


## "Covid-19 Pandemic" As a Controversial Social-Scientific Issue: Teachers' Beliefs and Informal Reasoning

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### ABSTRACT

The main purpose of this study is to examine the epistemological beliefs and informal reasoning of science and social studies teachers about Covid-19, which is a controversial socioscientific issue. Qualitative research, specifically phenomenological design, was used in the study. During the data collection process, teachers' epistemological beliefs, reasoning skills and perceptions of Covid-19 were elicited using the Semi-Structured Interview Protocol (SSIP) developed by the researchers. Categorical analysis, a type of content analysis, was used in the examination of qualitative data. As a result of the research, it was found that teachers' epistemological beliefs about Covid-19 are formed in order to define and explain the source of this information. In contrast, it was found that while the most common sources of information about Covid-19 are the internet, the environment, and intuition, the least used source of information is scientific publications. Teachers failed to provide sufficient evidence to substantiate their claims and found it difficult challenging scientific arguments to bolster their own opinions. Science teachers believe that the main purpose of teaching social science issues is to develop scientific process skills. Social studies teachers believe that the main purpose is to develop a sense of citizenship and the thinking and decision-making skills that individuals need to solve social problems.

*Keywords:* beliefs, Covid-19 pandemic, controversial issues, teachers.

### Introduction

Individuals face many controversial issues in society and need to make decisions on these subjects. Some of these controversial subjects include a scientific dimension. Such subjects are characterized by the expression of very different opinions and the inability to reach a definitive conclusion (Sadler & Donnelly, 2006; Topcu et al., 2010). For this reason, such subjects are referred to as controversial social-scientific issues. Socioscientific issues (SSI) are scientific topics that are "based on scientific concepts or problems, are controversial in nature, are discussed in public environments, and are frequently subject to political and social influences" (Sadler & Zeidler, 2005, p. 113). In order to make effective decisions on these subjects, individuals need to produce arguments and use scientific knowledge in discussion environments about them (Lee & Grace, 2012). In this case, science literacy appears as a prerequisite. For this reason, in the reforms carried out in many different countries in recent years in the field of science education, it has been emphasized that students should be scientifically literate, and regulations have been made for this purpose (American

Association for the Advancement of Science, 2000; Australian Curriculum Assessment and Reporting Authority, 2015; Rennie et al., 2001; MoE, 2018). The main purpose of science teaching in the international arena today is to enable students to understand and make decisions about the events around them from a scientific point of view. There are different definitions of scientific literacy in the literature. In this study, scientific literacy is defined as being able to recognize, understand, and interpret scientific knowledge, to question events in everyday life and to view these events from a scientific perspective.

Many studies state that the use of SSI contributes not only to the science literacy or cognitive development of students but also to their social and emotional development. The first changes related to science education in Turkey started in 1992 under the name of the Science-Technology-Society (STS) approach, and SSI were directly included in the science education program in 2013 (MoE, 2013). In the 2018 program update, science education was founded on the Science-Technology-Engineering-Mathematics (STEM) approach. Again, this update aimed to develop students' reasoning ability, scientific thinking habits, and decision-making skills using sociological topics (MoE, 2018). Therefore, in recent years, SSI has become an important part of both the science curriculum and the research topics of science teaching.

While science and technology constitute one dimension of SSI, the other important dimension is the social dimension, including ethical, political, moral, religious, personal, and social values. If there is also a scientific dimension in these social subjects, then it is expressed as SSI (Sadler, 2004). Therefore, global climate change, alternative energy, environmental subjects, hydroelectric power plants, cloning, and biotechnology are the most well-known socioscientific issues. These subjects also have an important place in the ethical and social dimensions of citizenship and social studies education. What is expected from students today is not being those who memorize the given information and answer when asked, but being those who are researching, questioning, discussing, and producing. SSI contributes to the development of higher-order skills, improves beliefs about the nature of science, increases ethical and moral sensitivity, and develops citizenship skills (Barrue & Albe, 2013; Ratcliffe & Grace 2003). Since these subjects are directly related to society, it allows individuals to be sensitive and responsible individuals for social subjects.

All these mentioned skills are also the qualities that a citizen who wants to be raised in a democratic society should have. Social studies aim to develop the knowledge and citizenship competencies necessary for students to be active and participate in public life. Citizenship competence is based on a commitment to democratic values and requires the ability to use knowledge, inquiry, and problem-solving skills about one's society, nation, and the world. Knowledgeable, talented, and democracy-committed young people are necessary to maintain, develop our democratic lifestyle, and become a member of the global community (National Council for the Social Studies, 2010, p. 2). Through SSI, students learn to be active and informed participants in society (Reis & Galvão, 2009). Several authors have argued in terms of citizenship, decision making, and democratic participation in teaching the nature of science (Driver et al., 1996). As Solomon claims (1994), the highest aims of Social Studies teacher (STS) education relate to how our students will behave as citizens. Social-scientific subjects could feature under any of the three headings: citizenship, scientific literature, sustainable development (Ratcliffe & Grace, 2003).

### **Epistemological Beliefs and Informal Reasoning Regarding SSI**

Due to the fact that sociological subjects contain controversial and complex problems, the process of informal reasoning can create an appropriate environment for discussing and trying to solve such subjects (Topcu, 2017). Informal reasoning is described by Zohar and Nemet (2002) as involving reasoning about causes and consequences and about advantages and disadvantages, or pros and cons, of partial propositions or decision alternatives. In the SSI discussion process, producing arguments in

order to support the claims put forward and rebut the objections and approaching a socioscientific subject from multiple perspectives improve informal reasoning (Sadler & Zeidler, 2005; Wu & Tsai, 2007; Zohar & Nemet, 2002). The informal reasoning process emerges whether the factors affecting the individual's decision are their own interests, the society they live in, all other people, their religious beliefs, political views, economic, scientific developments, or ecological concerns. In addition, whether there is an emotional, rational, or intuitive approach to the socioscientific subject emerges in the process (Elvan, 2020).

Research has shown that one of the most important factors influencing informal reasoning is epistemological beliefs. Epistemological beliefs include beliefs about the definition, creation, evaluation and status of knowledge (Hofer, 2001). Personal epistemology is a multifaceted concept that primarily reflects an individual's "beliefs about the nature of knowledge and the processes of knowing" (Hofer & Pintrich, 1997). It has been argued that individuals may hold epistemological beliefs about the certainty, source, justification, acquisition, and structure of knowledge. These different dimensions of knowledge have led researchers to define epistemological beliefs from a multidimensional perspective (Yılmaz-Tuzun & Topçu, 2008). Teachers' beliefs about the nature of science have a significant impact on their teaching style, assessment methods and lesson planning. A positivist approach sees the role within the classroom as primarily one of transmitting knowledge to students, whereas a constructivist approach encourages students to actively construct knowledge themselves. This orientation determines whether the lesson is teacher-centred or student-centred. While a positivist teacher believes that students should passively receive knowledge, a constructivist teacher encourages students to actively engage in the construction of knowledge. Positivist teachers are often perceived as authoritative figures who impart correct knowledge, whereas constructivist teachers have more egalitarian relationships with students and encourage active exploration of knowledge. Sadler et al. (2006) reported that some teachers saw SSI as important subjects to deal with, so they preferred student-centered activities where students could share their ideas and tried to provide a classroom environment. However, some teachers believed that science teachers were responsible for teaching scientific facts, and they did not have to deal with ethical or moral concerns, which were part of SSI. Therefore, they designed their lectures mostly teacher-centered. Teachers, educators, and researchers claim that teachers' beliefs shape their approach and practical theories in classroom teaching, influencing their instructional strategies and performance in the classroom (Cheng et al., 2009).

### **Covid-19” As a Controversial Socioscientific Subject**

Socioscientific subject contexts can be classified as national, local, or global. The new type of coronavirus (Covid-19), which first appeared in China in the last months of 2019, affected the whole world by transforming into a global pandemic quickly. Several pandemics, such as H1N1, Asian Flu, and Spanish Flu, have occurred before, but none have spread so widely and confined to specific regions or continents. Depending on the technological and economic developments, human mobility has increased, and the pandemic spread rapidly in a short time. Everyone became interested in Covid-19 as a socioscientific topic due to its immediate and deadly impact. Throughout this process, all countries have taken various measures to prevent the pandemic from spreading further. Public discussions have focused on many of these measures. Public demonstrations protested the strict measures taken in many countries, including Germany, Italy, England, Brazil, the USA, Canada, Australia, and New Zealand. Until now, no socioscientific subject, including global warming or other environmental problems, has affected the whole world in such a short time.

