending on this matrix, reductions were made according to 10 titles and the meaningful ones among these topics were reported in the findings section.

Document clustering with K-means

The K-means algorithm (Lloyd, 1957; MacQueen, 1967) aims to divide the data into k sets by using the data set in the input. The algorithm determines k points as the starting process as the working process and performs the clustering process according to the distances to other points from these points (Jin & Han, 2010). In this study, after the clustering of the documents, the top 10 terms according to the TFIDF values of the terms in the documents were reported in the findings section.

Data Analysis

Word Art (https://wordart.com/) application was used to create word clouds in the study. Scikit-learn (Pedregosa et al., 2011) library, Anaconda and Spyder software and python programming language were used for other text mining analysis in data sets. Scikit-learn (Pedregosa et al., 2011) is a library that allows the development of machine learning applications using the python programming language.

FINDINGS

In this study, findings are presented in line with the purpose of the research derived from the data set including the studies around the world and in Turkey.

A comparison of research conducted in Turkey and the world in a word cloud

The word cloud obtained from studies conducted in Turkey and in the world is given in Figure 5 and Figure 6.

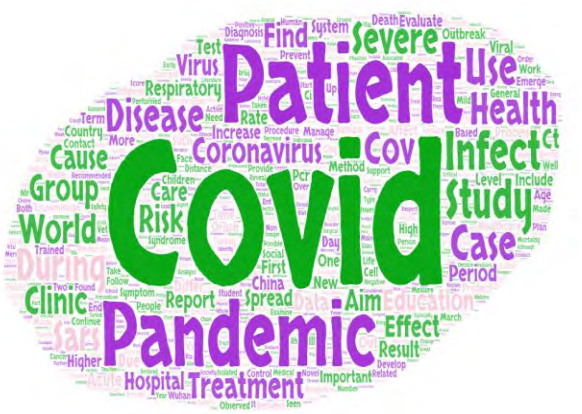

Figure 5. The word cloud created for studies in Turkey

As shown in Figure 5 by the studies in Turkey “Covid”, “patient”, “pandemic”, “treatment”, “infect”, “study”, “disease” keywords come into prominence. These keywords indicate that pandemic is emphasized mainly on studies in Turkey.

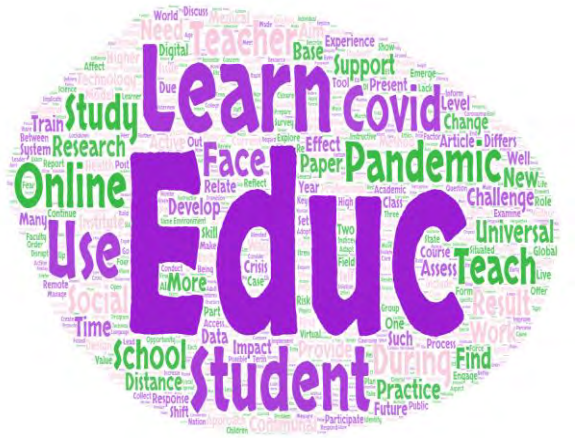

Figure 6. The word cloud created for studies in the world

In worldwide studies, the concepts of “Educ”, “Learn”, “Student”, “Online”, “Use”, “Pandemic”, “Covid”, “Teach”, “Study” and “Face” are seen (Figure 6). In these studies, it is seen that concepts related to education are emphasized.

Comparison of the TF-IDF Values Studies in Turkey and the World

Studies have been analyzed with different n-gram values. As a result of the analysis, it was seen that the terms created with groups of 2, 3 words were more meaningful than other analysis results. Findings obtained from TR Index search engine and Web of Science are given in Figure 7 and Figure 8.