Covid-19 meets all the criteria of a socioscientific subject. Because it includes a scientific and technological dimension, it is widely discussed by society, and also the ethical, political, social, and economic dimensions of this subject are included. For example, the emergence of Covid-19, the

process of its spread, the measures taken, and the discussions during the vaccine development process draw attention to their scientific and social aspects. Thus, Covid-19 is a rather important socioscientific subject that can be addressed in both science and social studies classes. Covid-19 has been selected as a socioscientific topic due to the fact that it is a current topic in this study.

### **Previous research**

Examining previous studies on SSI reveals a primary focus on students and teachers within the science course. Research on students about SSI includes studies on the impact of SSI on students' attitudes towards science lessons (Ottander & Ekborg, 2012; Ritchie et al., 2011), as well as studies on enhancing students' knowledge and argumentation skills (Dawson, 2015; Dawson & Carson, 2017; Dawson & Venville, 2010; Wu & Tsai, 2007; Yang & Anderson, 2003; Zohar & Nemet, 2002). Studies on teachers about SSI encompass subjects like teachers' beliefs and arguments (Ekborg et al., 2013; Liu & Roehrig, 2019), as well as the perception, competencies, and informal reasoning of teacher candidates (Choi & Cha, 2018; Lee et al., 2006; Robertshaw & Campbell, 2013). On the other hand, research on SSI in the field of social studies is limited. However, recent studies have observed the use of SSI in social studies (Elvan, 2020) and the teaching of citizenship subjects (Barrue & Albe, 2013; Lee et al., 2013). However, no comparative studies have been conducted on Covid-19, a current topic in SSI. The main purpose of this study is to examine the epistemological beliefs and informal reasoning of science and social studies teachers about Covid-19, which is a controversial socioscientific subject. This research seeks answers to the following questions:

- RQ1. What personal epistemology do teachers hold about the Covid-19 pandemic?  
What are the beliefs developed in:
  - RQ1.1. the structure of knowledge?
  - RQ1.2. the source of knowledge?
  - RQ1.3. the stability of knowledge?
- RQ2. What are the teachers' views on the teaching process of social-scientific subjects?

## **Methods**

### **Research Design**

This qualitative research study used phenomenology design. The phenomenology design examines events, experiences, perceptions, orientations, and situations in the universe that we are aware of, but lack a deep and detailed understanding of, and that we can observe directly or indirectly (Creswell & Poth, 2016). The study considered the Covid-19 pandemic as a phenomenon and aimed to reveal teachers' beliefs, perceptions, and meanings associated with it.

### **Participants and Procedure**

Homogeneous sampling, one of the purposive sampling methods, was used in the creation of the study group. By choosing a purposeful sampling method, it was possible to study the Covid-19 phenomenon within the scope of the study in-depth, and the diversity of the participants associated with the problem of the study was reflected as much as possible in a relatively small sample (Creswell & Poth, 2016; Patton, 2014). In this process, the study group was determined to consist of similar, variable, and different situations related to the problem. In this context, a study group consisting of a total of 14 people, seven science and seven social studies teachers, was formed in the context of gender, seniority, school location, and education level difference. Within the scope of the study, the

researchers tried to find out whether there were common or shared cases that vary, and aimed to examine the different dimensions of the research problem depending on this diversity (Marczyk et al., 2005). Demographic information for study participants is available in Table 1.

**Table 1**

*Demographic Information of the Teachers in the Study Group*

<b>Participant</b>	<b>Branch</b>	<b>Gender</b>	<b>Seniority</b>	<b>Education level</b>
SE1	Science	Male	7	Master
ST2	Science	Male	11	Bachelor
ST3	Science	Male	13	Bachelor
ST4	Science	Male	8	Bachelor
ST5	Science	Female	18	Master
ST6	Science	Female	9	Bachelor
ST7	Science	Female	5	Master
SST1	Social Studies	Male	9	Bachelor
SST2	Social Studies	Female	5	Bachelor
SST3	Social Studies	Male	5	Master
SST4	Social Studies	Male	14	Bachelor
SST5	Social Studies	Male	18	Master
SST6	Social Studies	Female	9	PhD
SST7	Social Studies	Female	9	Bachelor

A total of 14 teachers, including seven science and seven social studies teachers, are included in the study sample. While eight of the teachers are male, six of them are female. In general, the seniority of teachers ranges from five to 18 years. Two of the teachers in the study group work in the village, five of them work in the district, and seven of them work in the city center. In addition, eight teachers have bachelor's degrees, while six teachers have graduate degrees.

**Instrumentation**

In the data collection process, the "Semi-Structured Interview Protocol" (SSIP) developed by the researchers was used to determine the epistemological beliefs, informal reasoning, reasoning skills, and perceptions of teachers about Covid-19. SSIP was used as the main data collection source in the research. During the development of the draft measurement tool, a total of nine questions were prepared in the context of Schommer's (1990) Multidimensional Epistemological Belief System, and the opinions of two experts were sought. In this process, the opinions of the experts for each item were taken in the form of "usable," "usable after correction," and "unusable" triple Likert for each item. In accordance with the feedback from the experts, two questions were combined with other questions contained in the draft interview form, and additional questions were added to the questions. The inter-assessor Cohen Kappa coefficient of agreement of the SSIP, which consists of seven questions in its final form, was calculated as .76. This result can be interpreted as the interview form will give reliable results in the study.

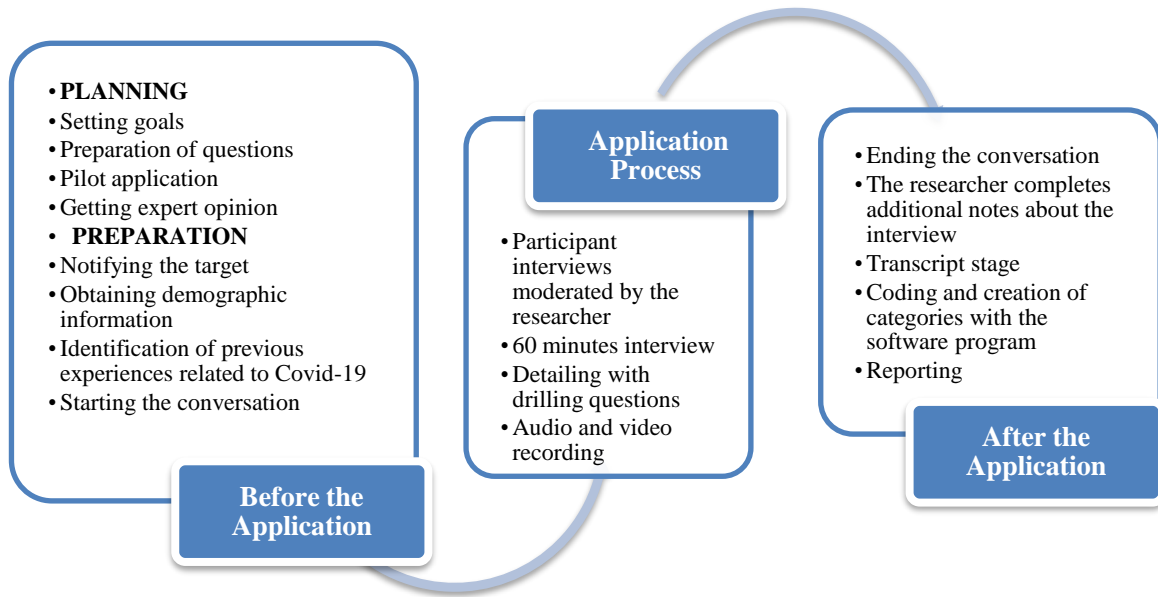
**Data Collection Process**

Interviews with teachers were conducted under the moderation of the researchers. In addition, the interviews were videotaped. This process aims to prevent the factors that are thought to cause mistakes in the interview process, such as the researcher's bias, directions, and subjects that are not emphasized. In addition, the internal reliability of the study could be increased in this way. The

procedures related to the operations before, during, and after the interview are summarized in Figure 1 step by step.

**Figure 1**

*Symbolic View of the Application Process*



### ***Before the Application***

Pre-application of the research was structured in two dimensions. In the planning phase, the study's aims with the research team were clarified, the topic of Covid-19 was chosen as the research topic, SSIP was developed accordingly, expert opinion was taken, and a pilot application was made. SSIP was applied to a teacher who was not in the study group at the pilot application stage. This process aimed to see possible risks/deficiencies such as time management, organization of the online meeting environment, determining the meeting time, internet interruption, video-sound quality, video-audio recording process, and to produce possible solutions.

In the second dimension of the pre-application period, preparatory studies were carried out. In this process, the teachers were informed about the subject, their demographic information was obtained, their experiences before the interview about Covid-19 were tried to be determined, and information was given about the interview process.

### ***Application Process***

The study team, consisting of two moderators and a teacher, carried out the application process and conducted an online interview. While one of the study team's researchers conducted the interview as the main moderator, another researcher made observations to prevent the discussion of unrelated subjects and to ensure the recording process was completed and checked.

The application process was limited to a total of seven questions in a period of 45-60 minutes, and drill questions were asked for detailed purposes. During the interviews, teachers were asked to express themselves in a democratic process in a way that would allow them to express their epistemological beliefs and informal reasoning about Covid-19.

### *After the Application*

This phase covers the processes in which teachers' statements are evaluated through interviews. In this process, the stages of the researcher completing the diary-style additional notes about the interview, the transcription of the audio recordings, the categorical analysis of the qualitative data obtained with the MAXQDA program (theme-category-code), and the reporting of the data were carried out.

### **Data Analysis**

In the analysis of the obtained qualitative data, categorical analysis, one of the content analysis types, was used. Categorical analysis generally refers to dividing a particular message into units and then grouping these units into categories according to certain criteria (Bilgin, 2000). The stages of the qualitative data analysis process are listed below.

- Transcript stage: The audio recordings obtained within the scope of the interview were transcribed sentence by sentence to reflect the expressions in the original audio recordings. In addition, the additional notes of the study team about the interview were associated with the relevant parts of the transcripts.
- Coding phase with inductive paradigm: In the study, the data were first coded and turned into meaningful wholes with inductive analysis. In this process, the aim was to try to reveal the concepts underlying the data and the relationships between these concepts.
- Category creation stage: The data obtained in the coding process were divided into meaningful sections (one word, one sentence). The aim of this process is to divide the observation and interview texts into sections, to examine, compare, conceptualize and associate them. Then, commonalities between the codes were tried to be found and categories were formed by bringing them together. In the thematic coding process, it was aimed to determine the similarities and differences of the qualitative codes obtained and to determine the themes that can bring together the codes that are related to each other accordingly. In this process, categories were formed by finding the commonalities between the codes related to teachers' epistemological beliefs.
- Reliability phase: In this process, codes were gathered under themes by two different researchers and the inter-rater agreement coefficient was determined. According to Miles and Huberman's (1994) disagreement-agreement principle, the inter-rater agreement was calculated as .92. This finding shows that the internal reliability of the data is highly consistent.
- Reporting stage: Categories were determined, meaning units or items were placed in these categories, and their frequencies were determined. In this process, intensity and importance were determined for the categories.
- Quoting from original texts: In order to increase the internal reliability of the obtained data, the obtained data are given in the findings in the form of direct quotations. In this process, “ST” was used for Science teachers, “SST” was used for Social Studies teachers, and numbers were used for teacher order.

## Limitations of the Study

This study is limited to the responses of a total of 14 teachers, seven social studies and seven science teachers, to the semi-structured interview form regarding the Covid-19 pandemic.

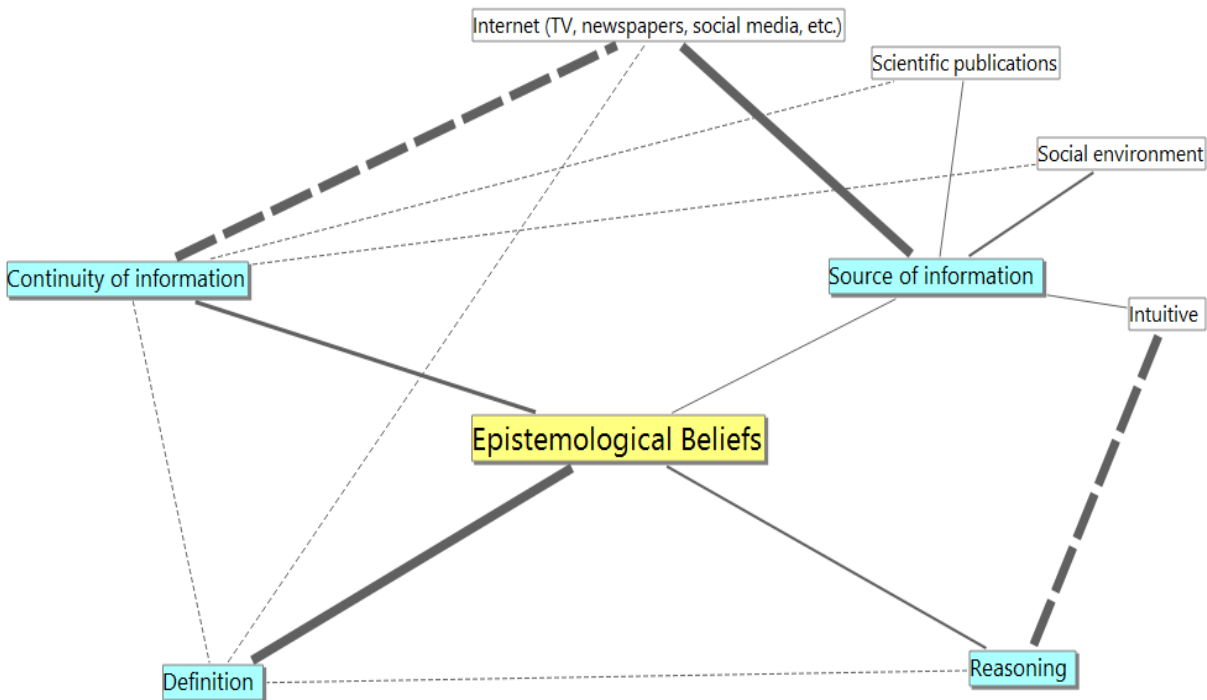
## Findings

### Epistemological Beliefs

The categories and subcategories formed for teachers' epistemological beliefs and the relationship between them are summarized in Figure 2.

**Figure 2**

*Categories of Epistemological Beliefs*



As seen in Figure 2, teachers' epistemological beliefs were mostly formed in a way to explain the definition and the source of this information. In the category of the source of information, the codes are collected under four subcategories: internet (TV, newspapers, social media channels, etc.), environment, intuitive and scientific publications. The least codes are included in the categories of reasoning and effects.

When the relational codings were examined, while related codes were formed between the source-intuitive subcategory of knowledge and reasoning, related codes were formed between the continuity of knowledge and the internet (TV, newspaper, social media channels, etc.), environment, and scientific publications subcategories. However, there is a relationship between the continuity of information and the internet (TV, newspaper, social media channels, etc.). In addition to these, related codes have emerged between the categories of continuity of information and changeability of information.



## Definition

Examining the definitions of Covid-19 reveals two distinct perspectives. According to the widely recognized definition, Covid-19 is classified as a pandemic disease. All teachers who identified it as a pandemic disease also identified Covid-19 as a virus.

The second definition of Covid-19 does not incorporate any health-related concepts. In this definition, Covid-19 has been defined as a reaction of nature, a conspiracy theory, an interstate show of power, a disaster, a process of unity, or a change of habits. One of the important points in the definition is that all the science teachers emphasized it as “*a virus*” when describing Covid-19. While a few of the social studies teachers emphasized it as a virus, others defined it as a “process” with its effects. For example, ST3 defined it as “a virus that looks like flu but shows its effects in different ways according to the immune system of the person and for example, according to chronic diseases”, while SST2 defined it as “Covid-19, a process that reveals how important social relations and health are, and how important education is.”

## The Source of the Information

The codes collected under the category of the source of information were collected under four subcategories. These are the internet (TV, newspaper, social media channels, etc.) (40), environment (experience) (16), intuitive (9), and scientific publications (4) subcategories. In this process, the main sources of information for teachers are the resources they accessed via the Internet and mainly social media tools. On the other hand, it can be said that the statements of the minister of health are mainly followed through Internet resources, followed by some social media, Internet news, and column articles. Among the internet resources, only SST7 and ST1 emphasized academic articles. For example, ST7 said, “Sometimes, I also get information from the articles I read during my own research. The information provided by a scientist can sometimes be consistent with the information provided by another colleague. But sometimes, it can also be contradictory. This leads me to do more research on topics I am interested in.”