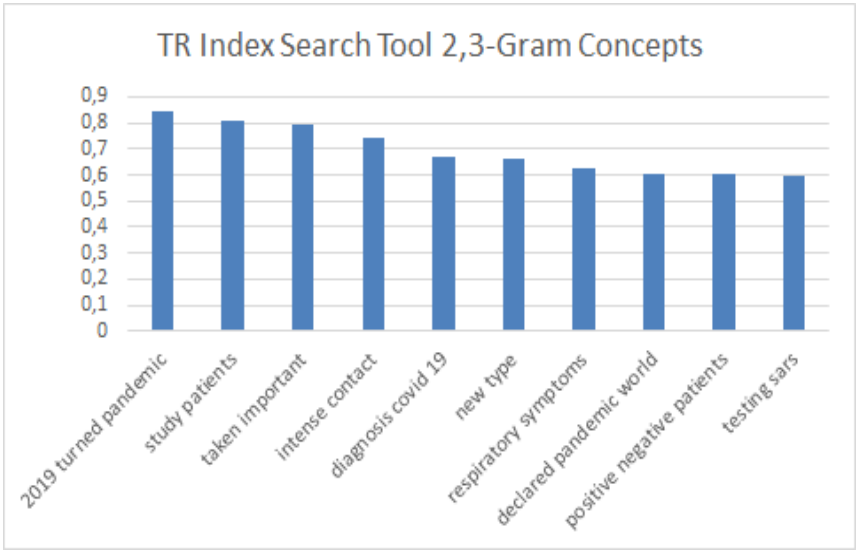

Figure 7. TR Index search engine 2,3-gram term weight values

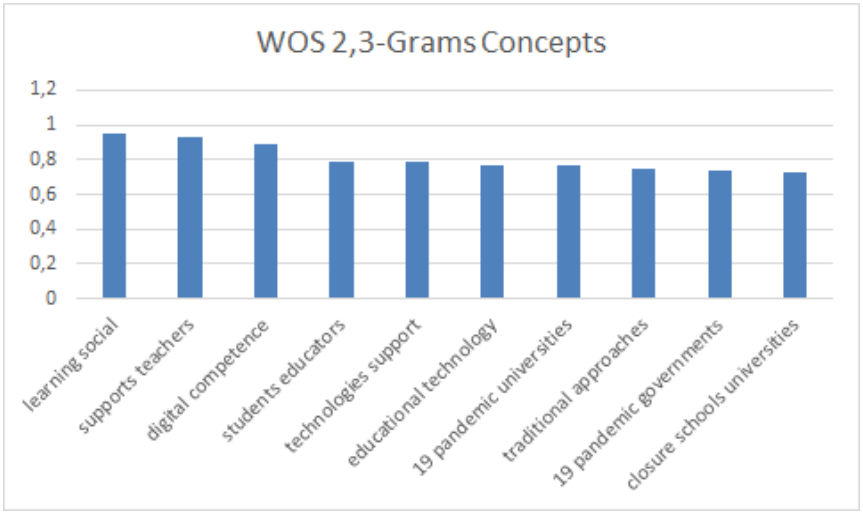

Figure 8. Web of Science 2,3-gram term weight values

When Figure 7 is analyzed, the results obtained from the word cloud from the studies in Turkey pandemic-related terms predominate in parallel with findings. On the other hand, when Figure 8 is examined, it is seen that the terms "learning social", "support teachers", "digital competence", "student educators", "technologies support" and "educational technology" come into prominence in the studies conducted in the Web of Science. This finding shows that the concepts within the framework of educational theories come to the fore in the international literature, and that the concepts of determining the situation are at the forefront in the national literature.

Topics derived from studies in Turkey and the World

Analyzes with different n-gram parameter values were made to infer the topics from the data set used in the study and the findings were examined. As a result of the examinations, it was understood that the results found by classifying at the 2,3-gram level were more meaningful than other word classifications. By analyzing text data sets in Turkey and the world; creating 10 different topics were aimed, but there were repetitions. Therefore, the number of topics data was decided 3 for Turkey, for the world 7. Findings from the determining the topics of the studies in Turkey are shown in Figure 9.

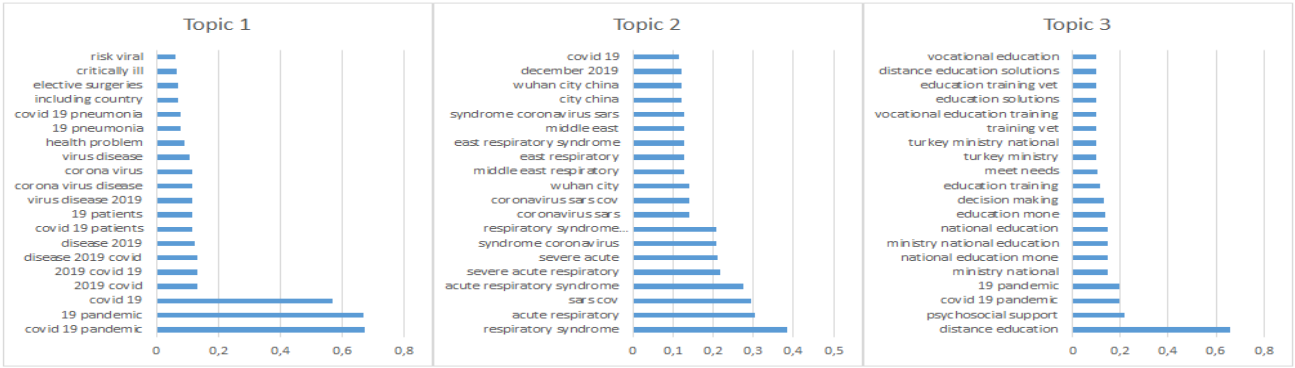

Figure 9. Topics from the studies in Turkey

Keywords found in the classified topics of studies in Turkey considering respectively "Covid", "shake" and "distance education" have been called. Based on this finding, it can be said that studies mainly focus on health problems. Examination of the terms to the forefront of education in Turkey these terms "distance education", "psychosocial support", "ministry of national education" and "vocational education" are focused on the subject. It is thought that researchers focused on research on distance education due to the continuation of educational activities with distance education during the epidemic process.