In addition, some teachers especially think that information sources do not provide accurate information and are skeptical. For example, ST2 stated “I have some doubts about the information I obtained from the Internet, but there is no certainty before or during this process.” When the answers in the subcategory of the environment (16) were examined, it was determined that the teachers had information about Covid-19 through the information they obtained from their neighbors, the events experienced by their relatives, and the people around them, and their friends. As an example, ST3 made a statement, “I have that information from people living in my neighborhood, people who have survived Covid-19 or people they know at work, through what we heard from them.”

On the other hand, some teachers used intuitive (9) expressions when describing Covid-19. In this process, they stated that “they believed that their explanation was like this,” and they did not have a source for this information and had not read a scientific publication. These findings indicate that some teachers approach the information acquisition process intuitively and do not feel the need to access the content of a scientific article/publication related to it. In fact, scientific publications (4) are the least emphasized subcategory in the subcategory of the source of knowledge.

## Continuity of Information

Two subcategories arise under the category of continuity of information (19). These are certainty (15) and doubt (4) subcategories. Predominantly, teachers believe that the statements of official institutions such as the World Health Organization, the Ministry of Health, the Scientific

Council, the scientists, or the health professionals in their immediate surroundings are "accurate information." On the other hand, some teachers have expressed that they have to believe the statements of these institutions. As an example, ST3 expressed that "This information is entirely information that we obtain from the ministry of health or members of the scientific committee. I believe in its accuracy, I trust the scientific committee." A few teachers stated that the information they obtained was not certain, there were contradictions in this information, and they doubted this information. Teachers especially expressed that they were suspicious of the information they obtained from the internet.

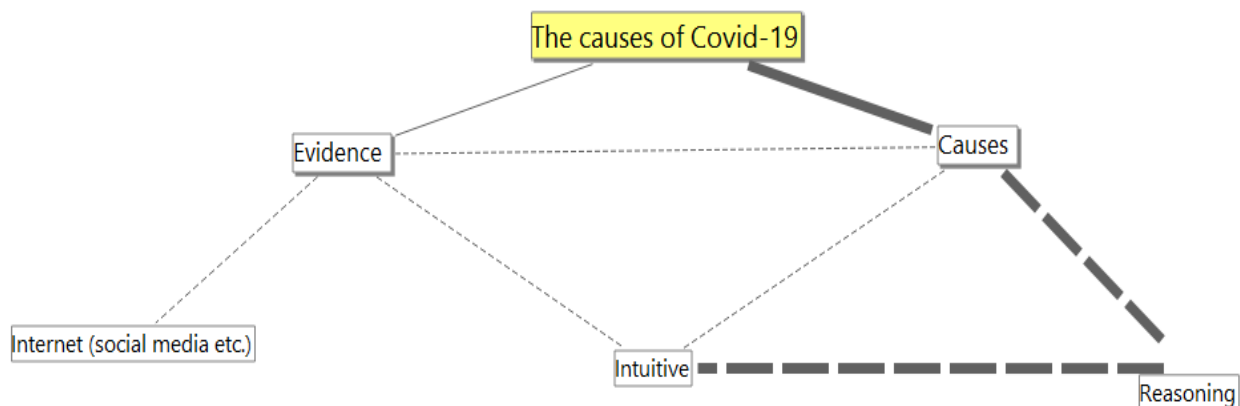
Participating teachers do not find the statements of policymakers reliable. Teachers have stated that politicians have very different goals, that their main goal is to maintain their power and show strength, that they are fighting to prevent the economy from being negatively affected, and that politicians all over the world are aiming for certain interests. Some teachers stated that it was not right for politicians to be so prominent during this process. They did not take their discourses into account and created distrust with contradictory statements. Some teachers stated that they follow the minister of health in Turkey because he is a scientist. In this regard, for example, STT2 stated the following: "Some things lose their credibility when they go together with politics. I don't believe in politicians anyway, so I think there's no credibility in politicians' policies either." The majority of the participating teachers emphasized that even if they have different discourses, they find scientists reliable because they have no interests and that they follow their explanations, but that scientists may be under pressure in some cases. In this regard, for example, SST3 stated: "I think the scientist thinks universally and humanistically. I trust the scientists, but that's not 100 percent."

### Causes of Covid-19

As can be seen in Figure 3, the evidence for Covid-19 is that teachers mostly explain it with intuitive answers. In this process, the source of their information is mostly based on the reasons they obtained through the internet (social media, etc.).

**Figure 3**

*Categories Related to the Causes of Covid-19*



### Causes

The causes category is grouped under two subcategories, *natural* and *artificial*. All of the teachers who believed that Covid-19 emerged naturally emphasized that this virus emerged in China and was

transmitted from an animal to a person. Teachers who have this thought believed that the main reason for human transmission was the result of an unhealthy diet in China, not paying attention to cleanliness and hygiene, not taking the necessary precautions, and not giving information to the world. A few teachers, who thought that it emerged naturally, stated that they thought this virus was a result of people harming nature for years, and that they thought it was a reaction of nature. Teachers who believe that Covid-19 was created artificially, on the other hand, claim that this virus was produced in a laboratory environment for various reasons. It is seen that there are mainly social studies teachers in this thought. These teachers stated that they believed that the virus was produced in a laboratory environment for a biological warfare purpose, that many things were wanted to be tested in the international arena for this purpose, and that some states were engaged in power wars. For example, SST2 expressed an opinion on this subject: "First of all, I think that Covid-19 is an artificial virus produced in a laboratory environment."

### **Evidence**

Almost all of the teachers who expressed their opinions about the emergence of Covid-19 did not reveal any scientific evidence for the reasons they put forward. Teachers who believed that Covid-19 emerged naturally cited sources of information (internet, news, etc.) as evidence. On the other hand, a few science teachers claimed that the virus multiplies in dirty and unhealthy environments. This information is included in textbooks or scientific articles, so these are scientific proofs. Teachers who believe that Covid-19 emerged artificially, on the other hand, stated that it is intuitive or logical as evidence, and they do not have any scientific evidence other than that.

### **Results of the Covid-19 pandemic**

As can be seen in Figure 4, while the responses were mainly positive in the environmental and scientific categories, they were negative in the social/psychological, political, education, health and economic categories. These findings show that especially teachers think that positive results have emerged in the context of the results of Covid-19 as well.

#### ***Social/Psychological***

Teachers gave opinions about the social/psychological results of Covid-19 in two subcategories as *negative* (47) and *positive* (7). Teachers who expressed a negative opinion stated that the pandemic caused many psychological concerns in individuals and, therefore, in societies. Teachers have said that they have experienced many complex emotions with the pandemic, such as fear of losing loved ones, anxiety about the future, fear of loneliness, obsession with cleanliness, insecurity, and anxiety. Teachers stated that they did not know how the Covid-19 virus spread and that scientists' explanations significantly impacted their psychology. On the other hand, some teachers emphasized that the pandemic also had positive results in the social field. These teachers said that with the pandemic, their family members came together, and they could spend more time together