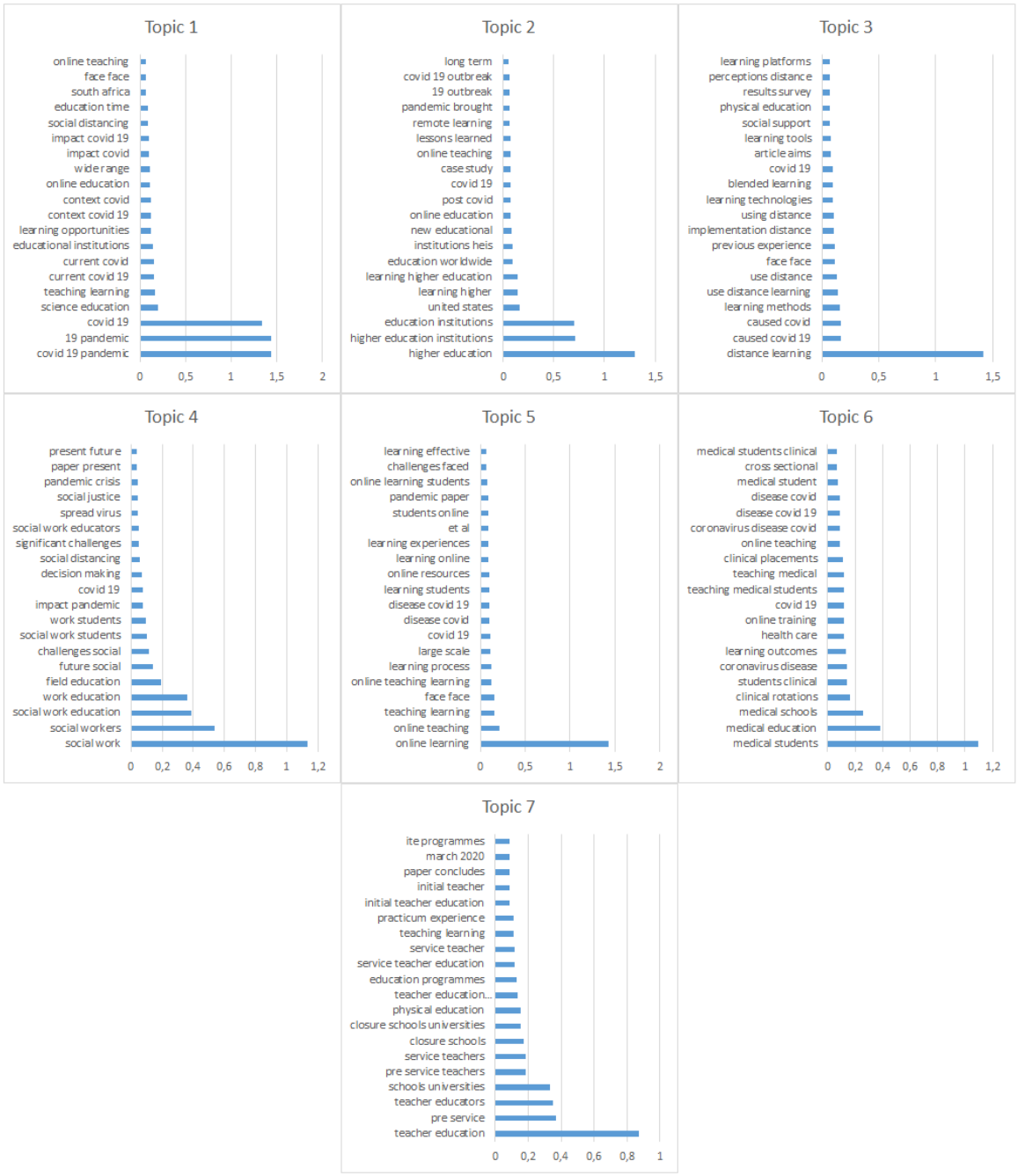

Figure 10. Topics from the studies in the world

The topics created from the studies in the world are collected in 7 groups. These topics are named as “covid”, “higher education”, “distance learning”, “social learning”, “online learning”, “medical education” and "teacher education”, respectively. When the study topics in studies examined “Covid” and “distance education” is seen as the term is common. In addition to this, in the context of education in the international literature, the subjects of “higher education”, “social learning”, “online learning”, “medical education” and “teacher education” come to the fore (See Figure 10). Therefore, parallel to the findings from the word clouds, it can be said that while the international literature includes more in-depth and theoretical research in the context of education, situation determination and superficial distance education studies are carried out in the national literature.

Cluster analysis results of the studies in Turkey and in the world

In order to perform cluster analysis, the texts in the data set were classified at different n-gram levels and the findings obtained from the analysis were examined. As a result of the examination, it was seen that the findings obtained from the classifications made at the 2,3-gram level were more meaningful than the other classifications. Therefore, in this section, 10 important terms in the clusters formed as a result of the cluster analysis created with the 2,3-gram classification are listed. Important in terms of studies in Turkey and the world at the cluster of cluster analysis results are given in Table 4.

Table 4. Important terms in clusters as a result of K-means algorithm

WOS 2,3 Gram	Cluster 1: self efficacy, home schooling, digital technologies, social isolation, positive aspects, problem solving, deeper understanding, based learning, results indicated, social engagement, Cluster 2: covid 19, 19 pandemic, covid 19 pandemic, distance learning, higher education, social work, teaching learning, face face, teacher education, online learning, Cluster 3: higher education, distance education, online learning, education institutions, higher education institutions, online teaching, covid 19, distance learning, online education, physical education, Cluster 4: medical students, covid 19, medical education, coronavirus disease, medical schools, disease covid 19, disease covid, online learning, 19 pandemic, covid 19 pandemic,
TR 2,3-Grams	Cluster 1: higher education, distance education, turkish higher education, turkish higher, online education, 2019 turned, 2019 turned pandemic, turned pandemic, based recent, face face, Cluster 2: covid 19, respiratory syndrome, sars cov, acute respiratory, december 2019, acute respiratory syndrome, intensive care, severe acute, severe acute respiratory, coronavirus disease, Cluster 3: covid 19, covid 19 pandemic, 19 pandemic, distance education, decision making, covid 19 patient, 19 patient, covid 19 outbreak, 19 outbreak, ministry health, Cluster 4: covid 19, 19 infection, covid 19 infection, pandemic period, blood group, ct findings, sars cov, covid 19 patients, 19 patients, diagnosed covid,

In Table 4, when the first cluster created for studies in the world is examined, it is seen that "self efficacy", "home schooling", "digital technologies", "positive aspects", "problem solving", "deeper understanding" and "social engagement" come to the fore. This cluster sheds light on the problem headings encountered in the teaching process during the epidemic process. When the second and third clusters in the international literature are examined, it can be said that the terms in this cluster are similar. Depending on the terms in these clusters, it can be said that teaching from a distance, education of teachers and social interaction are important. In the fourth cluster in the international literature, it is seen that the studies conducted for students working in the field of health sciences and terms related to health education are important.

When the clusters formed from the data set of the studies conducted in the TR Index are examined, it is seen that the first cluster emphasizes the terms higher education and distance education. In other clusters, it is seen that terms related to health and epidemics such as covid, sars, infection are predominant. Based on these findings, it can be said that while the international literature focuses on problems such as social learning, participation and problem solving in the context of education, the national literature focuses on situational research.

DISCUSSION and CONCLUSIONS

This study provides a text-mining-based literature analysis of scientific studies on Covid-19. Existing data sets include the decisions made by societies in terms of education during the pandemic process, strategies to guide education policies, equality, demography and educational attitude during the epidemic, difficulties experienced, solutions and their social reflections. In addition, these data can provide guidance on predicting the course of social processes in an epidemic, designing new political programs, and what types of data are relevant in studies on outbreaks. On the other hand, the nature of data mining methods as a reliable and functional tool to see social responses in the fight against pandemic increases the importance of this study. In this context, the findings of text mining analysis at different levels were discussed.

According to the data converted into text-based word clouds, the studies in Turkey mainly emphasized the pandemic, education in international studies emphasized the concepts of education, student and online. This finding is remarkable when the effects of Covid-19 on education at national and international level and the responses are reviewed. Indeed, the pandemic has prompted governments and citizens to rethink how life should be like in a new normal. Scientific studies are the field in which this situation is examined, discussed and new ideas constructed. Therefore, it can be said that the responses to the pandemic in the field of education are not sufficiently reflected in national studies in the field of education. In studies in the field of education at the international level, together with the pandemic process, education has been interpreted as the first of the answers to the digital transformation of education. However, according to Özcan & Tomasi (2020), effective responses to the effects of Covid-19 are subject to full and effective global cooperation, and sufficient data could not be produced and analyzed for the answers given for full and effective cooperation. From this point of view, it can be said that there is a need for scientific studies that examine the existing data with data mining techniques in order to explore education, difficulties, solutions, and their reflections on social and policies.