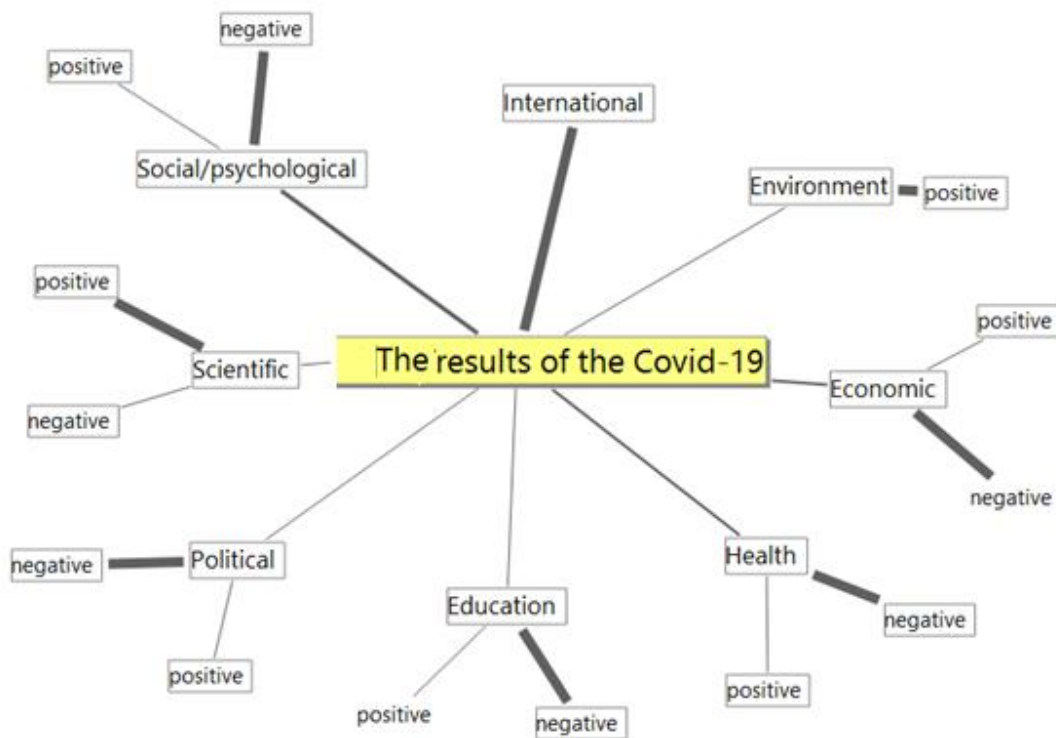
#### ***Economic***

Teachers gave opinions about the economic results of Covid-19 in two subcategories as *negative* (43) and *positive* (11). In the economics category, both science and social studies teachers emphasized the adverse results of the pandemic on the national and global economy. They emphasized that people lost their jobs on a national scale, tradespeople closed their jobs, the industry came to a standstill, and the tourism sector was adversely affected. By drawing attention to the adverse results of the pandemic

on a global scale, teachers stated that the worldwide economy was adversely affected, the supply chain was disrupted, countries had to print money, and this situation caused severe inflation. On the other hand, some teachers have noted the positive results of the pandemic on the economy. The teachers who expressed their opinions on the positive results drew attention to two points. One of them is savings, and the other is the digitalization of trade. Regarding savings, teachers have noted that people were necessarily turning to savings, reducing their unnecessary consumption. Some teachers have pointed out that people were necessarily turning to online commerce and that the digitalization that can be experienced in the ten-year process is experienced in 1 year.

**Figure 4**

*Categories Related to the Results of the Covid-19 Pandemic*



### ***Education***

Regarding the results of Covid-19 on education, negative (64) and positive (18), teachers expressed their opinions in two subcategories. It was observed that a large number of opinions have been expressed regarding the closure of schools and the distance education process. The teachers stated that the consequences of the schools being closed would be very severe, that the children were affected psychologically very negatively, and that many new problems emerged with the online education process. Regarding the online education process, they stated that the country's infrastructure, teachers, and students were not ready for this subject. Teachers emphasized that quality access could not be provided due to the lack of infrastructure. A quality teaching process was not experienced due to teachers' lack of digital competence, and students did not have the digital tools and access due to inequality of opportunity. Many students could not attend the lesson. It has been stated that there are different problems with students who have digital access. Many of them have

increased digital addictions, a quality teaching process cannot be carried out, they cannot follow the students, and assessments and evaluations cannot be made. ST6 stated the following on this subject: “On the one hand, we do not have an adequate infrastructure as National Education; on the other hand, students do not have enough opportunities. Therefore, the education sector has experienced a great deal of hardship and is still experiencing it.”

Teachers, who stated that Covid-19 had positive (18) effects on education, stated that a revolution was experienced in education without taking time and space into account. In this process, teachers emphasized that the digital competencies of educators developed rapidly, countries accelerated their infrastructure activities in this field, that digitalization, which can be experienced in a very long time, is experienced in a short time in the field of education, and that digital contents and research in this field have increased.

### ***Environment***

It is seen that teachers only gave *positive* (14) opinions regarding the results of Covid-19 on the environment. The teachers who participated in the research pointed out that the environment was relieved when people were closed to their homes. The damage caused by human beings to the environment in this process was minimized. The teachers stated that the factories were closed, the vehicles were not on the road, people did not go on vacation, the seas were cleaned, and nature had a chance to renew itself. Regarding this subject, SST1 stated that: "... There have also been positive results. Nature took a breather because people were at home. For example, air pollution decreased because there was no traffic.”

### ***Other***

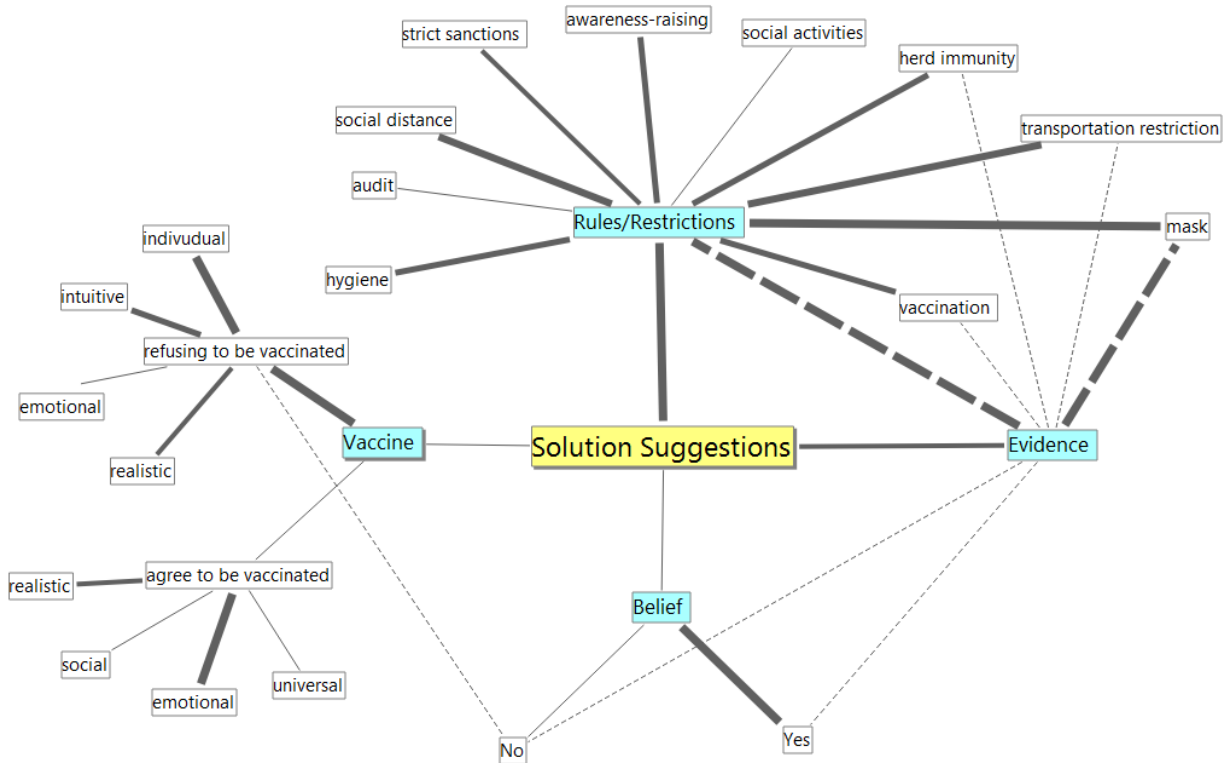
Some teachers drew attention to the results of the pandemic on politics, science, and health. A few social studies teachers stated that with the pandemic, the power of governments had increased worldwide, personal rights and freedoms were restricted, and compulsory acceptance of people has increased. These teachers stated that interstate and international relations were also affected, causing cooperation in some areas and tensions in some areas. On the other hand, some science teachers emphasized that they have severe results on science and health, that science may be helpless even in this century, that states should make more severe investments in health and science, and that the inconsistent statements of scientists cause distrust in people.

### **Solution Suggestions**

As can be seen in Figure 5, the concepts that teachers express as evidence are also related to teachers' belief in the solution and rules/restrictions. Moreover, the statements in the evidence category are also related to the *changeability of information*, which is the sub-dimension of the theme of teachers' epistemological beliefs.

### **Figure 5**

*Categories Related to Solution Suggestions*



### ***Belief***

Most of the teachers who participated in the research believed that a solution to Covid-19 will definitely be found. One of the main reasons behind this belief is that there have been such pandemics in history, and a solution has been found for them, or they disappeared within two years. On the other hand, some teachers stated that science and technology had developed incredibly today, so a solution will definitely be found for this pandemic. Also, some teachers emphasized that they firmly believed that the virus would mutate and that there would be a solution through herd immunity. A small number of teachers, on the other hand, stated that they believed that this virus was already an artificial virus, so the solution was ready from the beginning. On the other hand, a few teachers stated that they believed that there will be no solution to this pandemic in a short time because they believed that the virus mutates and will undergo negative changes; even vaccines cannot be a solution. This situation will last for at least five years.

### ***Rules/Restrictions***

It was determined that the teachers who participated in the research mostly expressed their views on the mask, social distance, cleaning/hygiene, herd immunity, transportation restriction, awareness-raising, and vaccination in the rules/restrictions category. By emphasizing the rules, many teachers also argued that social awareness should be gained about these rules, that the rules should be strictly supervised, and that there should be strict sanctions against those who do not comply with the rules. Some of the teachers with this view stated that if they were the administrators, they would either increase the restrictions more or apply the rules more strictly.

However, not all participating teachers agree that restrictions will be the solution. The other half of the teachers also emphasized that the restrictions were exaggerated, that curfews and closing of schools were a loss of rights, that many people violated these restrictions, and that the restrictions

were not adequately supervised. Some of the social studies teachers who hold this view stated that if they were administrators, they would never close the schools, but they would remove a significant part of the restrictions, if not wholly. For example, on this subject, SST5 stated, "I do not find prohibitions such as total curfew and closing of schools reasonable. All of this is also a violation of rights."

### ***Vaccine***

Teachers suggested vaccination as another solution. Some teachers argue that the vaccine is very protective, so this pandemic can only be overcome with a vaccine. However, almost all the teachers who both recommend and do not recommend vaccination as a solution stated that they will not be subject to vaccination. They claimed that the main reason for this was that they felt insecure about this subject, there would be many side effects, the process was not transparent, they thought of their children, foreign vaccines would not be trusted, or that it was a political scenario, and that the leaders of the order could find the subjects.

Some teachers agreed to become subjects. ST3 said, "Of course, I would like to be a subject. I have no other purpose. My only purpose is to contribute to humanity", and ST4 said, "I would be at the volunteer level. Because I am a bit of self-sacrifice, I make sacrifices for my students and humanity." These statements mostly show that the reasons for teachers to be a volunteer are in line with social benefit/interest.

### ***Herd Immunity***

Except for a few teachers, all of the other teachers opposed the idea of herd immunity. A few teachers who defended herd immunity stated that there is no other solution to such pandemics. Many people will catch this virus anyway, the virus has lost its former power, and the virus must spread in a controlled way, and herd immunity should be gained. Regarding this, while ST12 expressed his belief in herd immunity as "I believe in herd immunity," ST2 stated that "Maybe it can undergo mutations and decrease by what they call herd immunity, maybe it is the only alternative," and has the opinion that mutations will reduce the effect of the virus.

All the other teachers were against the idea of herd immunity. They stated that this is ignorant courage and unscientific. European countries that try to do this do not care about their people; Turkey even brings its patients from abroad, so the idea of herd immunity cannot be applied in our country. For example, ST11 on this subject says, "Those who are weak in herd immunity will die. Therefore, this is not a preferred method. This is completely contrary to our values". These answers show that values, destiny, and feelings are the dominant factors in teachers' opposition to herd immunity.

### **Evidence**

Teachers' statements as evidence are also related to their belief in the solution and the categories of rules/restrictions. Teachers suggested masks, social distance, and cleaning, which are expressed in the category of rules/restrictions as an example of solutions that scientists recommend, and they stated that the virus enters the body through the nose and mouth; the virus cannot enter the body when wearing a mask, disinfectants will not affect the virus, and that soap kills the virus. They also made claims that the virus would die due to increasing weather temperature. In this context, it was determined that both science and social studies teachers put forward some non-scientific personal opinions as evidence. They stated that scientists constantly say these things through the media; they trust scientists, and they hear about them from close health professionals or read about them in some sources. For example, ST11 made a statement in the form of "But some people say that it decreases in temperature." ST12 made a statement that "There may be bacteria in the environments we touch,

it is said that soap kills the virus. I think it kills.” Teachers who disagreed with this view stated that wearing a mask will not be a solution, the virus will be transmitted through the eyes, and the virus can stick to the body more when using the cologne. They showed the environment as a source of information on this subject. For example, STT1 stated the following on this subject “Actually, it is said that the cologne does not kill the virus; on the contrary, it sticks it more.”

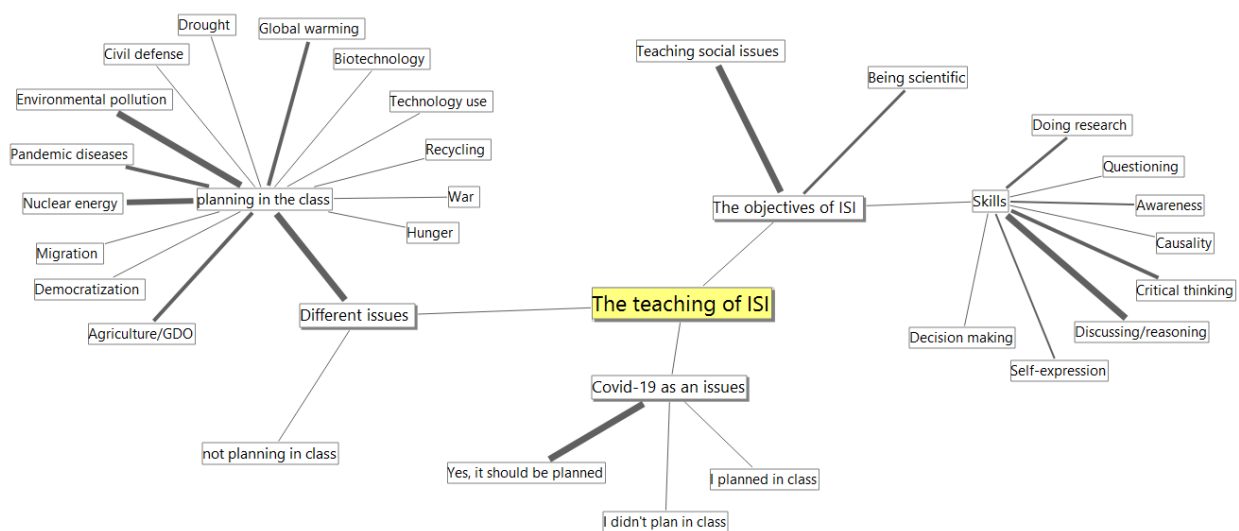
Teachers, who suggested herd immunity as a solution, claimed that the virus had to mutate and its effect would decrease. As evidence, they claimed that for the virus to survive, the human metabolism must also survive, so the virus would have to mutate, in which case the destructive power of the virus would disappear.

## The Teaching of Socio-Scientific Issues

As can be seen in figure 6, the answers given by the teachers regarding the teaching of socio-scientific issues are grouped into three categories. These are the objectives of socio-scientific topics, opinions on Covid-19 as an SSI, and different topics included in the courses.

**Figure 6**

*Categories That are Formed Related to the Teaching of Socio-Scientific Issues*



## Purpose

The answers given by the teachers as the primary purpose of teaching SSI are grouped as teaching social issues (23), being scientific (9), and skill acquisition (37). In particular, teachers emphasized that the use of such topics is to gain skills in students. In this process, the skills of discussing/reasoning, critical thinking, and doing research were expressed the most. In addition, the skills of decision making, self-expression, causality, awareness, and questioning are also mentioned. In addition to these, social studies teachers stated that on SSI such as Covid-19, the social dimension of such problems is more important to them, so they give more importance to this aspect; when they get into the scientific part, the discussions are blocked, and the students cannot express any opinions on this subject. On the other hand, science teachers stated that they briefly mentioned the scientific aspect of such matters and then mentioned the social dimension. Like the statement of social studies teachers,



science teachers also pointed out that there were no deep scientific discussions, students got stuck, and the main arguments were in social dimensions.

Science teachers, who include SSI such as Covid-19, stated that it is to gain essential skills such as critical thinking, questioning, reasoning, using evidence, and information literacy. On the other hand, social studies teachers stated that their primary purpose is to create a discussion environment in the classroom, see different perspectives, be sensitive to social subjects, be liable to the environment and nature, and fulfill individual responsibilities.

### **Other Issues**

The majority of the teachers participating in the research stated that they included SSI in their lessons. Environmental pollution (11), nuclear energy (10), agriculture (5), global warming (6), and pandemic diseases (6) are the leading SSI that they stated to be included in the curriculum, especially in this process. In addition, teachers stated that they considered drought (3), recycling (3), technology use (3), migration (2), war (2), hunger (2), biotechnology (2), civil defense (1) and democratization (1) as SSI.