According to studies in Turkey and the world formed by 2,3-word groups of different n-gram values, the data in parallel are obtained from research in the word cloud in Turkey of terms for detecting conditions associated with a pandemic has gained weight. In international studies, it is seen that the terms "learning social", "support teachers", "digital competence", "student educators", "technologies support" and "educational technology" are predominant. In the international literature, the educational approach in the pandemic process stands out in the context of scientific theories. The pandemic has prompted governments, educational institutions, educators, scientists and citizens to rethink how education should be like in a new normal. It required the emergence of new scientific educational approaches to respond to the pandemic, and it required governments to come up with different policies and solutions. As a matter of fact, while a pandemic like Covid-19 affects many areas such as health, education, economy, tourism, industry and culture (Yamamoto & Altun, 2020), education stands out as an area related to all areas that touch social life. However,

the application of pedagogical theoretical approaches in response to the Covid-19 pandemic is instrumental in the success of education. From this point of view, it is seen that according to international scientific studies, Bandura (1977) social learning theory is based on the effectiveness of education in the pandemic process and the principles of constructivism education learning theory are used. As an example, socialization of teaching, providing support mechanisms, peer learning has been used in international studies with a theoretical perspective. As a matter of fact, there are approximately 1.5 billion students (Drane, Vernon, & O'Shea, 2020a) who need to take responsibility for their own learning remotely from the learning environment during the pandemic process. So, one of the biggest problems in distance education is that the student provides learning self-control away from the learning environment. Otherwise, the student faces the danger of dropout and Amelan (2020) is experiencing this danger of 4 million students. At this point, the importance of operating the principles of these theoretical approaches in the educational environment is better understood. On the other hand, in order to reduce the effects of Covid-19, besides medical solutions, it is important to use educational theories that take the individual as a dominant value in order to act collectively in the implementation of the measures and raising the awareness of the society. On the other side, the basic function of education acts as a bridge between the state and society (Wiborg, 2000, p. 238) and transfers the state and its policies to its own society through education. In other words, there is an inevitable connection between education and politics, and the education system is a political tool that ensures the continuity of the society (Eren, 2020). Therefore, while a pandemic like Covid-19 affects many areas such as health, education, economy, tourism, industry and culture (Yamamoto & Altun, 2020), education stands out as an area related to all areas that touch social life. Van Bavel et al. (2020) noted that as efforts to develop medical response for Covid-19 continue, social sciences and behavioral sciences can provide valuable information to manage the pandemic and its effects. In this context, Van Bavel et al. (2020) identified areas and made inferences to explain how policy makers, leaders and the public will manage threats, improve the situation in different social and cultural contexts, improve scientific communication, balance individual and collective interests, and use them effectively. However, large-scale studies on the effectiveness of educational decisions and measures in response to the Covid-19 outbreak and how disadvantaged students are affected by the negative consequences of school closure have yet to be conducted. In addition, long-term closure of schools caused the interruption of school-based services such as raising awareness in terms of health/hygiene rules, vaccination, nutrition, psychological support, mental health (TEDMEM, 2020a). According to Worldbank (2020), the Covid-19 outbreak has caused an economic recession triggered by worldwide pandemic control measures. As we strive to cope with this recession, school closure will lead to loss of learning, increased dropouts, higher inequality, deepen the economic recession, and further increase the damage in all areas of society by reducing the demand for education. This will bring long-term costs and damages to human capital and welfare, according to Worldbank (2020). To mitigate this damage, policy responses should be applied towards coping, managing continuity, improving and accelerating. In implementing these policies, education systems should aim to save the past (e.g. assessment, pedagogy, technology, financing and parental involvement, etc.), taking the opportunity to "rebuild in a better way" by eliminating pre-Covid educational inequalities.

In order to infer the topics from the data set, analyzes were made with the values of 1 n-gram parameters and the results by classifying at the 2, 3-gram level were examined. As a result of the investigations considering the keywords contained in the classified topics of research in Turkey respectively "Covid", "shake" and "distance education" has been called. Based on this finding, it can be said that studies conducted mainly focus on health problems. In this way, it can be said that the first response to Covid-19 was in the field of health. The prominent terms concentrate on "distance education", "psychosocial support", "ministry national education" and "vocational education". From the perspective of education, Turkey's first response has been distance education. This result coincides with the world's response to the pandemic from an education perspective. It has been observed that the Ministry of National Education stands out as an institution and policy maker. Psychosocial support is another important answer. As a matter of fact, one of the most important dimensions of the pandemic process concerning social sciences is the psychological dimension. According to Reimers (2020), a comprehensive assessment from the educational perspective of the Covid-19 era should be taken from a cultural, psychological, professional, institutional and political perspective. Daniel (2020) has outlined a framework for providing pragmatic guidance to teachers, institutional managers and government officials who need to manage the educational consequences of the Covid-19 crisis. This framework includes "the preparations that systems can make, determining the needs of students at different levels, reassuring students and parents, determining an approach to distance education, organizing curriculum, evaluation and useful resources, planning what to do after Covid-19". On the other hand, one of Turkey's pandemic responses is vocational education. UNESCO (2020) presented a framework that examines the educational responses of countries in the pandemic process under nine topics. These nine dimensions; "Health and wellbeing, continuity of learning and teaching, gender equity and equality, teaching and learning, higher education, technical and vocational education and training (TVET), education and culture, education policy and planning, vulnerable populations and education for sustainable development". In this context, Turkey's pandemic response from the educational perspective can be evaluated among the dimensions of "health and wellbeing, continuity of learning and teaching, technical and vocational education and training, education policy and planning".