Some of the teachers who participated in the research stated that they did not include SSI in their lessons. In this process, teachers stated that they did not specifically mention SSI such as Covid-19 because the psychology of children would be adversely affected; children had already heard about this subject everywhere. They never mentioned the Covid-19 pandemic in their classes, not to apply any pressure. Again, some teachers stated that they did not receive a letter from the Ministry of National Education that this subject should be included in the lessons. They did not include it because the students could engage in political discourse. A few teachers stated that SSI are not included in the curriculum. For example, STT1 has expressed his opinion, "Because there is a curriculum that the Ministry of National Education wants from us, and we need to be on schedule," and ST3 has expressed his opinion as "socio-scientific issues in the curriculum did not attract my attention at all."

They stated that in the subcategory of the environment, the most common topics are global warming, climate change, forest fires, biodiversity, environmental awareness, acid rain, recycling, and waste. The environment is the socio-scientific subject most frequently expressed by both social studies teachers and science teachers. On the other hand, some teachers stated that nuclear energies, health-related pandemics, conscious agriculture, and GMO products are included in the curriculum. Some social studies teachers stated that socio-scientific issues are not included in the curriculum.

A large part of the teachers stated that for effective planning of SSI in teaching to be carried out, these subjects must be included in educational programs and textbooks. Teachers stated that such subjects should be taught by creating an environment of debate and discussion, using out-of-school learning environments, different methods, and techniques. On the other hand, some teachers emphasized that there should be fun ready-made activities suitable for the level of the students in these subjects and that the lesson hours should be increased to be able to implement them. In this case, the teachers would be able to plan more efficiently.

### **Inclusion of Covid-19 as a Socio-Scientific Subject**

Nearly half of the science and social studies teachers participating in the study stated that they include Covid-19 subjects in their classes. Teachers who stated that they included Covid-19 said that they mostly talked about what they should pay attention to at the beginning of the lesson and the importance of following the rules, but they did not plan a class and create a designed discussion environment. This process is planned mainly for informational and protection purposes.

All of the teachers stated that SSI such as Covid-19 should be included in their lessons. Social studies teachers emphasized that these subjects are social, affect everyone, take their subjects from

society in their social studies, and be included for students to have a particular awareness. On the other hand, science teachers stated that science is included in these subjects and that these subjects should be given a place so that students can have different views. STT1 said, "It is highly probable that such outbreaks will occur in the future. Therefore, it should be included in both educational programs and textbooks."

## **Result and Discussion**

This study analyzed the epistemological beliefs and informal reasoning of science and social studies teachers regarding the Covid-19 pandemic as a controversial socio-scientific subject, using Schommer's (1990) Multidimensional Epistemological Belief System and the concepts of "structure of knowledge," "source of knowledge," and "stability of knowledge". Additionally, the personal epistemology paradigm encompasses the concepts of "speed of learning" and "ability to learn". According to Schommer's (1990) research, individuals can develop two types of beliefs in each domain. These individuals possess both naive and immature beliefs, as well as sophisticated ones. In this study, data was collected and interpreted under the structure of knowledge, source of knowledge, and stability of knowledge of Schommer's (1990) belief system. This is because the model's suggested dimensions of learning ability and speed necessitated long-term observations and interviews. Schommer (1998) stated that in the speed of learning dimension, naive people develop the belief that learning will either happen quickly or not at all, while sophisticated people believe that learning is a gradual process. Beliefs about the speed of information especially affect the time individuals spend in solving a problem. This period may vary from individual to individual depending on the individual's problem-solving ability. Given this situation, it is necessary to diversify the data obtained through observations, written documents, and interviews in order to determine teachers' beliefs about their ability to learn and the speed at which they learn. This requires a significant amount of time and interaction during the data collection process. Furthermore, identifying beliefs within the continuity of knowledge dimension becomes challenging for a variety of reasons, including the challenge of monitoring teachers throughout the study, the presence of numerous external variables, and the uncertainty of problem-solving timelines.

## **Results of RQ1**

### ***RQ1.1. Structure of Knowledge: Covid-19 definition***

Teachers formed their epistemological beliefs about Covid-19 to further define and explain the source of this information. While some teachers defined Covid-19 as a virus-related pandemic, others described it as a conspiracy theory, an interstate show of power, or a disaster, without using the concepts of pandemic or virus. While the most common sources of information for teachers about Covid-19 are the internet, the environment, and intuition, the least used source of information is scientific publications. Teachers who believed in the natural emergence of Covid-19 emphasized that the virus originated in China and spread from animals to humans. Teachers who hold this belief believe that the primary cause of human transmission is China's unhealthy diet, a disregard for cleanliness and hygiene, a failure to take necessary precautions, and a failure to disseminate information to the world. Teachers who believed that Covid-19 was created artificially, on the other hand, claim that this virus was produced in a laboratory environment for various reasons. Almost all the teachers who expressed their opinions about the emergence of Covid-19 did not reveal any scientific evidence for the reasons they put forward. Teachers who believed that Covid-19 emerged naturally cited sources of information (internet, news, etc.) as evidence. Teachers primarily use intuitive and reasoning-based answers to explain Covid-19. When thinking and making decisions

about SSI, Sadler and Zeidler (2005) argued that informal reasoning replaces formal consideration, dividing informal logic into three categories: logical, emotional, and intuitive. All participants in this study used at least one of these three classifications in the context of Covid-19.

In addition, it was determined that some misconceptions occurred in teachers' definitions. Some of those are as follows: disinfectants do not kill the virus; on the contrary, they stick to the body more, the effect of the virus decreases in temperature, soap kills the virus, and the virus cannot enter the body when wearing a mask. It was determined that teachers structured these misconceptions depending on the discourse of someone. In particular, teachers can convey their misconceptions directly to the students during the lessons, as well as cause misconceptions in many different ways, such as not having a good command of the subject and not choosing the right method and technique (Erdem et al., 2001).

### ***RQ1.2. Source of knowledge***

While most of the participating teachers believe that the pandemic started naturally due to some habits in China, some social studies teachers believed that Covid-19 was created artificially and that this virus was produced in a laboratory environment. Almost all the teachers who expressed their opinions about the emergence of Covid-19 did not reveal any scientific evidence for the reasons they put forward. Teachers also showed the tools they used as a source of information as evidence. The internet (TV, newspaper, social media channels, etc.), environment (life), and intuitive and scientific publications were primary sources of information. Among the Internet resources, several teachers emphasized academic articles. On the other hand, some teachers tried to explain Covid-19 by reasoning with intuitive expressions. In this process, they stated that they "believed that their explanation was like this," and they did not have a source for this information and had not read a scientific publication. Previous studies stated that pre-service teachers benefited from different sources of information such as school, environment, TV, and internet on a SSI (Atasoy, 2018). It has been determined that the most important source of information about nuclear power plants is the media, not scientific sources (Eş et al., 2016).

According to Schommer-Aikins (2004), individuals can develop two types of beliefs in sources of knowledge, which range from omniscient authority to reason and empirical evidence. While some individuals develop beliefs that knowledge consists of simple and separate parts (naive/immature), that experts are the source of knowledge, and that authorities disseminate knowledge, others develop beliefs that knowledge has a complex and holistic structure (sophisticated). Sophisticated individuals hold the belief that knowledge originates not only from omniscient authorities, but also from meticulous observation and reasoning. This study determined that teachers generally organized information about Covid-19 at a simpler level, developed beliefs based on the knowledge they received from an authority, and were unable to produce scientific evidence to support their beliefs. This situation demonstrates that teachers tend to hold more naive or immature beliefs.

One of the key findings of the research is that the teachers who presented various reasons for the emergence of the virus failed to provide sufficient evidence to back their claims, struggled to produce scientifically oriented arguments to support their views, or did not use any ideas at all. They even believe that these sources do not provide accurate information and should be viewed with suspicion. This situation was associated with the continuity of the information category. Studies in the literature have revealed that teachers experience various difficulties in producing and evaluating arguments in previous studies (Sampson & Blanchard, 2012). For example, Liu and Roehrig (2019) found as a result of their research examining the argumentation competencies of science teachers that although science teachers cited their arguments on climate subjects as evidence, the evidence was often insufficient to justify their claims. Similarly, studies conducted with pre-service teachers (Atasoy, 2018)

or students (Wu & Tsai, 2007) revealed that participants struggled to produce arguments based on scientific evidence.