The topics from the studies around the world are named "covid", "higher education", "distance learning", "social learning", "online learning", "medical education" and "teacher education". In addition to this, in the context of education in the international literature, the subjects of "higher education", "social learning", "online learning", "medical education" and "teacher education" come to the fore. It can be said that UNESCO (2020)'s educational responses in the pandemic process of countries are "health and wellbeing, continuity of learning and teaching, teaching and learning, higher education, technical and vocational education and training (TVET), education policy and planning." At this point, it is striking that gender equity and equality, vulnerable populations and education for sustainable development dimensions are not taken into account. As a matter of fact, in the digital divide, which grows more with the Covid-19 process, it is necessary to focus more on inequalities and disadvantages of disadvantaged groups. Future studies should continue studies on this subject in different cultures.

As a result of the cluster analysis, when the clusters created for the studies in the world are examined, "self-efficacy", "home schooling", "digital technologies", "positive aspects", "problem solving", "deeper understanding" and "social engagement" come to the fore. In addition, the prominence of the studies conducted for students working in the field of health sciences and terms related to health education is another remarkable result. From this point of view, it can be said that health education in the field of education is prioritized within education fields due to the pandemic. These results also draw attention to the problems experienced during the pandemic process in the field of education. In fact, a way to equip individuals to contribute more in terms of pandemic action is more effective education. Education in terms of pandemic-related measures goes beyond the protection of the individual and society and covers both the community and the cultural, technical and social aspects. Thus, education for children and young people has been deeply affected by pandemic conditions, and there are many difficulties in distance education strategies. On the other hand, it is very important that educational theories have effects on the response to the pandemic in the field of education. For example, the concepts of self-efficacy and social engagement are the most important concepts for the development of learning and these concepts have come to the fore in the response to the pandemic. When the clusters formed from the data set of national studies are examined, it is seen that they focus on terms related to health and epidemics such as higher education and distance education, covid, sars, infection. It may be suggested to determine road maps regarding what should be done in extraordinary conditions at all levels of education.

In addition, there are some limitations in this study. First of all, this study examines the studies published in a part of the Covid-19 period. In addition, only TR Index and Web of Science databases were used. In future studies, new studies can be carried out by expanding the date range in different databases.

Ethics and Consent: Ethical approval was not sought for the present study because data set has not been used. Ethics committee permission is not applicable because this article does not contain any studies with human or animal subjects.

REFERENCES

Amelan, R. (2020). UN Secretary-General warns of education catastrophe, pointing to UNESCO estimate of 24 million learners at risk of dropping out. Retrieved from https://en.unesco.org/news/secretary-general-warns-education-catastrophe-pointing-unesco-estimate-24-million-learners-0

Atman Uslu, N., & Yildiz Durak, H. (2022). Understanding self-regulation, achievement emotions, and mindset of undergraduates in emergency remote teaching: a latent profile analysis. *Interactive Learning Environments*, 1-20.

Aydoğdu, Ş. (2020). Metin Madenciliği. In T. Güyer, H. Yurdugül, & S. Yıldırım (Eds.), Eğitsel veri madenciliği ve öğrenme analitikleri. Ankara: Anı.

Azzalini, A., & Scarpa, B. (2012). *Data analysis and data mining: An introduction*. OUP USA.

Balamurugan, R., & Pushpa, D. S. (2015). A Review on Various Text Mining Techniques and Algorithms. *2nd International Conference on recent innovations in science, engineering, and management JNU convention center, New Delhi, 22nd November.*

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, *84*(2), 191–215.

Bandura, A. (1986). Social foundations of thought and action. *Englewood Cliffs, NJ*, *1986*(23-28).

Bardak, T., & Sözen, E. (2018, October). Veri madenciliği ve önemi. 6th ASM International Congress of Agriculture and Environment, 2018 Proceeding Book.

Bender, L. (2020). Key Messages and Actions for COVID-19 Prevention and Control in Schools. https://www.unicef.org/romania/documents/key-messages-and-actions-covid-19-prevention-and-control-schools

Birinci, M., & Bulut, T. (2020). Covid-19'un Sosyo-Ekonomik Yönden Dezavantajlı Gruplar Üzerindeki Etkileri: Sosyal Hizmet Bakış Açısından Bir Değerlendirme. *Sosyal Çalışma Dergisi*, *4*(1), 62-68.

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.

Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., ... & Rodes, V. (2020). A global outlook to the interruption of education due to COVID-19 Pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education*, *15*(1), 1-126.

Chen, J., Chen, M., Qu, J., Chen, H., & Ding, J. (2018). *Smart and connected health projects: Characteristics and research challenges.* Paper presented at the International Conference on Smart Health.