### ***RQ1.3. Stability of knowledge***

Another result reached in the research is that the participating teachers believed the statements of official institutions such as the World Health Organization, the ministry of health, the scientific council, or independent scientists as "accurate information". Some teachers, on the other hand, expressed that they have to believe the statements of these institutions. While the majority of the teachers found scientists reliable because they think they have no interests even though they have different rhetoric, they do not find the statements of policymakers reliable for various reasons. On the other hand, some teachers think that the information they have obtained was not certain, arguing that there are contradictions in the information received and they are suspicious of it. In particular, they stated that they did additional research to confirm the continuity of the information they obtained from the internet. In Baxter Magolda's (1993) Epistemological Projection Model, the development process of individuals' epistemological beliefs is grouped under four categories. These are: absolute category, transitional category, independent category, and contextual category. In the absolute category, individuals believe that the information is certain and transmitted by an authority. In the transitional category, the belief that the information will not be sure and the authority cannot know everything is dominant. In the context of active learning and critical thinking in the independent category, individuals believe that authority is not the only source of knowledge and that the individual's thought is also valuable. In the contextual category, the individual discusses different perspectives and creates his viewpoint in this context. The results obtained in the research showed that most of the teachers, in particular, are in the absolute category class. In addition, it can be said that several of the teachers are in the transitional and independent categories. One dimension of epistemological belief is the source of knowledge. Especially as this process is emphasized in the Epistemological Reflection Model, it can be defined as an individual with naive epistemological understanding, (absolute and transitional category) defending authority, or that knowledge is transmitted by omniscient authorities and individuals with a sophisticated epistemological understanding (independent and contextual category) (Hofer & Pintrich, 1997; Schommer, 1990). In this respect, it can be said that the teachers participating in the study have a naive epistemological understanding of the absolute and transitional category, where they develop beliefs based on the information conveyed by the authorities about Covid-19.

### **Results of the Covid-19 Pandemic and Belief in Solution**

The most emphasized categories in teachers' opinions about the results of the Covid-19 pandemic are social/psychological, economic, and educational results. These were followed by international, environmental, health, scientific, and political results. In addition, while teachers in particular think that Covid-19 has positive effects as environmental and scientific results, they believed that negative impacts occur in social/psychological, political, education, health, and economic categories. Socially/psychologically, the teachers stated that they would never return to their old behaviors. They feared losing their relatives to the pandemic and worried about the future. They feared loneliness and had an obsession with cleanliness, insecurity, and uneasiness. While emphasizing the adverse results of the pandemic on the national and global economy, they stated that children were affected psychologically in terms of education, and many new problems arose with the online education process. In other dimensions, they emphasized that the power of governments increased in the world, human rights and freedoms were restricted, it had severe results on science and health, science can be helpless even in this century so states should make more serious investments in the

field of health and science, and inconsistent statements of scientists cause distrust in people. The effects on the environment are positive. These are emphasized as the relaxation of the environment and the minimization of the damage caused by human beings to the environment during this process.

All the participating teachers believed that a solution will definitely be found for Covid-19 because they trust science and scientists. A significant part of the participants believed that the most critical solution, for now, is to comply with the precautions (mask-distance-cleaning) recommended by scientists and to be vaccinated. Half of the participants believed that there should be restrictions, that these restrictions would increase even more if they were the administrator, and that everyone has to follow the rules. Herd immunity was not seen as a solution by the majority of participants. The fact that the answers given by teachers about herd immunity were emotion-based, away from a logical context, shows that they have problems in the process of creating arguments. In addition, the arguments developed do not contain statements aimed at determining the correctness of the arguments with supporting or opposing evidence. In this context, the arguments developed by teachers about herd immunity can be grouped as poorly structured, incomplete, unclear, and not based on rules (van Bruggen et al., 2003). This result shows that teachers' argumentation skills should be improved. According to Britt and Larson (2003), the ability to construct and understand arguments is a primary indicator of literacy. In addition, Jonassen and Kim (2010) concluded in their study that teachers' pedagogical competencies are essential in the argumentation process of students. It has been emphasized that if teachers are weak in creating arguments and cannot create appropriate learning environments, it also makes their students unable to produce quality and strong arguments.

### **Results of RQ2. Teaching socio-scientific issues**

Teachers point out that SSI such as Covid-19 should be included in the curriculum due to some gains. Environment, nuclear energy, health, agriculture, and GMO products are the leading SSI that participant teachers stated exist in the science and social studies curriculum in Turkey, apart from the Covid-19 pandemic. The environment subject is the socio-scientific subject most frequently expressed by both social studies and science teachers. Some teachers stated that SSI are not included in the curriculum. In the last 30 years, there have been serious changes in science education in Turkey. Since 2013, SSI have been directly included in the science curriculum (MoE, 2013). Finally, the program update made in 2018 aimed to develop students' reasoning skills, scientific thinking habits, and decision-making skills by using socioscientific subjects (MoE, 2018). The social studies curriculum has undergone radical changes since 2005. The latest update in 2018 aimed to provide the student with the knowledge, skills, attitudes, values, and behaviors necessary for life in a structure that concerns all humanity. Ultimately, the acquisitions related to socioscientific subjects are clearly and directly included in the curriculum of science and social studies courses in Turkey (Türksever et al., 2020).

Teachers grouped the main purpose of SSI as teaching social subjects, being scientific, and gaining skills. In particular, teachers emphasized that the purpose of such topics is to develop skills in students. The most expressed skills in this process were discussing/reasoning, critical thinking, and conducting research. Additionally, the research highlighted the skills of decision-making, self-expression, causality, awareness, and questioning. Therefore, the results of this research show that teachers have a positive attitude toward the teaching of SSI. Numerous studies have determined that SSI enhances students' critical thinking and scientific literacy (Zeidler & Nichols, 2009), fosters empathy and respect, develops reasoning skills (Atasoy et al., 2019), and enhances questioning skills (Evren & Kaptan, 2014) by enhancing moral sensitivity (Fowler et al., 2009).

### **Educational Implications**

The primary purpose of social studies is to acquire citizenship awareness, knowledge, skills, attitudes, values, and behaviors necessary for social life. It aims to develop the thinking and decision-making skills needed for the individual to solve social problems. Social-scientific subjects could feature citizenship, scientific literature, and sustainable development under the three headings. Ultimately, one of the essential goals of science education is character development, including moral decision-making and the development of democratic citizenship (Driver et al., 2000; Sadler & Zeidler, 2005; Solomon, 1994). Examining the literature reveals that SSI significantly contributes directly to citizenship competencies. Özden (2015) found that activities based on SSI can improve the citizenship competencies of students in his study. Lee et al. (2013) discovered that SSI enhances global citizenship values. Ratcliffe and Grace (2003) state that SSI increases ethical and moral sensitivity and encourages individuals to be good citizens.

Therefore, SSI directly serves the purposes of both the science and social studies courses. However, the results of this research also reveal that science and social studies teachers lack the necessary skills to effectively teach these subjects. Some of the study's teachers noted concerns about using these and similar SSI in their lessons. Teachers who do not have the necessary resources are unable to teach SSI in a planned manner. Teachers believe that curriculum and textbooks should include SSI to effectively plan, and they believe that teaching such subjects should involve creating an environment of debate and discussion, utilizing out-of-school learning environments, and employing different methods and techniques. However, teachers do not consider themselves to have this qualification. In previous studies, both science teachers (Gardner & Jones, 2011; Lee et al., 2006; Lee & Witz, 2009; Namdar & Tuskan, 2018; Sadler et al., 2006) and social studies teachers (Busey & Mooney, 2014; Chikoko et al., 2011; Kuş, 2015; Kuş & Öztürk, 2019) face various difficulties in terms of pedagogical and content knowledge.

Yang and Anderson (2003) distinguished between two types of research: scientifically oriented research and socially oriented research, while examining solutions to a nuclear energy problem. This study found that both social studies and science teachers conducted more social-oriented studies related to the Covid-19 pandemic. The teachers attributed this situation to the students' inability to continue and deepen their discussions in the scientific dimension. It seems quite normal for social studies teachers to focus on the social aspect of SSI since the courses they take during their undergraduate education are generally social, and social-based subjects are predominant in the curriculum. However, the inability of science teachers to conduct a scientifically based discussion may lead them to primarily focus on the social aspect of SSI.

This study's data is based on in-depth interviews with teachers. Future studies can incorporate observations, both inside and outside the classroom, and teacher documents such as materials and lesson plans into the data analysis process through triangulation. This approach can enhance the internal reliability of the collected data.

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