Cucinotta, D., & Vanelli, M. (2020). WHO declares COVID-19 a pandemic. *Acta Bio Medica: Atenei Parmensis, 91*(1), 157.

Çiftçi, N. (2003). Kohlberg'in bilişsel ahlak gelişimi teorisi: Ahlak ve demokrasi eğitimi. Değerler Eğitimi Dergisi, *1*(1), 43-77.

Daniel, S. J. (2020). Education and the COVID-19 pandemic. *Prospects*, 1-6.

Diakite, A., Dubourg, G., & Raoult, D. (2021). Updating the repertoire of cultured bacteria from the human being. *Microbial Pathogenesis*, *150*, 104698.

Drane, C. F., Vernon, L., & O'Shea, S. (2020b). Vulnerable learners in the age of COVID-19: A scoping review. *The Australian Educational Researcher*, 1-20.

Drane, C., Vernon, L., & O'Shea, S. (2020a). The impact of 'learning at home'on the educational outcomes of vulnerable children in Australia during the COVID-19 pandemic. *Literature Review Prepared by the National Centre for Student Equity in Higher Education. Curtin University, Australia*.

Eren, E. (2020). Yeni Tip Koronavirüs'ün Türk eğitim politikaları uygulamalarına etkisi: Milli E¤itim Bakanlığının ve Yükseköğretim Kurulunun yeni düzenlemeleri. *Yükseköğretim Dergisi, 10*(2), 153–162. doi:10.2399/yod.20.716645.

Feldman, R., & Dagan, I. 1995. KDT - knowledge discovery in texts. In Proceedings of the First International Conference on Knowledge Discovery (KDD-95). Menlo Park, CA: AAAI Press.

Han, J., Kanber, M., & Pei, J. (2012). Data Mining. Concepts and Techniques. 3rd edition. Amsterdam: Elsevier

Hung, J. L. (2012). Trends of e-learning research from 2000 to 2008: Use of text mining and bibliometrics. *British journal of educational technology*, *43*(1), 5-16.

Jin, X., & Han, J. (2010). K-Means Clustering. In C. Sammut & G. I. Webb (Eds.), *Encyclopedia of Machine Learning* (pp. 563-564). Boston, MA: Springer US.

Kohlberg, L. (1981). The philosophy of moral development moral stages and the idea of justice. Harper & Row, Cambridge.

Kolesnikov, A. M., Lomachenko, T. I., Kokodey, T. A., Khitushchenko, V. V., & Mihailov, Y. I. (2019). *A strategy of visualization and interactive support for university level educational digitalization.* Paper presented at the 2019 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (EIConRus).

Lee, D. D., & Seung, H. S. (1999). Learning the parts of objects by non-negative matrix factorization. *Nature*, *401*(6755), 788-791.

Lloyd, S. P. (1957). Least squares quantization in PCM. Technical Report RR-5497, Bell Lab, September 1957.

Lohmann, S., Heimerl, F., Bopp, F., Burch, M., & Ertl, T. (2015). *Concentri cloud: Word cloud visualization for multiple text documents.* Paper presented at the 2015 19th International Conference on Information Visualisation.

Lopes, N., & Ribeiro, B. (2015). Non-Negative Matrix Factorization (NMF). In N. Lopes & B. Ribeiro (Eds.), *Machine Learning for Adaptive Many-Core Machines - A Practical Approach* (pp. 127-154). Cham: Springer International Publishing.

MacQueen, J. B. (1967). Some methods for classification and analysis of multivariate observations. In L. M. Le Cam & J. Neyman (Eds.), Proceedings of the fifth Berkeley symposium on mathematical statistics and probability (Vol. 1, pp. 281–297). California: University of California Press.

Milli Eğitim Bakanlığı (2020). İzleme ve Değerlendirme Raporu 2020 "Küresel Salgın Döneminde Uzaktan Eğitim". http://covid19.meb.gov.tr/assets/files/02-rapor-yayin-bilgilendirme/04-raporlar/01.pdf

Miner, G., Delen, D., Elder, J., Fast, A., Hill, T., & Nisbet, R. A. (2012). *Practical text mining and statistical analysis for non-structured text data applications.* Academic Press.

Özcan & Tomasi, (2020). COVID-19'un Ekonomi ve İstihdam Üzerinde Yarattığı Etkilere Verilecek Yanıt Küresel Çapta Tam ve Etkin İş Birliğinden Geçiyor. http://www.iktisatvetoplum.com/wp-content/uploads/2020/06/ILOveUNDP.pdf

Özer, M. (2020a). Educational policy actions by the Ministry of National Education in the times of COVID-19 pandemic in Turkey. Kastamonu Education Journal, 28(3), 1124–1129.

Özer, M. (2020b). Vocational education and training as "a friend in need" during Coronavirus pandemic in Turkey. Bartın University Journal of Faculty of Education, 9(2), 1–7.

Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., ... & Duchesnay, E. (2011). Scikit-learn: Machine learning in Python. *the Journal of machine Learning research*, *12*, 2825-2830.

Reimers, F. M. (2020). *Educating students to improve the world* (p. 131). Springer Nature.

Reimers, F. M., & Schleicher, A. (2020). A framework to guide an education response to the COVID-19 Pandemic of 2020. *OECD. Retrieved April*, *14*(2020), 2020-04.

Sağlık Bakanlığı, (2020). T. C. Sağlık Bakanlığı Covid-19 Bilgilendirme Sayfası. https://covid19.saglik.gov.tr

Salton, G., & Buckley, C. (1988). Term-weighting approaches in automatic text retrieval. *Information processing & management*, *24*(5), 513-523.

Sezgin, S., & Fırat, M. (2020). Covid-19 pandemisinde uzaktan eğitime geçiş ve dijital uçurum tehlikesi. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, *6*(4), 37-54.

TEDMEM (2020a). COVID-19 Sürecinde Eğitim: Uzaktan Öğrenme, Sorunlar ve Çözüm Önerileri. https://tedmem.org/yayin/covid-19-surecinde-egitim-uzaktan-ogrenme-sorunlar-cozum-onerileri

TEDMEM (2020b). Okulları Yeniden Açmak: Ne Zaman, Kim İçin ve Nasıl?. https://tedmem.org/download/okullari-yeniden-acmak-ne-zaman-kim-icin-nasil?wpdmdl=3342&refresh=5fffdfb23752e1610604466).

Toquero, C. M. (2020). Challenges and Opportunities for Higher Education Amid the COVID-19 Pandemic: The Philippine Context. *Pedagogical Research*, *5*(4), 1-5.

Turkish Academy of Science (2020). Covid-19 Pandemi Değerlendirme Raporu. http://www.tuba.gov.tr/files/images/2020/kovidraporu/Covid-19%20Raporu-Final%2B.pdf

UNESCO. (2020a). COVID-19 Impact on Education. https://en.unesco.org/covid19/educationresponse

UNESCO. (2020b). School closures caused by Coronavirus (Covid-19). UNESCO. https://en.unesco.org/covid19/educationresponse UNESCO. (2020b). Startling digital divides in distance learning emerge. UNESCO. https://en.unesco.org/news/startling-digital-divides-distance-learning-emerge

United Nations (2020). United Nations Comprehensive Response to COVID-19. https://www.un.org/sites/un2.un.org/files/un_comprehensive_response_to_covid-19_june_2020.pdf

United Nations Development Programme [UNDP] (2020a). Covid-19 Resilience and Response. https://www.tr.undp.org/content/turkey/en/home/projects/COVID-19-response.html

United Nations Development Programme [UNDP], (2020b). Putting the un framework for socio-economic response to Covid-19 into action: Insights. https://reliefweb.int/report/world/brief-2-putting-un-framework-socio-economic-response-covid-19-action-insights-june-2020

Van Bavel, J. J., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., ... & Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour*, 1-12.

Vezne, R., Yildiz Durak, H., & Atman Uslu, N. (2022). Online learning in higher education: Examining the predictors of students' online engagement. *Education and Information Technologies*, 1-25.

WHO (2020a). Coronavirus disease 2019 (COVID-19) situaiton report – 96. World Health Organization. Accessed through. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200425-sitrep-96-covid-19.pdf?sfvrsn=a33836bb_2

WHO (2020b). Turkey's Response to COVID-19: First Impressions. https://apps.who.int/iris/bitstream/handle/10665/335803/WHO-EURO-2020-1168-40914-55408-eng.pdf

WHO (2021). COVID-19 Explorer. https://worldhealthorg.shinyapps.io/covid

Wiborg, S. (2000). Political and cultural nationalism in education. The ideas of Rousseau and Herder concerning national education. Comparative Education, Nigel Grant Festschrift, 36(2), 235–243.

Wong, A. S., & Kohler, J. C. (2020). Social capital and public health: responding to the COVID-19 pandemic. *Globalization and Health*, *16*(1), 1-4.

Worldbank (2020). The COVID-19 Pandemic: Shocks to Education and Policy Responses. https://www.worldbank.org/en/topic/education/publication/the-covid19-pandemic-shocks-to-education-and-policy-responses

Yamamoto, G. T., & Altun, D. (2020). Coronavirüs ve çevrimiçi (online) eğitimin önlenemeyen yükselişi. Üniversite Araştırmaları Dergisi, 3 (1), 25-34.

Yildiz Durak, H., Şimşir Gökalp, Z., Seki, T., Saritepeci, M., & Dilmaç, B. (2022). Examination of non-cognitive variables affecting academic achievement: a conceptual model proposal. *Quality & Quantity*, 1-22.